At DTU Electrical Engineering we educate engineers within electrical engineering technologies as well as biomedical engineering. We offer studies at BEng-, BSc-, MSc- and PhD levels. The department also participates in international master programmes.

We conduct research within biomedical engineering, antenna and microwave technology, robot technology, power- and physical electronics, electric technology, acoustic environment, audiology, and electro-acoustics.

A large part of our research is carried out in close interaction with industry and Research institutions in Denmark and abroad.

Publications:

A two-layer game theoretical attack-defense model for a false data injection attack against power systems

With the widespread application of information and communication technology in power systems, cyber security has become critical for ensuring effective measurement, communication, calculation and execution. A successful false data injection attack (FDIA) can bypass traditional systems for identifying bad data and interfere with decision making in control centers, thus causing power system failures. In this paper, the measurements within the phasor measurement units (PMUs) are used as attack and defense objects, and load shedding resulting from line failure is utilized to quantify the attack consequences. To construct the optimal defense against an FDIA, this paper examines the characteristics and construction of FDIAAs from the perspective of attackers, aiming to reveal the shortcomings of traditional bad data identification. From the perspective of those defending against an FDIA, a two-layer defense model is proposed that includes detection and protection. First, information from multiple sources is utilized to improve the detection of false data. Second, extra PMUs are added as a protection method to strengthen the measurement redundancy. A zero-sum static game algorithm is applied to optimize the deployment of defense resources. The effectiveness of the proposed strategy is tested using IEEE 14-bus, 57-bus and 118-bus systems, and the impact of information asymmetry is also discussed.

General information
State: Published
**Combined active and reactive power control in an operation of a wind farm**

The present disclosure relates to a method and system for controlling an operation of a wind farm connected to a grid, the wind farm comprising a plurality of wind turbines, each wind turbine having a local controller, the method comprising the steps of: minimizing a central voltage deviation in a point of connection between the grid and the wind farm compared to a reference voltage provided by the grid; and/or minimizing local voltage deviations compared to local bus reference voltages for each connection to the wind turbines, by: calculating sensitivity coefficients for the wind turbines; and regulating local power references comprising an active power reference and a reactive power reference to each of the local controllers based on the calculated sensitivity coefficients.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Zhao, H. (Intern), Wu, Q. (Intern), Huang, S. (Intern), Liu, Z. (Intern)
Publication date: 6 Dec 2018

**Publication information**

IPC: F03D7/04; H02J3/38; H02J3/18
Patent number: WO2018115431
Date: 28/06/2018
Priority date: 28/06/2018
Priority number: EP20160206546
Original language: English
Electronic versions:
WO2018115431A1.pdf
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 150433317
Publication: Research › Patent – Annual report year: 2018

**Cryogenic Preamplifiers for Magnetic Resonance Imaging**

Pursuing the ultimate limit of detection in magnetic resonance imaging (MRI) requires cryogenics to decrease the thermal noise of the electronic circuits. As cryogenic coils for MRI are slowly emerging cryogenic preamplifiers are required to fully exploit their potential. A cryogenic preamplifier operated at 77 K is designed and implemented for C imaging at 3 T (32.13 MHz), using off-the-shelves components. The design is based on a high electron mobility transistor (ATF54143) in a common source configuration. Required auxiliary circuitry for optimal cryogenic preamplifier performance is also presented consisting of a voltage regulator (noise free supply voltage and optimal power consumption), switch, and trigger (for active detuning during transmission to protect the preamplifier). A gain of 18 dB with a noise temperature of 13.7 K is achieved. Performing imaging experiments in a 3 T scanner showed an 8% increased signal-to-noise ratio from 365 to 399 when lowering the temperature of the preamplifier from 296 to 77 K while keeping the coil at room temperature. This paper thus enables the merger of cryogenic coils and preamplifiers in the hopes of reaching the ultimate limit of detection for MRI.

**General information**

State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Electromagnetic Systems, Electromagnetic Systems Group, Technical University of Denmark
Pages: 202-210
Publication date: 1 Feb 2018
Main Research Area: Technical/natural sciences
Radiative MRI Coil Design Using Parasitic Scatterers: MRI Yagi

Conventionally, radiofrequency (RF) coils used for magnetic resonance imaging (MRI) are electrically small and designed for nearfield operation. Therefore, existing antenna design techniques are mostly irrelevant for RF coils. However, the use of higher frequencies in ultrahigh field (UHF) MRI allows for antenna design techniques to be adapted to RF coil designs. This study proposes the use of parasitic scatterers to improve the performance of an existing 7T MRI coil called the single-sided adapted dipole (SSAD) antenna. The results reveal that scatterers arranged in a Yagi fashion can be applied to reduce local specific absorption rate (SAR) maxima of a reference SSAD by 40% with only a 6% decrease in the propagated B1 + field at the tissue depth of 15 cm. The higher directivity of the proposed design also decreasing the coupling with additional elements, making this antenna suitable for use in high density arrays. These findings show the potential of parasitic scatterers as an effective method to improve the performance of existing radiative MRI coils.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, Center for Magnetic Resonance, Lund University, Lite-On Mobile AB
Latency and bit-error-rate evaluation for radio-over-ethernet in optical fiber front-haul networks

Nowadays several research projects are under progress to manage a soft migration toward the 5th generation networks. Radio over Ethernet (RoE) is one of recent topics that try to have a cost efficient and independent front-haul network. In this paper, we discuss the requirements of the 5G networks and analyze the conditions for the implementation of a RoE protocol. For this purpose we digitalize radio frames that are taken from BBU or RRH and create RoE basic frames considering all the requirements of protocol. We then encapsulate RoE basic frames into an Ethernet packet and finally experimentally evaluate this Ethernet packet as a case of study for RoE applications. The packet is transmitted through different fiber spans, measuring the BER and latency on each case. The system achieves BER values below the FEC limit and a manageable latency. These results serve as a guideline and proof of concept for applications on RoE, showing the viability of its implementation as part of the next generation of front-haul networks.

General information
State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Electromagnetic Systems, Technical University of Denmark
Authors: Sayadi, M. (Ekstern), Rodríguez, S. (Intern), Olmos, J. J. V. (Intern), Tafur Monroy, I. (Intern)
Pages: 88-92
Publication date: 1 Jan 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Optical Switching and Networking
Volume: 27
ISSN (Print): 1573-4277
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): SNIP 0.815 SJR 0.293 CiteScore 1.65
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.95 SJR 0.364 SNIP 0.883
Scopus rating (2015): SJR 0.312 SNIP 0.684 CiteScore 1.33
Scopus rating (2014): SJR 0.289 SNIP 0.802 CiteScore 1.39
Scopus rating (2013): SJR 0.3 SNIP 0.707 CiteScore 1.36
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.399 SNIP 1.003 CiteScore 1.28
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 0.338 SNIP 1.066 CiteScore 1.43
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.305 SNIP 0.878
Scopus rating (2009): SJR 0.292 SNIP 0.933
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.314 SNIP 0.858
Scopus rating (2007): SJR 0.314 SNIP 0.877
On-line Fault Diagnosis of Produced Water Treatment with Multilevel Flow Modeling

Making sense of alarms can be difficult on oil and gas platforms. Multilevel Flow Modeling provides a structure for modelling plant functionality and inferring causes for alarms and predicting consequences. Currently, Multilevel Flow Modeling has limited application for on-line fault diagnosis. Based on a fault emulated on a pilot plant for offshore produced water treatment, Multilevel Flow Modeling is used for reasoning about causes for triggered alarms. The inferred causes are analysed to investigate the current maturity of Multilevel Flow Modeling for on-line diagnosis.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Aalborg University, Electromagnetic Systems Group
Authors: Nielsen, E. K. (Intern), Jespersen, S. (Ekstern), Zhang, X. (Intern), Ravn, O. (Intern), Lind, M. (Intern)
Pages: 225-232
Publication date: 1 Jan 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 51
Issue number: 8
ISSN (Print): 2405-8963
Ratings:
Scopus rating (2017): CiteScore 0.68 SJR 0.26 SNIP 0.434
Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Scopus rating (2005): SJR 0.192 SNIP 0.445
Scopus rating (2004): SJR 0.245 SNIP 0.419
Scopus rating (2003): SJR 0.26 SNIP 0.403
Original language: English
Multilevel Flow Modeling, Plantwide Fault Diagnosis, Produced Water Treatment

Electronic versions:
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Source: Scopus
Source-ID: 85050125357
Publication: Research - peer-review › Journal article – Annual report year: 2018

3D Hyperpolarized C-13 EPI with Calibrationless Parallel Imaging

With the translation of metabolic MRI with hyperpolarized $^{13}$C agents into the clinic, imaging approaches will require large volumetric FOVs to support clinical applications. Parallel imaging techniques will be crucial to increasing volumetric scan coverage while minimizing RF requirements and temporal resolution. Calibrationless parallel imaging approaches are well-suited for this application because they eliminate the need to acquire coil profile maps or auto-calibration data. In this
work, we explored the utility of a calibrationless parallel imaging method (SAKE) and corresponding sampling strategies to accelerate and undersample hyperpolarized $^{13}$C data using 3D blipped EPI acquisitions and multichannel receive coils, and demonstrated its application in a human study of [1-$^{13}$C]pyruvate metabolism.

**General information**

State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, University of California at San Francisco
Authors: Gordon, J. W. (Ekstern), Hansen, R. B. (Intern), Shin, P. J. (Ekstern), Feng, Y. (Ekstern), Vigneron, D. B. (Ekstern), Larson, P. E. Z. (Ekstern)
Pages: 92-99
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Magnetic Resonance
Volume: 289
ISSN (Print): 1090-7807
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.963 SJR 1.182 CiteScore 2.57
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.37 SJR 1.016 SNIP 0.983
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.111 SNIP 1.07 CiteScore 2.88
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.113 SNIP 1.013 CiteScore 2.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.103 SNIP 0.937 CiteScore 2.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.117 SNIP 1.046 CiteScore 2.28
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.097 SNIP 1.137 CiteScore 2.55
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.363 SNIP 1.066
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.632 SNIP 1.123
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.52 SNIP 1.08
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.375 SNIP 1.083
Scopus rating (2006): SJR 1.436 SNIP 1.062
Scopus rating (2005): SJR 1.337 SNIP 1.122
Scopus rating (2004): SJR 1.305 SNIP 1.362
Scopus rating (2003): SJR 1.252 SNIP 1.195
A 10 MHz GaNFET Based Isolated High Step-Down DC-DC Converter

This paper presents design of an isolated high-step-down DC-DC converter based on a class-DE power stage, operating at a 10 MHz switching frequency using enhancement mode Gallium Nitride (GaN) transistors. The converter operating principles are discussed, and the power stage design rated for 20 W is presented for a stepdown from 200-300 V to 0-28 V. Commercially available magnetic materials were explored and the high-frequency (HF) resonant inductor and transformer designs using a low-loss Fair-Rite type 67 material are presented. Finite element simulations have been performed to estimate the AC resistances of magnetics at 10 MHz. Experimental results are presented at 12 W, 254 V to 22 V on a laboratory prototype operating at 10 MHz. At 20 W the experimental prototype achieved an efficiency of 85.2%.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Electronics, Utah State University
Authors: Thummala, P. (Intern), Yelaverthi, D. B. (Ekstern), Zane, R. (Ekstern), Ouyang, Z. (Intern), Andersen, M. A. E. (Intern)
Pages: 4066-73
Publication date: 2018

A 380 V High Efficiency and High Power Density Switched-Capacitor Power Converter using Wide Band Gap Semiconductors

State-of-the-art switched-capacitor DC-DC power converters mainly focus on low voltage and/or high power applications. However, at high voltage and low power levels, new designs are anticipated to emerge and a power converter that has both high efficiency and high power density is highly desirable. This paper presents such a high voltage low power switched-capacitor DC-DC converter with an input voltage upto 380 V (compatible with rectified European mains) and an output power experimentally validated up to 21.3 W. The wideband gap semiconductor devices of GaN switches and SiC diodes are combined to compose the proposed power stage. Their switching and loss characteristics are analyzed with transient waveforms and thermal images. Different isolated driving circuits are compared and a compact isolated halfbridge driving circuit is proposed. The full-load efficiencies of 98.3% and 97.6% are achieved for the power stage and the complete power converter, without heatsink or airflow. The corresponding power densities are 7.9 W/cm3 and 2.7 W/cm3, based on boxed volumes, respectively.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Fan, L. (Intern), Knott, A. (Intern), Jørgensen, I. H. H. (Intern)
Number of pages: 6
Publication date: 2018
Conference: International Conference on Renewable Energies and Power Quality (ICREPQ’18), Salamanca, Spain, 21/03/2018 - 21/03/2018
Main Research Area: Technical/natural sciences
A Bilevel Model for Participation of a Storage System in Energy and Reserve Markets

We develop a decision-making tool based on a bilevel complementarity model for a merchant price-maker energy storage system to determine the most beneficial trading actions in pool-based markets, including day-ahead (as joint energy and reserve markets) and balancing settlements. The uncertainty of net load deviation in real-time is incorporated into the model using a set of scenarios generated from the available forecast in the day-ahead. The objective of this energy storage system is to maximize its expected profit. The day-ahead products of energy storage system include energy as well as reserve commitment (as one of the ancillary services), whereas its balancing product is the energy deployed from the committed reserve. The proposed model captures the interactions of different markets and their impacts on the functioning of the storage system. It also provides an insight for storage system into clearing process of multiple markets and enables such a facility to possibly affect the outcomes of those markets to its own benefit through strategic price and quantity offers. The validity of the proposed approach is evaluated using a numerical study.
Accuracy and Precision of a Plane Wave Vector Flow Imaging Method in the Healthy Carotid Artery

The objective of the study described here was to investigate the accuracy and precision of a plane wave 2-D vector flow imaging (VFI) method in laminar and complex blood flow conditions in the healthy carotid artery. The approach was to study (i) the accuracy for complex flow by comparing the velocity field from a computational fluid dynamics (CFD) simulation to VFI estimates obtained from the scan of an anthropomorphic flow phantom and from an in vivo scan; (ii) the accuracy for laminar unidirectional flow in vivo by comparing peak systolic velocities from VFI with magnetic resonance angiography (MRA); (iii) the precision of VFI estimation in vivo at several evaluation points in the vessels. The carotid artery at the bifurcation was scanned using both fast plane wave ultrasound and MRA in 10 healthy volunteers. The MRA geometry acquired from one of the volunteers was used to fabricate an anthropomorphic flow phantom, which was also scanned using the fast plane wave sequence. The same geometry was used in a CFD simulation to calculate the velocity field. Results indicated that similar flow patterns and vortices were estimated with CFD and VFI in the phantom for the carotid bifurcation. The root-mean-square difference between CFD and VFI was within 0.12 m/s for velocity estimates in the common carotid artery and the internal branch. The root-mean-square difference was 0.17 m/s in the external branch. For the 10 volunteers, the mean difference between VFI and MRA was -0.17 m/s for peak systolic velocities of laminar flow in vivo. The precision in vivo was calculated as the mean standard deviation (SD) of estimates aligned to the heart cycle and was highest in the center of the common carotid artery (SD = 3.6% for velocity magnitudes and 4.5° for angles) and lowest in the external branch and for vortices (SD = 10.2% for velocity magnitudes and 39° for angles). The results indicate that plane wave VFI measures flow precisely and that estimates are in good agreement with a CFD simulation and MRA.

General information

State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Pages: 1727-1741
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Main Research Area: Technical/natural sciences

Publication information
Journal: Ultrasound in Medicine and Biology
Volume: 44
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.5 SJR 0.932 SNIP 1.031
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.7 SJR 0.915 SNIP 1.111
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.929 SNIP 1.174 CiteScore 2.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.054 SNIP 1.407 CiteScore 2.65
Web of Science (2014): Indexed yes
A comparative study of methods for automatic detection of rapid eye movement abnormal muscular activity in narcolepsy

Objective: To evaluate rapid eye movement (REM) muscular activity in narcolepsy by applying five algorithms to electromyogram (EMG) recordings, and to investigate its value for narcolepsy diagnosis. Patients/methods: A modified version of phasic EMG metric (mPEM), muscle activity index (MAI), REM atonia index (RAI), supra-threshold REM EMG activity metric (STREAM), and Frandsen method (FR) were calculated from polysomnography recordings of 20 healthy controls, 18 clinic controls (subjects suspected with narcolepsy but finally diagnosed without any sleep abnormality), 16 narcolepsy type 1 without REM sleep behavior disorder (RBD), 9 narcolepsy type 1 with RBD, and 18 narcolepsy type 2. Diagnostic value of metrics in differentiating between groups was quantified by area under the receiver operating characteristic curve (AUC). Correlations among the metrics and cerebrospinal fluid hypocretin-1 (CSF-hcrt-1) values were calculated using linear models. Results: All metrics excluding STREAM found significantly higher muscular activity in narcolepsy 1 cases versus controls (p<0.05). Moreover, RAI showed high sensitivity in the detection of RBD. The mPEM achieved the highest AUC in differentiating healthy controls from narcoleptic subjects. The RAI best differentiated between narcolepsy 1 and 2. Lower CSF-hcrt-1 values correlated with high muscular activity quantified by mPEM, sMAI, lMAI, PEM and FR (p<0.05). Conclusions: This automatic analysis showed higher number of muscle activations in narcolepsy 1 compared to controls. This finding might play a supportive role in diagnosing narcolepsy and in discriminating narcolepsy subtypes. Moreover, the negative correlation between CSF-hcrt-1 level and REM muscular activity supported a role for hypocretin in the control of motor tone during REM sleep.

General information
A Comparison Study of Vector Velocity, Spectral Doppler and Magnetic Resonance of Blood Flow in the Common Carotid Artery

Magnetic resonance phase contrast angiography (MRA) is the gold standard for blood flow evaluation. Spectral Doppler ultrasound (SDU) is the first clinical choice, although the method is angle dependent. Vector flow imaging (VFI) is an angle-independent ultrasound method. The aim of the study was to compare VFI- and SDU-estimated peak systolic
velocities (PSV) of the common carotid artery (CCA) with PSV obtained by MRA. Furthermore, intra- and inter-observer agreement was determined. MRA estimates were significantly different from SDU estimates (left CCA: p
A comprehensive study of cryogenic cooled millimeter-wave frequency multipliers based on GaAs Schottky-barrier varactors

The benefit of cryogenic cooling on the performance of millimeter-wave GaAs Schottky-barrier varactor-based frequency multipliers has been studied. For this purpose, a dedicated compact model of a GaAs Schottky-barrier varactor using a triple-anode diode stack has been developed for use with a commercial RF and microwave CAD tool. The model implements critical physical phenomena such as thermionic-field emission current transport at cryogenic temperatures, temperature dependent mobility, reverse breakdown, self-heating, and high-field velocity saturation effects. A parallel conduction model is employed in order to include the effect of barrier inhomogeneities which is known to cause deviation from the expected I--V characteristics at cryogenic temperatures. The developed model is shown to accurately fit the I--V-T dataset from 25 to 295 K measured on the varactor diode stack. Harmonic balance simulations using the model are used to predict the efficiency of a millimeter-wave balanced doubler from room to cryogenic temperatures. The estimation is verified experimentally using a 188 GHz balanced doubler cooled down to 77 K. The model has been further verified down to 14 K using a 78 GHz balanced doubler.

General information
State: Published
Authors: Johansen, T. K. (Intern), Rybalko, O. (Intern), Zhurbenko, V. (Intern), Bulcha, B. (Ekstern), Hesler, J. (Ekstern)
Number of pages: 10
Pages: 1-10
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Microwave and Wireless Technologies
ISSN (Print): 1759-0787
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 0.6 SJR 0.184 SNIP 0.432
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 0.65 SJR 0.21 SNIP 0.497
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.201 SNIP 0.486 CiteScore 0.53
Scopus rating (2014): SJR 0.211 SNIP 0.343 CiteScore 0.55
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 0.257 SNIP 0.657 CiteScore 0.81
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.273 SNIP 0.561 CiteScore 0.77
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.216 SNIP 0.544 CiteScore 0.62
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.157 SNIP 0.233
Acoustic Virtual Reality – Methods and challenges

Virtual reality is a technology that has seen increasing usage in architecture and building design in recent years. It can add value to the design process by, for example, making it easier to communicate design considerations with relevant stakeholders, such as clients, developers, engineers and architects. It also helps the designers themselves by providing a more immersive and realistic view of the modelled building and a better sense of scale. VR is also used in several other fields, such as entertainment (video games in particular), training, education and healthcare. Incorporating sound and acoustics into the virtual reality sphere adds another dimension to the experience. It both makes the immersion more believable, and in the context of building design, makes it easy and intuitive to try out different acoustic designs and soundscapes. In traditional auralization, although a very powerful tool in itself, the receiver location is usually fixed. In VR, the receiver can move around in the modeled space and switch between different designs with a click of a button, and this way get a better feeling for the acoustics of the space. In this paper, a brief overview of some of the current technologies used in acoustic virtual reality will be outlined, where the pros and cons of different approaches will be discussed. Furthermore, some examples of how the technology has been used at Henning Larsen on chosen projects will be given.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Technical University of Denmark, Henning Larsen Architects A/S
Authors: Pind Jörgensson, F. K. (Intern), Jeong, C. (Intern), Llopis, H. S. (Ekstern), Kosikowski, K. (Ekstern), Strømann-Andersen, J. (Ekstern)
Number of pages: 6
Publication date: 2018

Host publication information
Title of host publication: Proceedings of BNAM 2018
Main Research Area: Technical/natural sciences
Conference: Baltic-Nordic Acoustics Meeting 2018, Reykjavik, Iceland, 15/04/2018 - 15/04/2018
Source: PublicationPreSubmission
Source-ID: 146595673
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Active room compensation for sound reinforcement using sound field separation techniques

This work investigates how the sound field created by a sound reinforcement system can be controlled at low frequencies. An indoor control method is proposed which actively absorbs the sound incident on a reflecting boundary using an array of secondary sources. The sound field is separated into incident and reflected components by a microphone array close to the secondary sources, enabling the minimization of reflected components by means of optimal signals for the secondary sources. The method is purely feed-forward and assumes constant room conditions. Three different sound field separation techniques for the modeling of the reflections are investigated based on plane wave decomposition, equivalent sources, and the Spatial Fourier transform. Simulations and an experimental validation are presented, showing that the control method performs similarly well at enhancing low frequency responses with the three sound separation techniques. Resonances in the entire room are reduced, although the microphone array and secondary sources are confined to a small region close to the reflecting wall. Unlike previous control methods based on the creation of a plane wave sound field, the investigated method works in arbitrary room geometries and primary source positions.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, d&b audiotechnik GmbH
Authors: Heuchel, F. M. (Intern), Fernandez Grande, E. (Intern), Agerkvist, F. T. (Intern), Shabalina, E. (Ekstern)
Pages: 1346-1354
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
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Issue number: 3
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Adaptive and Selective Time Averaging of Auditory Scenes

To overcome variability, estimate scene characteristics, and compress sensory input, perceptual systems pool data into statistical summaries. Despite growing evidence for statistical representations in perception, the underlying mechanisms remain poorly understood. One example of such representations occurs in auditory scenes, where background texture appears to be represented with time-averaged sound statistics. We probed the averaging mechanism using "texture steps"—textures containing subtle shifts in stimulus statistics. Although generally imperceptible, steps occurring in the previous several seconds biased texture judgments, indicative of a multi-second averaging window. Listeners seemed unable to willfully extend or restrict this window but showed signatures of longer integration times for temporally variable textures. In all cases the measured timescales were substantially longer than previously reported integration times in the auditory system. Integration also showed signs of being restricted to sound elements attributed to a common source. The results suggest an integration process that depends on stimulus characteristics, integrating over longer extents when it benefits statistical estimation of variable signals and selectively integrating stimulus components likely to have a common cause in the world. Our methodology could be naturally extended to examine statistical representations of other types of sensory signals. Sound texture perception is thought to be mediated by time-averaged sound statistics. McWalter and McDermott use texture steps to reveal an obligatory multi-second averaging process whose extent depends on texture variability. Averaging excludes other concurrent sounds, implicating texture perception as inseparable from auditory scene analysis.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Massachusetts Institute of Technology
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Pages: 1405-1418.e10
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.99 SJR 4.294 SNIP 1.533
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.705 SNIP 1.58 CiteScore 5.21
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.519 SNIP 1.59 CiteScore 5.02
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 4.896 SNIP 1.647 CiteScore 5.18
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 4.75 SNIP 1.77 CiteScore 4.98
ISI indexed (2012): ISI indexed yes
Adaptive Control of Wind Turbines for Maximum Power Point Tracking

This chapter presents an adaptive controller for maximum power point tracking (MPPT) of a small variable-speed wind energy conversion system (WECS). According to the speed control criterion, WECSs can be classified into two types: fixed speed and variable speed. The chapter focuses on the generator control of wind turbines for maximum power point tracking in the partial-load regime. The MPPT control methods can be classified into the following three categories: hill-climbing search control, power signal feedback control and tip-speed ratio control. A full-converter wind turbine with a squirrel cage induction generator (SCIG) is used to illustrate the generator control system for a variable-speed WECS. The chapter also presents case studies have been carried out to verify the developed adaptive controller for WECSs. WECSs are non-linear systems with parameter uncertainties and which are subject to disturbances, in the form of non-linear and unmodeled aerodynamics.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy
Authors: Zhao, H. (Intern), Wu, Q. (Intern)
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Adaptive Observer for Nonlinearly Parameterised Hammerstein System with Sensor Delay – Applied to Ship Emissions Reduction
Taking offspring in a problem of ship emission reduction by exhaust gas recirculation control for large diesel engines, an underlying generic estimation challenge is formulated as a problem of joint state and parameter estimation for a class of multiple-input single-output Hammerstein systems with first order dynamics, sensor delay and a bounded time-varying parameter in the nonlinear part. The paper suggests a novel scheme for this estimation problem that guarantees exponential convergence to an interval that depends on the sensitivity of the system. The system is allowed to be nonlinear parameterized and time dependent, which are characteristics of the industrial problem we study. The approach requires the input nonlinearity to be a sector nonlinearity in the time-varying parameter. Salient features of the approach include simplicity of design and implementation. The efficacy of the adaptive observer is shown on simulated cases, on tests with a large diesel engine on test bed and on tests with a container vessel.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, MAN Diesel & Turbo, Linköping University
Authors: Nielsen, K. V. (Ekstern), Blanke, M. (Intern), Eriksson, L. (Ekstern)
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Scopus rating (2017): CiteScore 5.89 SJR 1.832 SNIP 2.728
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.655 SNIP 2.643
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.966 SNIP 2.798 CiteScore 4.72
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.786 SNIP 3.006 CiteScore 4.34
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.707 SNIP 3.41 CiteScore 4.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 3.011 CiteScore 3.7
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.585 SNIP 2.909 CiteScore 3.26
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.098 SNIP 2.391
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.587 SNIP 2.789
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.43 SNIP 2.736
Scopus rating (2007): SJR 1.082 SNIP 2.205
Scopus rating (2006): SJR 1.021 SNIP 2.306
Adaptive parametric model order reduction technique for optimization of vibro-acoustic models: Application to hearing aid design

Finite Element (FE) models of complex structural-acoustic coupled systems can require a large number of degrees of freedom in order to capture their physical behaviour. This is the case in the hearing aid field, where acoustic-mechanical feedback paths are a key factor in the overall system performance and modelling them accurately requires a precise description of the strong interaction between the light-weight parts and the internal and surrounding air over a wide frequency range. Parametric optimization of the FE model can be used to reduce the vibroacoustic feedback in a device during the design phase; however, it requires solving the model iteratively for multiple frequencies at different parameter values, which becomes highly time consuming when the system is large. Parametric Model Order Reduction (pMOR) techniques aim at reducing the computational cost associated with each analysis by projecting the full system into a reduced space. A drawback of most of the existing techniques is that the vector basis of the reduced space is built at an offline phase where the full system must be solved for a large sample of parameter values, which can also become highly time consuming. In this work, we present an adaptive pMOR technique where the construction of the projection basis is embedded in the optimization process and requires fewer full system analyses, while the accuracy of the reduced system is monitored by a cheap error indicator. The performance of the proposed method is evaluated for a 4-parameter optimization of a frequency response for a hearing aid model, evaluated at 300 frequencies, where the objective function evaluations become more than one order of magnitude faster than for the full system.
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.31 SNIP 2.15 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.41 SNIP 2.308 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.32 SNIP 2.553 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.441 SNIP 2.939 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.383 SNIP 2.661 CiteScore 2.05
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.175 SNIP 2.039
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.34 SNIP 2.147
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.165 SNIP 1.911
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.144 SNIP 1.687
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.888 SNIP 1.628
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.014 SNIP 1.559
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.91 SNIP 1.476
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.216 SNIP 1.392
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.233 SNIP 1.27
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.825 SNIP 1.339
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.974 SNIP 1.206
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.953 SNIP 1.123

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Source-ID: 145366651
Publication: Research - peer-review › Journal article – Annual report year: 2018
**Adaptive Processes in Hearing**

Our auditory environment is constantly changing and evolving over time, requiring us to rapidly adapt to a complex dynamic sensory input. This adaptive ability of our auditory system can be observed at different levels, from individual cell responses to complex neural mechanisms and behavior, and is essential to achieve successful speech communication, correct orientation in our full environment, and eventually survival. These adaptive processes may differ in individuals with hearing loss, whose auditory system may cope via “readapting” itself over a longer time scale to the changes in sensory input induced by hearing impairment and the compensation provided by hearing devices. These devices themselves are now able to adapt to the listener’s individual environment, attentional state, and behavior. These topics related to auditory adaptation, in the broad sense of the term, were central to the 6th International Symposium on Auditory and Audiological Research held in Nyborg, Denmark, in August 2017. The symposium addressed adaptive processes in hearing from different angles, together with a wide variety of other auditory and audiological topics. The papers in this special issue result from some of the contributions presented at the symposium.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, University of Copenhagen, University of Southern Denmark
Authors: Santurette, S. (Intern), Christensen-Dalsgaard, J. (Forskerdatabase), Tranebjærg, L. (Ekstern), Andersen, T. (Ekstern), Poulsen, T. (Intern), Dau, T. (Intern)
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Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.006 SNIP 1.099 CiteScore 0
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 0.953 SNIP 1.009
Scopus rating (2012): SJR 0.981 SNIP 0.909
Scopus rating (2011): SJR 1.164 SNIP 1.551
Scopus rating (2010): SJR 1.612 SNIP 1.997
Scopus rating (2009): SJR 1.263 SNIP 1.208
Scopus rating (2008): SJR 1.87 SNIP 1.678
Scopus rating (2007): SJR 2.255 SNIP 2.124
Scopus rating (2006): SJR 0.97 SNIP 1.095
Scopus rating (2005): SJR 0.892 SNIP 0.572
Scopus rating (2004): SJR 0.289 SNIP 0.259
Scopus rating (2003): SJR 0.524 SNIP 1.142
Scopus rating (2002): SJR 0.377 SNIP 1.134
Scopus rating (2001): SJR 0.308 SNIP 1.09
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Original language: English
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A device and method for generating a polybinary signal
The present disclosure relates to a method for generating an L-level polybinary signal, comprising the steps of: providing a baseband signal with a spectrum defined by a predefined frequency period, f_p; filtering the baseband signal using a low-pass filter having a pre-defined cut-off frequency, f_c, and a pre-defined polynomial order, n, whereby the L-polybinary signal is generated; filtering the L-polybinary signal before or after it is generated, with at least one band-stop filter having a pre-defined center frequency, f_c', and a pre-defined bandwidth, Δ, thereby isolating f_p of the baseband signal.

General information
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Organisations: Metro-Access and Short Range Systems, Department of Electrical Engineering, Electromagnetic Systems, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance
Authors: Cimoli, B. (Intern), Johansen, T. K. (Intern), Zhurbenko, V. (Intern), Vegas Olmos, J. J. (Intern), Tafur Monroy, I. (Intern), Jensen, J. B. (Intern)
Publication date: 2018

Age-dependent effects of brain stimulation on network centrality
Functional magnetic resonance imaging (fMRI) studies have suggested that advanced age may mediate the effects of transcranial direct current stimulation (tDCS) on brain function. However, studies directly comparing neural tDCS effects between young and older adults are scarce and limited to task-related imaging paradigms. Resting-state (rs-) fMRI, that is independent of age-related differences in performance, is well suited to investigate age associated differential neural tDCS effects. Three “online” tDCS conditions (anodal, cathodal, sham) were compared in a cross-over, within-subject design, in 30 young and 30 older adults. Active stimulation targeted the left sensorimotor network (active electrode over left sensorimotor cortex with right supraorbital reference electrode). A graph-based rs-fMRI data analysis approach (eigenvector centrality mapping) and complementary seed-based analyses characterized neural tDCS effects. An interaction between anodal tDCS and age group was observed. Specifically, centrality in bilateral paracentral and posterior regions (precuneus, superior parietal cortex) was increased in young, but decreased in older adults. Seed-based analyses revealed that these opposing patterns of tDCS-induced centrality modulation were explained from differential effects of tDCS on functional coupling of the stimulated left paracentral lobule. Cathodal tDCS did not show significant effects. Our study provides first evidence for differential tDCS effects on neural network organization in young and older adults. Anodal stimulation mainly affected coupling of sensorimotor with ventromedial prefrontal areas in young and decoupling with posterior medial areas in older adults.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, University of Greifswald, Freie Universität Berlin, University of Queensland, Humboldt-Universität zu Berlin, Physikalisch-Technische Bundesanstalt
Authors: Antonenko, D. (Ekstern), Nierhaus, T. (Ekstern), Meinzer, M. (Ekstern), Prehn, K. (Ekstern), Thielischer, A. (Intern), Ittermann, B. (Ekstern), Flöel, A. (Ekstern)
Pages: 71-82
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Aggregation Policies for Tuple Spaces

Security policies are important for protecting digitalized information, control resource access and maintain secure data storage. This work presents the development of a policy language to transparently incorporate aggregate programming and privacy models for distributed data. We use tuple spaces as a convenient abstraction for storage and coordination. The language has been designed to accommodate well-known models such as k-anonymity and (ε, δ) -differential privacy, as well as to provide generic user-defined policies. The formal semantics of the policy language and its enforcement mechanism is presented in a manner that abstracts away from a specific tuple space coordination language. To showcase our approach, an open-source software library has been developed in the Go programming language and applied to a typical coordination pattern used in aggregate programming applications.

A Grid Synchronization PLL Method Based on Mixed Second- and Third-Order Generalized Integrator for DC-Offset Elimination and Frequency Adaptability

The second order generalized integrator (SOGI) has been widely used to implement grid synchronization for grid-connected inverters, and from grid voltages it is able to extract the fundamental components with an output of two orthogonal sinusoidal signals. However, if there is a dc offset existing in the grid voltages, the general SOGI’s performance suffers from its generated dc effect in the lagging sine signal at the output. Therefore, in this paper, a mixed second- and third-order generalized integrator (MSTOGI) is proposed to eliminate this effect caused by the dc offset of grid voltages. A detailed theoretical analysis on the proposed MSTOGI is presented to reveal the mechanism of eliminating the dc offset. After that, the MSTOGI is applied to a phase-locked loop (PLL) and thereby establish an MSTOGI-PLL which is more adaptable to various grid conditions and power quality. Moreover, a frequency-adaptive control scheme is added to the proposed MSTOGI-PLL to eliminate the phase difference between the PLL output and the grid in grid-connected applications where the grid frequency may vary. Finally, the experimental results from a laboratory prototype are given to demonstrate and verify the effectiveness of the proposed MSTOGI-PLL in terms of steady-state performance, dynamic response and frequency adaptability.
A High-Voltage Low-Power Switched-Capacitor DC-DC Converter Based on GaN and SiC Devices for LED Drivers

Previous research on switched-capacitor DC-DC converters has focused on low-voltage and/or high-power ranges where the efficiencies are dominated by conduction loss. Switched-capacitor DC-DC converters at high-voltage (> 100 V) low-power (< 10 W) levels with high efficiency and high power density are anticipated to emerge. This paper presents a switched-capacitor converter with an input voltage up to 380 V (compatible with rectified European mains) and a maximum output power of 10 W. GaN switches and SiC diodes are analytically compared and actively combined to properly address the challenges at high-voltage low-current levels, where switching loss becomes significant. Further trade-off between conduction loss and switching loss is experimentally optimized with switching frequencies. Three variant designs of the proposed converter are implemented, and the trade-off between the efficiency and the power density is validated with measurement results. A peak efficiency of 98.6% and a power density of 7.5 W/cm³ are achieved without heatsink or airflow. The characteristic impedance level of the switched-capacitor converter is an order of magnitude higher than previously published ones. The converter is intended for LED drivers.
A local energy market for electricity and hydrogen

The proliferation of distributed energy resources entails efficient market mechanisms in distribution-level networks. This paper establishes a local energy market (LEM) framework in which electricity and hydrogen are traded. Players in the LEM consist of renewable distributed generators (DGs), loads, hydrogen vehicles (HVs), and a hydrogen storage system (HSS) operated by a HSS agent (HSSA). An iterative LEM clearing method is proposed based on the merit order principle. Players submit offers/bids with consideration of their own preferences and profiles according to the utility functions. The decentralized LEM clearing process not only avoids complex calculation induced by centralized decision process, but also preserves players' privacy. Case studies are conducted that demonstrate that the LEM promotes local integration of renewable energy, reduces peak demand, and improves players' utilities. Sensitivity analysis is then implemented to discuss the influences on the LEM clearing results of capacities of DGs, Loads, and the HSS, as well as price of hydrogen from the hydrogen station (HS).

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Xi'an Jiaotong University
Authors: Xiao, Y. (Ekstern), Wang, X. (Ekstern), Pinson, P. (Intern), Wang, X. (Ekstern)
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Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
Web of Science (2015): Indexed yes
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A Market Framework for Enabling Electric Vehicles Flexibility Procurement at the Distribution Level Considering Grid Constraints

In a context of extensive electrification of the transport sector, the use of flexibility services from electric vehicles (EVs) is becoming of paramount importance. This paper defines a market framework for enabling EVs flexibility at the distribution level, considering grid constraints. The main objective is to establish an adequate incentive system and proceed with an evaluation of EVs grid support for both users and DSOs, benchmarking it against the typical reinforcement solution. To exploit this framework, a billing process based on a two-price system is proposed for the controlled EV charging. The derived methodology is applied to a piece of semi-urban Danish distribution grid consisting of 42 customers. The service remuneration spans from 16 €/year to 51 €/year per customer, depending on the incentive scheme, and avoids a standard reinforcement of approximately 6200 €/year. It is demonstrated the benefit for DSOs and society, proving a technical and economic feasible solution.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources , Technical University of Denmark
A mouse model of the auditory nerve to study cochlear synaptopathy

Several non-human animal studies have demonstrated a permanent loss of auditory nerve (AN) fiber synapses after noise over-exposure, termed cochlear synaptopathy, without causing hair cell loss nor altering normal auditory thresholds (e.g., Kujawa and Liberman, 2009). Studies in human listeners are generally inconclusive, mainly because assessing the status of the AN in humans represents a major challenge. In a previous study, we proposed the use of envelope following responses (EFR) as a tool to investigate synaptopathy both in mice and humans (Encina-Llamas et al., under review; Parthasarathy et al., 2017). Similar patterns in synaptopathic mice and humans were found. The use of a "humanized" version of the AN model by Zilany et al. (2009, 2014) could qualitatively account for the patterns obtained in the human listeners. Nevertheless, the use of the original animal version of the AN model (based on the cat) failed to simulate EFRs in mice. It was argued that a species-specific AN model could improve the non-human animal simulations. Given that the mouse is the most used and best characterized species in connection with cochlear synaptopathy, the present study proposes a modification of the original AN model by Zilany et al. (2009, 2014) based on cat data adapted to the mouse.

A Multi-Port Bidirectional Power Conversion System for Reversible Solid Oxide Fuel Cell Applications

Reversible Solid Oxide Fuel Cell/Electrolyser Cell (SOFC/EC) technology is an attractive solution for high energy storage system in the utility grid. However, the wide range of voltage and low power of single SOFC/EC stack make it difficult to design the power conversion system for SOFC/EC storage system. In this paper, a new power multiport bidirectional conversion system is proposed to connect multiple SOFC/EC stacks with the utility grid. The converter structure contains a multi-port structure with two conversion stages. The two-stage conversion structure is first analyzed to address the wide-range of SOFC/EC stack’s voltage. The high-step-down CLLC resonant converter is implemented to achieve efficient voltage transformation, and the interleaved buck converter is employed as the second stage to control the voltage of SOFC/EC stack within a wide range. The derivation of the multi-port structure is introduced, and the control strategy of proposed conversion system is also discussed in this paper. The proposed conversion system enables a flexible control for the application of multiple SOFC/EC stacks. The feature of the proposed system is verified by the experiments from a down-scale prototype.
Analysis and Comparison of dc/dc Topologies in Partial Power Processing Configuration for Energy Storage Systems

This paper presents an analysis and comparison of dc/dc switched-mode power supplies (SMPS) for energy storage systems in partial power processing (PPP) configuration. The advantage of this configuration is that the SMPS only processes the partial power resulting from the voltage difference between the source and the energy storage element, thus allowing for a reduction of the converter power rating. Selection of an appropriate topology for a given system configuration is the key factor in achieving high efficiency power conversion. An analysis and comparison of dc/dc topologies based on component stress factor (CSF) is performed to determine the optimal solution for the evaluated application. Based on the results of the CSF analysis, a dc/dc converter is designed, built and tested. Experimental results prove the feasibility of the PPP configuration with a reduction of the 80% of the power rating compared to the traditional interconnection, which implies a reduction in cost, weight and an increase in efficiency.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Mira Albert, M. D. C. (Intern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 7
Publication date: 2018

Analysis of dDNP NMR metabolic data from cancer cells

With the rise of the field of systems biology, metabolomic data have been integrated with the data for other -omic sciences, and these gigantic collections of correlated data have with the ever improving computing power, been data mined to locate biomarkers and motifs.[1] In this project the metabolic fingerprint of four prostate cancer cell lines, with different levels of aggression were analyzed. Metabolic data were obtained by incubating the cells with 13C6-d7 isotope labeled glucose, then quenching the metabolism, removing the cell debris and hyperpolarizing the metabolite extracts with dissolution Dynamic Nuclear Polarization (dDNP).

By integrating the peaks of the resulting NMR spectra, a collection of metabolic data was obtained without the need for identification of specific compounds. On this data, data mining was applied, with the aim to identify biomarkers of cancer and to classify the aggressiveness of the cancer. The illustrations below show examples of obtained NMR spectra for the different cell types (on the left) and Principal Components-Discriminant Function Analysis (PCDFA) results from the four prostate cancer cell types and a breast cancer cell line, in red, (on the right). The PC-DFA is clearly able to separate the cell types, with the most aggressive clustering together (blue and green). As dDNP MNR have been shown to be quantitative and reproducible,[2] it could be an important tool in the future for cancer diagnostics.

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Main Research Area: Technical/natural sciences
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Analysis of room acoustics in Danish Hospitals

This project aims to compare room acoustic parameters and noise levels in various Danish hospitals: Odense, Gentofte, Bispebjerg, Hillerød and Aarhus Hospitals. Room acoustic conditions are measured in audiometric rooms at Odense, Gentofte, Bispebjerg and Aarhus hospitals. The noise levels in emergency rooms at Gentofte, Køge and Hillerød hospitals are measured over several days. The measurements are also compared with the requirements in the Danish Building Regulation, WHO guidelines and previous studies. The main parameters considered are the reverberation time parameters, e.g., Early decay time (EDT) and T20, and the sound pressure level metrics, namely the equivalent level and peak level. In addition, the staff at the hospitals is asked about their personal perception of the acoustic and noise conditions and the correlation between their subjective disturbances/annoyance and the objective acoustic parameters is investigated.

Analytical Assessment of Voltage Support via Reactive Power from new Electric Vehicles Supply Equipment in Radial Distribution Grids with Voltage-Dependent Loads

Grid operators have to cope with secure electric vehicles integration in the power system, which may lead to violations of the allowed voltage band. This work intends to provide an analytical assessment and guidelines for distribution system operators when evaluating new electric vehicle supply equipment installations with fast charging capability in existing low voltage distribution feeders. The aim is to prevent the voltage to exceed the permitted values when charging at high power, by exploiting the effect of reactive power. The contribution of each power component in distribution grids is analyzed, including the loads' voltage-dependency, which influences the effectiveness of reactive power control. The proposed guidelines indicate the amount of capacitive reactive power that an individual electric vehicle supply equipment is expected to provide, in order to effectively manage the voltage rise. The proposed method is validated on the Cigrè benchmark low voltage distribution network as well as on a real Danish low voltage grid.
An Architecture for Controller Parameterization

The focus in this paper is on the YJBK (after Youla, Jabr, Bongiorno and Kucera) parameterization of all stabilizing feedback controllers for a given system. A new formulation of YJBK controller architecture is presented and the relation with the double Bezout equation is described. In the standard formulation, a full order model of the system is required for an implementation of the YJBK controller architecture. Here, implementation of the YJBK parameterization will be based
on reduced order model, obtained by e.g. model reduction of the full order models or by using identification methods. The controller architecture based on reduced order models will be analyzed with respect to closed-loop stability.

A narrow line UV-induced non-persistent radical to generate highly polarized transportable glucose solid samples

An Asynchronous-Switched-Capacitor DC-DC Converter Based on GaN and SiC Devices

An Automatically Generated Texture-based Atlas of the Lungs

Many pulmonary diseases can be characterized by visual abnormalities on lung CT scans. Some diseases manifest similar defects but require completely different treatments, as is the case for Pulmonary Hypertension (PH) and Pulmonary Embolism (PE): both present hypo- and hyper-perfused regions but with different distribution across the lung and require different treatment protocols. Finding these distributions by visual inspection is not trivial even for trained radiologists who currently use invasive catheterism to diagnose PH. A Computer-Aided Diagnosis (CAD) tool that could facilitate the non-invasive diagnosis of these diseases can benefit both the radiologists and the patients. Most of the visual differences in the parenchyma can be characterized using texture descriptors. Current CAD systems often use texture information but the texture is either computed in a patch-based fashion, or based on an anatomical division of the lung. The difficulty of precisely finding these divisions in abnormal lungs calls for new tools for obtaining new meaningful divisions of the lungs. In this paper we present a method for unsupervised segmentation of lung CT scans into subregions that are similar in terms of texture and spatial proximity. To this extent, we combine a previously validated Riesz-wavelet texture descriptor with a well-known superpixel segmentation approach that we extend to 3D. We demonstrate the feasibility and accuracy of our
approach on a simulated texture dataset, and show preliminary results for CT scans of the lung comparing subjects suffering either from PH or PE. The resulting texture-based atlas of individual lungs can potentially help physicians in diagnosis or be used for studying common texture distributions related to other diseases.

### General information
- **State:** Published
- **Organisations:** Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Magnetic Resonance, Image Analysis & Computer Graphics, University of Applied Sciences Western Switzerland, University Hospital of Geneva
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- **Number of pages:** 8
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- **Article number:** 105753A
- **Main Research Area:** Technical/natural sciences
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- **DOIs:** 10.1117/12.2294004
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### A New Method for Handling Lockout Constraints on Controlled TCL Aggregations
Thermal loads are recognized as a valuable source of flexibility in face of the increasing variability caused by the large shares of renewable production. Lockout constraints can significantly reduce the flexibility of thermostatically controlled loads (TCLs). We propose a novel way of modifying the loads’ lockout durations to achieve non-intrusive centralized control without relying on local computations and estimations. We derive analytical expressions for the flexibility reduction and validate them via simulations, which show that the proposed method describes the TCLs flexibility accurately. We further show that a simple stochastic centralized controller, which does not rely on local temperature measurements, outperforms the commonly used priority-stack controller in terms of system robustness against infeasible trajectories.

### General information
- **State:** Accepted/In press
- **Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Lawrence Berkeley National Laboratory
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- **Main Research Area:** Technical/natural sciences
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- **Aggregation, Lockout constraints, Stochastic controller, Thermal battery model, Thermostatically controlled loads
- **Source:** PublicationPreSubmission
- **Source-ID:** 145122675
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### An Integrated Market for Electricity and Natural Gas Systems with Stochastic Power Producers
In energy systems with high shares of weather-driven renewable power sources, gas-fired power plants can serve as a back-up technology to ensure security of supply and provide short-term flexibility. Therefore, a tighter coordination between electricity and natural gas networks is foreseen. In this work, we examine different levels of coordination in terms of system integration and time coupling of trading floors. We propose an integrated operational model for electricity and natural gas systems under uncertain power supply by applying two-stage stochastic programming. This formulation co-optimizes day-ahead and real-time dispatch of both energy systems and aims at minimizing the total expected cost. Additionally, two deterministic models, one of an integrated energy system and one that treats the two systems independently, are presented. We utilize a formulation that considers the linepack of the natural gas system, while it results in a tractable mixed-integer linear programming (MILP) model. Our analysis demonstrates the effectiveness of the proposed model in accommodating high shares of renewables and the importance of proper natural gas system modeling.
in short-term operations to reveal valuable flexibility of the natural gas system. Moreover, we identify the coordination parameters between the two markets and show their impact on the system’s operation and dispatch.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, University of Malaga
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.83 SJR 2.489 SNIP 2.433
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.225 SNIP 2.364 CiteScore 3.59
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.143 SNIP 2.444 CiteScore 3.21
Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.328 SNIP 2.567 CiteScore 3.01
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ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
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BFI (2009): BFI-level 1
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Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.623 SNIP 2.027
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Scopus rating (2006): SJR 1.217 SNIP 2.007
Web of Science (2006): Indexed yes
An MR-Compatible Haptic Interface With Seven Degrees of Freedom

Functional magnetic resonance imaging (fMRI) is a powerful tool for neuroscience. It allows the visualization of active areas in the human brain. Combining this method with haptic interfaces allows one to conduct human motor control studies with an opportunity for standardized experimental conditions. However, only a small number of specialized MR-compatible haptic interfaces exist that were mostly built around specific research questions. The devices are designed for pure translational, rotational, or grasping movements. In this work, we present a novel MR-compatible haptic interface with seven degrees of freedom (DoF), which allows for both translations and rotations in three DoF each, as well as a two-finger precision grasp. The presented haptic interface is the first one with these capabilities and is designed as a universal tool for human motor control studies involving fMRI. It allows for the switching of the paradigm to reprogramming rather than redesigning when moving on to a new research question. We introduce its kinematics and control, along with results of MR compatibility tests and a preliminary fMRI study, showing the applicability of the device.
Application of functional modeling for monitoring of WTG in a cyber-physical environment

Decentralization of generation and increasing utilization of information communication systems bring challenges to present power system modeling approaches. This work applies functional modeling for monitoring and modeling of distributed energy resources, with wind turbine generator (WTG) application as a case study. First, we established a functional model of a generic WTG through the multilevel flow modeling approach. The model acts as basis of a state estimator (SE) for monitoring the WTG. Afterwards, the application of the SE is extended for wind power plant monitoring and control. The case study results show that the SE can efficiently limit the impact of information errors from different data integrity attacks during active power curtailment.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of New South Wales
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A Stochastic Market Design With Revenue Adequacy and Cost Recovery by Scenario: Benefits and Costs

Two desirable properties of electricity market mechanisms include: i) revenue adequacy for the market, and ii) cost recovery for all generators. Previously proposed stochastic market-clearing mechanisms satisfy both properties in expectation only, or satisfy one property by scenario and another in expectation. Consequently, market parties may perceive significant risks from market participation, and therefore be discouraged from making offers or perhaps even investing. We develop a stochastic two-stage market-clearing model including day-ahead and real-time settlements with an energy-only pricing scheme that ensures both properties by scenario. However, this approach is cost-inefficient in general and may sacrifice other desirable market attributes. Undesirable consequences include: one group of participants will have to pay more to ensure that all other participants have their costs covered, and thus their prices will not be equilibrium supporting; and day-ahead and real-time prices are not arbitraged in expectation, although this can be fixed by allowing virtual bidders to arbitrage but at the potential cost of increased market inefficiency. Considering these pros and cons, we propose our model as an appropriate tool for market analysis, and not for clearing actual markets. Numerical results from case studies illustrate the benefits and costs of the proposed stochastic market design.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Johns Hopkins University
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Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
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Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
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ISI indexed (2012): ISI indexed yes
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A three-dimensional acoustic Boundary Element Method formulation with viscous and thermal losses based on shape function derivatives

Sound waves in fluids are subject to viscous and thermal losses, which are particularly relevant in the so-called viscous and thermal boundary layers at the boundaries, with thicknesses in the micrometer range at audible frequencies. Small devices such as acoustic transducers or hearing aids must then be modeled with numerical methods that include losses. In recent years, versions of both the Finite Element Method (FEM) and the Boundary Element Method (BEM) including viscous and thermal losses have been developed. This paper deals with an improved formulation in three dimensions of the BEM with losses which avoids the calculation of tangential derivatives on the surface by finite differences used in a previous BEM implementation. Instead, the tangential derivatives are obtained from the element shape functions. The improved implementation is demonstrated using an oscillating sphere, where an analytical solution exists, and a condenser microphone as test cases.
Automatic Detection of Cortical Arousals in Sleep using Bi-direction LSTM Networks

Cortical arousals are transient events that occur during sleep. Although they can occur naturally, arousals are often used to evaluate sleep-wake dysfunction. The gold standard for detecting arousals is visual inspection of polysomnography recordings. Manual annotation of arousals is time consuming and has been shown to have a high inter- and intra-scorer variation. This study proposes a method to fully automate detection of arousals using recent advances in machine learning.

Methods:
The proposed method in this study extracted features from electroencephalography (EEG), electrooculography (EOG) and chin electromyography (EMG) to compute a probability of arousals through a bi-directional long short-term memory neural network. The study used a dataset of 233 nocturnal PSGs of population-based samples from Wisconsin Sleep Cohort (WSC) and 30 nocturnal PSGs of clinical samples from the Stanford Sleep Cohort (SSC). The model was trained on 186 recordings from WSC and annotations from two scorers. The model was tested on 47 recordings from WSC and then compared to a set of 3 annotations from 9 independent scorers on 30 recordings from both cohorts by measure of Fleiss’ Kappa (level of agreement greater than chance).

Results:
The model obtained a precision of 0.79, a recall of 0.8 and F1-score of 0.79 on the 47 recordings from WSC. The model was robust to different sleep stages showing an F1-score of 0.71 ± 0.19, 0.8 ± 0.13, 0.89 ± 0.18 and 0.8 ± 0.17 (mean ± SD) for N1, N2, N3 and REM sleep, respectively. Preliminary results comparing the scorers show a Fleiss’ Kappa of 0.38.
± 0.12, while including the model predictions result in a Fleiss' Kappa of 0.4 ± 0.1.

Conclusion:
Cortical arousals were detected automatically with the proposed algorithm with a high performance and robustness to different sleep stages. Preliminary results comparing nine independent scorers demonstrates a low inter-scorer reliability with a similar agreement to the model predictions.

General information
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Organisations: Department of Electrical Engineering, Biomedical Engineering, Stanford University, University of Wisconsin, Copenhagen University Hospital
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Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.618 SNIP 2.196 CiteScore 4.66
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 2.517 SNIP 2.165 CiteScore 4.83
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ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 2.681 SNIP 2.164
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Scopus rating (2008): SJR 2.235 SNIP 1.761
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Scopus rating (2003): SJR 1.113 SNIP 1.441
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Automatic Detection of Respiratory Events During Sleep Using Bidirectional LSTM Networks

Sleep apnea is a common sleep disorder, which involves cessation of breathing due to obstruction of the upper airway (obstructive) or due to suspension of ventilatory effort (central) during sleep. Currently, sleep apnea is diagnosed using polysomnography (PSG). Breathing events are manually scored by trained sleep technicians, however this is time-consuming, expensive, and prone to subjective interpretation. Thus, the aim of this study was to develop a fully automatic algorithm to detect respiratory events in sleep.

Methods:
Oxygen saturation, nasal pressure (transducer), oral airflow (thermistor), respiratory effort (RIP belts), and snoring signals were extracted from 2,366 PSGs from the Wisconsin Sleep Cohort (age: 59.7 ± 8.4, BMI: 31.6 ± 7.2 (mean±SD)). After filtering, sixteen features (time and frequency domain) were extracted from each signal using a sliding window of ten seconds with eight seconds overlap. Two models were developed based on bidirectional long short-term memory (bLSTM) neural networks: 1) a two-class model for classification of windows as “normal” or “event”, and 2) a four-class model for classification as “normal”, “obstructive”, “central”, or “mixed”. 1882 subjects were used for training; 249 subjects were used for validation. Preliminary results were obtained for a test set of 235 subjects.

Results:
With respect to the total number of events, the two-class model obtained precision of 0.740 and recall of 0.769. The four-class model obtained precision of 0.787, 0.205, and 0.100, and recall of 0.685, 0.190, and 0.0985, for obstructive, central, and mixed events, respectively. The Pearson correlation coefficient between annotated and predicted apnea hypopnea index (AHI) were 0.844 and 0.861 for the two-class and the four-class model, respectively.

Conclusion:
These results indicate that obstructive events can be reliably detected with a bLSTM network. However, the models had difficulties detecting central and mixed events correctly, which were present in a very limited number (1.5 % and 0.21 % of events). Future work includes improving the models for central and mixed event detection.
Automatic, ECG-based detection of autonomic arousals and their association with cortical arousals, leg movements, and respiratory events in sleep

The current definition of sleep arousals neglects to address the diversity of arousals and their systemic cohesion. Autonomic arousals (AA) are autonomic activations often associated with cortical arousals (CA), but they may also occur in isolation in relation to a respiratory event, a leg movement event or spontaneously, without any other physiological associations. AA should be acknowledged as essential events to understand and explore the systemic implications of arousals. We developed an automatic AA detection algorithm based on intelligent feature selection and advanced machine learning using the electrocardiogram. The model was trained and tested with respect to CA systematically scored in 258 (181 training size/77 test size) polysomnographic recordings from the Wisconsin Sleep Cohort. A precision value of 0.72 and a sensitivity of 0.63 were achieved when evaluated with respect to CA. Further analysis indicated that 81% of the non-CA-associated AAs were associated with leg movement (38%) or respiratory (43%) events. The presented algorithm shows good performance when considering that more than 80% of the false positives (FP) found by the detection algorithm appeared in relation to either leg movement or respiratory events. This indicates that most FP constitute autonomic activations that are indistinguishable from those with cortical cohesion. The proposed algorithm provides an automatic system trained in a clinical environment, which can be utilized to analyse the systemic and clinical impacts of arousals.

General information
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Organisations: Department of Electrical Engineering, Biomedical Engineering, Stanford University, University of Wisconsin, Copenhagen University Hospital
Authors: Olsen, M. (Intern), Schneider, L. D. (Ekstern), Cheung, J. (Ekstern), Peppard, P. E. (Ekstern), Jennum, P. J. (Ekstern), Mignot, E. (Ekstern), Sørensen, H. B. D. (Intern)
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Automatic skull segmentation from MR images for realistic volume conductor models of the head: Assessment of the state-of-the-art

Anatomically realistic volume conductor models of the human head are important for accurate forward modeling of the electric field during transcranial brain stimulation (TBS), electro- (EEG) and magnetoencephalography (MEG). In particular, the skull compartment exerts a strong influence on the field distribution due to its low conductivity, suggesting the need to represent its geometry accurately. However, automatic skull reconstruction from structural magnetic resonance (MR) images is difficult, as compact bone has a very low signal in magnetic resonance imaging (MRI). Here, we evaluate three methods for skull segmentation, namely FSL BET2, the unified segmentation routine of SPM12 with extended spatial tissue priors, and the skullfinder tool of BrainSuite. To our knowledge, this study is the first to rigorously assess the accuracy of these state-of-the-art tools by comparison with CT-based skull segmentations on a group of ten subjects. We demonstrate several key factors that improve the segmentation quality, including the use of multi-contrast MRI data, the optimization of the MR sequences and the adaptation of the parameters of the segmentation methods. We conclude that FSL and SPM12 achieve better skull segmentations than BrainSuite. The former methods obtain reasonable results for the upper part of the skull when a combination of T1- and T2-weighted images is used as input. The SPM12-based results can be improved slightly further by means of simple morphological operations to fix local defects. In contrast to FSL BET2, the SPM12-based segmentation with extended spatial tissue priors and the skullfinder tool of BrainSuite. To our knowledge, this study is the first to rigorously assess the accuracy of these state-of-the-art tools by comparison with CT-based skull segmentations on a group of ten subjects. We demonstrate several key factors that improve the segmentation quality, including the use of multi-contrast MRI data, the optimization of the MR sequences and the adaptation of the parameters of the segmentation methods. We conclude that FSL and SPM12 achieve better skull segmentations than BrainSuite. The former methods obtain reasonable results for the upper part of the skull when a combination of T1- and T2-weighted images is used as input. The SPM12-based results can be improved slightly further by means of simple morphological operations to fix local defects. In contrast to FSL BET2, the SPM12-based segmentation with extended spatial tissue priors and the BrainSuite-based segmentation provide coarse reconstructions of the vertebrae, enabling the construction of volume conductor models that include the neck. We exemplarily demonstrate that the extended models enable a more accurate estimation of the electric field distribution during transcranial direct current stimulation (tDCS) for montages that involve extraencephalic electrodes. The methods provided by FSL and SPM12 are integrated into pipelines for the automatic generation of realistic head models based on tetrahedral meshes, which are distributed as part of the open-source software package SimNIBS for field calculations for transcranial brain stimulation.
Autonomous 3d model generation of unknown objects for dual-manipulator humanoid robots

This paper proposes a novel approach for the autonomous 3D model generation of unknown objects. A humanoid robot (or any setup with two manipulators) holds the object to model in one hand, views it from different perspectives and registers the depth information using a RGB-D sensor. The occlusions due to limited movement of the manipulator and the gripper itself covering the object are avoided by switching the object from one hand to the other. This allows for additional viewpoints leading to the registration of more depth information of the object. The contributions of this paper are as follows:

1. A humanoid robot that manipulates objects and obtains depth information
2. Tracing the hand movements with the robot's head to be able to see the object at every moment.
3. Filtering the point clouds to remove parts of the robot from them.
4. Utilizing the Normal Iterative Closest Point algorithm (depth points, surface normals and curvature information) to register point clouds over time. This method will be applied to those point clouds that include the robot gripper for optimal convergence; the resultant transform is then applied to those point clouds that describe only the segmented object.
5. Changing the object from one hand to another.
6. Merging the resulting object's partial point clouds from both the left and right hands.
7. Generating a mesh of the object based on the triangulation of final points of the object's surface.

No prior knowledge of the objects is necessary. No human intervention nor external help (i.e. visual markers, turntables..) is required either.

General information

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Organisations: Department of Electrical Engineering, Automation and Control, Korean Advanced Institute of Science and Technology (KAIST)
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A Water Treatment Case Study for Quantifying Model Performance with Multilevel Flow Modeling

Decision support systems are a key focus of research on developing control rooms to aid operators in making reliable decisions, and reducing incidents caused by human errors. For this purpose, models of complex systems can be developed to diagnose causes or consequences for specific alarms. Models applied in safety systems of complex and
safety-critical systems require rigorous and reliable model building and testing. Multilevel Flow Modelling is a qualitative and discrete method for diagnosing faults and has previously only been validated by subjective and qualitative means. To ensure reliability during operation, this work aims to synthesize a procedure to measure model performance according to diagnostic requirements. A simple procedure is proposed for validating and evaluating the concept of Multilevel Flow Modelling. For this purpose, expert statements, dynamic process simulations, and pilot plant experiments are used for validation of simple Multilevel Flow Modelling models of a hydrocyclone unit for oil removal from produced water.

**General information**

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Organisations: Department of Electrical Engineering, Automation and Control, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, Centre for oil and gas – DTU, Aalborg University

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- Scopus rating (2015): SJR 0.901 SNIP 1.128 CiteScore 1.09
- Scopus rating (2014): SJR 0.969 SNIP 1.582 CiteScore 0.93
- Web of Science (2014): Indexed yes
- Scopus rating (2013): SJR 0.746 SNIP 1.523 CiteScore 0.91
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- Scopus rating (2012): SJR 0.808 SNIP 1.38 CiteScore 0.86
- ISI indexed (2012): ISI indexed yes
- Scopus rating (2011): SJR 0.475 SNIP 0.914 CiteScore 0.73
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**A wavenumber approach to quantifying the isotropy of the sound field in reverberant spaces**

This study proposes an experimental method for evaluating isotropy in enclosures, based on an analysis of the wavenumber spectrum in the spherical harmonics domain. The wavenumber spectrum, which results from expanding an arbitrary sound field into a plane-wave basis, is used to characterize the spatial properties of the observed sound field. Subsequently, the obtained wavenumber spectrum is expanded into a series of spherical harmonics, and the moments from this spherical expansion are used to characterize the isotropy of the wave field. The analytical framework is presented. The method is examined numerically and experimentally, based on array measurements in four chambers: two anechoic chambers (one with a single source and another with an array of 52 sources), a reverberation chamber, and the same reverberation chamber with a sample of absorbing material on the floor. The results indicate that the proposed methodology is suitable for assessing the isotropy of a sound field.

**General information**

State: Published
Balance control of grid currents for UPQC under unbalanced loads based on matching-ratio compensation algorithm

In three-phase four-wire systems, unbalanced loads can cause grid currents to be unbalanced, and this may cause the neutral point potential on the grid side to shift. The neutral point potential shift will worsen the control precision as well as the performance of the three-phase four-wire unified power quality conditioner (UPQC), and it also leads to unbalanced three-phase output voltage, even causing damage to electric equipment. To deal with unbalanced loads, this paper proposes a matching-ratio compensation algorithm (MCA) for the fundamental active component of load currents, and by employing this MCA, balanced three-phase grid currents can be realized under 100% unbalanced loads. The steady-state fluctuation and the transient drop of the DC bus voltage can also be restrained. This paper establishes the mathematical model of the UPQC, analyzes the mechanism of the DC bus voltage fluctuations, and elaborates the interaction between unbalanced grid currents and DC bus voltage fluctuations; two control strategies of UPQC under three-phase stationary coordinate based on the MCA are given, and finally, the feasibility and effectiveness of the proposed control strategy are verified by experiment results.
Benchmarking five numerical simulation techniques for computing resonance wavelengths and quality factors in photonic crystal membrane line defect cavities

We present numerical studies of two photonic crystal membrane microcavities: a short line-defect cavity with relatively low quality (Q) factor and a longer cavity with high Q. We use five state-of-the-art numerical simulation techniques to compute the cavity Q factor and the resonance wavelength (λ) for the fundamental cavity mode in both structures. For each method, the relevant computational parameters are systematically varied to estimate the computational uncertainty. We show that some methods are more suitable than others for treating these challenging geometries.

General information

State: Published
Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Centre of Excellence for Silicon Photonics for Optical Communications, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Plasmonics and Metamaterials, Zuse Institute Berlin, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO)
Authors: de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Gutsche, P. (Ekstern), Burger, S. (Ekstern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Ivinskaya, A. (Ekstern), Wang, F. (Intern), Sigmund, O. (Intern), Häyrynen, T. (Intern), Lavrinenko, A. V. (Intern), Mørk, J. (Intern), Gregersen, N. (Intern)
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Publication information

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ISSN (Print): 1094-4087
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.74 SJR 1.519 SNIP 1.567
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.48 SJR 1.532 SNIP 1.544
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.91 SNIP 1.674 CiteScore 3.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.313 SNIP 2.124 CiteScore 4.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.337 SNIP 2.196 CiteScore 4.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.562 SNIP 2.108 CiteScore 3.85
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.58 SNIP 2.572 CiteScore 4.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Benchmarking state-of-the-art numerical simulation techniques for analyzing large photonic crystal membrane line defect cavities

In this work, we perform numerical studies of two photonic crystal membrane microcavities, a short line-defect L5 cavity with relatively low quality (Q) factor and a longer L9 cavity with high Q. We compute the cavity Q factor and the resonance wavelength $\lambda$ of the fundamental M1 mode in the two structures using five state-of-the-art computational methods. We study the convergence and the associated numerical uncertainty of $Q$ and $\lambda$ with respect to the relevant computational parameters for each method. Convergence is not obtained for all the methods, indicating that some are more suitable than others for analyzing photonic crystal line defect cavities.

General information
State: Accepted/In press
Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Centre of Excellence for Silicon Photonics for Optical Communications, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Plasmonics and Metamaterials, Zuse Institute Berlin, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO)
Authors: Gregersen, N. (Intern), de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Gutsche, P. (Ekstern), Burger, S. (Ekstern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Ivinskaya, A. (Ekstern), Wang, F. (Intern), Sigmund, O. (Intern), Häyrynen, T. (Intern), Lavrinenko, A. (Intern)
Number of pages: 6
Publication date: 2018

Host publication information
Title of host publication: Proceedings of SPIE
Benchmarking state-of-the-art optical simulation methods for analyzing large nanophotonic structures

Five computational methods are benchmarked by computing quality factors and resonance wavelengths in photonic crystal membrane L5 and L9 line defect cavities. Careful convergence studies reveal that some methods are more suitable than others for analyzing these cavities.

General information
State: Published
Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Centre of Excellence for Silicon Photonics for Optical Communications, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Plasmonics and Metamaterials, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO), Zuse Institute Berlin
Authors: Gregersen, N. (Intern), de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Wang, F. (Intern), Sigmund, O. (Intern), Ivinskaya, A. (Ekstern), Lavrinenko, A. (Intern), Gutsche, P. (Ekstern), Burger, S. (Ekstern), Häyrynen, T. (Intern), Mørk, J. (Intern)
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Conference: 26th International Workshop on Optical Wave & Waveguide Theory and Numerical Modelling, Bad Sassendorf, Germany, 13/04/2018 - 13/04/2018
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Benefits of spatiotemporal modeling for short-term wind power forecasting at both individual and aggregated levels
The share of wind energy in total installed power capacity has grown rapidly in recent years. Producing accurate and reliable forecasts of wind power production, together with a quantification of the uncertainty, is essential to optimally integrate wind energy into power systems. We build spatiotemporal models for wind power generation and obtain full probabilistic forecasts from 15 min to 5 h ahead. Detailed analyses of forecast performances on individual wind farms and aggregated wind power are provided. The predictions from our models are evaluated on a data set from wind farms in western Denmark using a sliding window approach, for which estimation is performed using only the last available measurements. The case study shows that it is important to have a spatiotemporal model instead of a temporal one to achieve calibrated aggregated forecasts. Furthermore, spatiotemporal models have the advantage of being able to produce spatially out-of-sample forecasts. We use a Bayesian hierarchical framework to obtain fast and accurate forecasts of wind power generation not only at wind farms where recent data are available but also at a larger portfolio including wind farms without recent observations of power production. The results and the methodologies are relevant for wind power forecasts across the globe and for spatiotemporal modeling in general.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Norwegian University of Science and Technology
Authors: Lenzi, A. (Intern), Steinsland, I. (Ekstern), Pinson, P. (Intern)
Number of pages: 17
Publication date: 2018
Main Research Area: Technical/natural sciences
Benefits of spatio-temporal modelling for short term wind power forecasting at both individual and aggregated levels

The share of wind energy in total installed power capacity has grown rapidly in recent years. Producing accurate and reliable forecasts of wind power production, together with a quantification of the uncertainty, is essential to optimally integrate wind energy into power systems. We build spatio-temporal models for wind power generation and obtain full probabilistic forecasts from 15 minutes to 5 hours ahead. Detailed analysis of the forecast performances on the individual wind farms and aggregated wind power are provided. The predictions from our models are evaluated on a data set from wind farms in western Denmark using a sliding window approach, for which estimation is performed using only the last available measurements. The case study shows that it is important to have a spatio-temporal model instead of a temporal one to achieve calibrated aggregated forecasts. Furthermore, spatio-temporal models have the advantage of being able to produce spatially out-of-sample forecasts. We use a Bayesian hierarchical framework to obtain fast and accurate forecasts of wind power generation at wind farms where recent data are available, but also at a larger portfolio including wind farms without recent observations of power production. The results and the methodologies are relevant for wind power forecasts across the globe as well as for spatial-temporal modelling in general.

General information
State: Submitted
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Cognitive Systems, Norwegian University of Science and Technology
Authors: Lenzi, A. (Intern), Pinson, P. (Intern), Steinsland, I. (Ekstern)
Number of pages: 35
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Environmetrics
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.36 SJR 1.014 SNIP 0.875
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.59 SJR 0.989 SNIP 1.029
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.979 SNIP 0.852 CiteScore 1.48
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.056 SNIP 1.153 CiteScore 1.64
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.067 SNIP 1.216 CiteScore 1.65
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.571 SNIP 0.921 CiteScore 1.12
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.54 SNIP 0.994 CiteScore 1.3
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.661 SNIP 0.811
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.563 SNIP 0.929
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Bi-Level Decentralized Active Power Control for Large-Scale Wind Farm Cluster

This paper presents a bi-level decentralized active power control (DAPC) for a large-scale wind farm cluster, consisting of several wind farms for better active power dispatch. In the upper level, a distributed active power control scheme based on the distributed consensus is designed to achieve fair active power sharing among multiple wind farms, which generates the power reference for each wind farm. A distributed estimator is used to estimate the total available power of all wind farms. In the lower level, a centralized control scheme based on the Model Predictive Control (MPC) is proposed to regulate active power outputs of all wind turbines (WTs) within a wind farm, which reduces the fatigue loads of WTs while tracking the power reference obtained from the upper level control. A wind farm cluster with 8 wind farms and totally 160 WTs, was used to test the control performance of the proposed decentralized active power control scheme.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark, Shandong University, North China Electric Power University
Authors: Huang, S. (Ekstern), Wu, Q. (Intern), Guo, Y. (Ekstern), Lin, Z. (Ekstern)
Number of pages: 8
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: I E T Renewable Power Generation
ISSN (Print): 1752-1416
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.18 SJR 0.979 SNIP 1.453
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.55 SJR 0.878 SNIP 1.434
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.976 SNIP 1.555 CiteScore 3.13
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.229 SNIP 2.282 CiteScore 3.56
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.601 SNIP 2.799 CiteScore 4.96
ISI indexed (2013): ISI indexed yes
Cable Connection Scheme Optimization for Offshore Wind Farm Considering Wake Effect

In order to reduce the levelised cost of energy (LCOE) of the offshore wind farm, many optimization works should be done to reduce the investment and increase the energy production. As one of the main expenses, the electrical system can take up more than 15% of the total investment while cable costs take a large proportion. In order to make a cost-effective wind farm, the cable connection layout should be optimized. This paper proposes a novel way for offshore wind farm cable connection layout design. The LCOE, which concerns three aspects: electrical power losses, power captured by wind turbines (WT) and investment, is selected to set up the objective function. Since all the optimization variables are integers, a heuristic algorithm, integer particle swarm optimization algorithm (IPSO), is adopted to find a near optimal solution. To improve the performance of the IPSO, an adaptive method for parameter control is used to help to find a better solution. Comparisons are made with results obtained by the Norwegian center for offshore wind energy (NORCOWE) reference wind farm and the presented method. From the simulation, it can be noticed that the presented approach can help to find a cable connection scheme which can reduce the LCOE by 1.75%.

Characterization of acoustic scattering from objects via near-field measurements

Acoustic scattering is defined as the disturbance of a given incident sound field due to an object’s shape and surface properties. The effect of scattering can be expressed in terms of a scattered sound field, which is calculated as the difference between the sound field when the object is present and the incident field without the object. The scattered
sound field obeys Sommerfeld’s radiation condition. Therefore its radial dependence (spherical decay) and its angular
dependence can be separated in the far-field. The angular component, so-called the far-field pattern, is a complex
directivity function, which is uniquely determined by the scattering object for a given incident sound field. Therefore, this
quantity constitutes a good scattering measure, which includes both scattering from the surface (roughness scattering) as
well as from the shape of the object (volume scattering). There are two main challenges associated to measuring the far-
field pattern directly: i) it requires large distances between the object and the measurement points, and ii) the incident and
the scattered fields need to be separated. In this study, we propose a method to estimate the far-field pattern via near-field
pressure and particle velocity measurements. The sound field is measured on a closed arbitrary
surface enclosing the object. The far-field pattern is estimated from an asymptotical formulation of the Helmholtz Integral
Equation. It is possible to use either the total sound field or just the scattered
part in the integral. Boundary element simulations show that the far-field patterns of different objects
are correctly recovered, provided that the measurement points are less than half a wavelength apart.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Richard, A. P. A. (Intern), Fernandez Grande, E. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern)
Pages: 2195-2202
Publication date: 2018

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Main Research Area: Technical/natural sciences
Conference: Euronoise 2018, Hersonissos, Crete, Greece, 27/05/2018 - 27/05/2018
Source: PublicationPreSubmission
Source-ID: 148895832
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Closed loop identification of a piezoelectrically controlled radial gas bearing: Theory and experiment**
Gas bearing systems have extremely small damping properties. Feedback control is thus employed to increase the
damping of gas bearings. Such a feedback loop correlates the input with the measurement noise which in turn makes the
assumptions for direct identification invalid. The originality of this article lies in the investigation of the impact of using
different identification methods to identify a rotor-bearing systems’ dynamic model when a feedback loop is active. Two
different identification methods are employed. The first method is open loop Prediction Error Method, while the other
method is the modified Hansen scheme. Identification based on the modified Hansen scheme is conducted by identifying
the Youla deviation system using subspace identification. Identification of the Youla deviation system is based on the
Youla–Jabr–Bongiorno–Kucera parametrisation of plant and controller. By using the modified Hansen scheme,
identification based on standard subspace identification methods can be used to identify the Youla deviation system of the
gas bearing. This procedure ensures the input to the Youla deviation system, and the noise is uncorrelated even though
the system is subject to feedback control. The effect of identifying the Youla deviation system compared to direct
subspace identification of the gas bearing is further investigated through a simulation example. Experiments are
conducted on the piezoelectrically controlled radial gas bearing. A dynamic model is identified using the modified Hansen
scheme as well as using Prediction Error Method identification. The resulting models are compared for different imperfect
nominal models,
to examine under which conditions each method should be used.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Applied Mathematics and
Computer Science , Dynamical Systems, Department of Mechanical Engineering, Solid Mechanics
Authors: Sekunda, A. K. (Intern), Niemann, H. H. (Intern), Poulsen, N. K. (Intern), Santos, I. F. (Intern)
Number of pages: 11
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Main Research Area: Technical/natural sciences

**Publication information**
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Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.703 SJR 0.394 CiteScore 1.39
This chapter presents a dynamic discrete time piecewise affine (PWA) model of a wind turbine. This can be used for the advanced optimal control of a wind farm, in approaches such as model predictive control (MPC). The nonlinearity identification is based on a clustering-based algorithm, which combines clustering, linear identification, and pattern recognition techniques. The chapter focuses on the identification of a PWA wind turbine model for wind farm control applications. The wind turbine model developed by US National Renewable Energy Laboratory (NREL) consists of several subsystems, including representations of the aerodynamics, drivetrain, tower, generator, pitch actuator and the wind turbine controller. The chapter also presents a case study of the developed PWA model that was verified by the comparison with the 5-MW NREL non-linear wind turbine model. The developed PWA model is suitable for advanced optimal control at wind farm level, including MPC and the linear-quadratic regulator.
CMOS Analog IC Design: Fundamentals
This book is intended for use as the main textbook for an introductory course in CMOS analog integrated circuit design. It is aimed at electronics engineering students who have followed basic courses in mathematics, physics, circuit theory, electronics and signal processing. It takes the students directly from a basic level to a level where they can start working on simple analog IC design projects or continue their studies using more advanced textbooks in the field. A distinct feature of this book is an emphasis on the interaction between analytical methods and simulation methods. Whenever relevant, the theoretical concepts are illustrated both through traditional mathematical models and through circuit simulations using the universally accepted program SPICE (Simulation Program with Integrated Circuit Emphasis). The material presented in this book has been adapted from material used by the author for many years of teaching an introductory one-semester course (5 ECTS credits) in CMOS analog integrated circuit design at the Technical University of Denmark.

General information
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Organisations: Department of Electrical Engineering, Electronics
Authors: Bruun, E. (Intern)
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Main Research Area: Technical/natural sciences
Electronic versions:
cmos_analog_ic_design_fundamentals.pdf

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Publication: Research - peer-review › Book – Annual report year: 2018

Combination of Synchronous Condenser and Synthetic Inertia for Frequency Stability Enhancement in Low Inertia Systems
Inertia reduction due to high-level penetration of converter interfaced components may result in frequency stability issues. The paper proposes and analyzes different strategies using synchronous condenser (SC), synthetic inertia (SI) of wind power plant, and their combination to enhance the frequency stability of low inertia systems under various scenarios and wind conditions. Furthermore, one of the SC models includes hardware of automatic voltage regulator (AVR) for better representation of the reality is implemented. The simplified Western Danish power system simulated in real time digital simulator (RTDS) is used as a test system of low inertia to demonstrate the effectiveness of the strategies. The comparative results show that the combination of SC with AVR hardware-in-the-loop test and SI offers a better improvement not only on frequency stability (rate of change of frequency and frequency deviation) but also on the system synchronism under various operating conditions.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Siemens A/S
Authors: Nguyen, H. T. (Intern), Yang, G. (Intern), Nielsen, A. H. (Intern), Jensen, P. H. (Ekstern)
Number of pages: 9
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Sustainable Energy
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BFI (2017): BFI-level 1
Combined Hyperpolarized $^{13}$C-pyruvate MRS and $^{18}$F-FDG PET (HyperPET) Estimates of Glycolysis in Canine Cancer Patients

$^{13}$C Magnetic Resonance Spectroscopy (MRS) using hyperpolarized $^{13}$C-labeled pyruvate as a substrate offers a measure of pyruvate-lactate interconversion and is thereby a marker of the elevated aerobic glycolysis (Warburg effect) generally exhibited by cancer cells. Here, we aim to compare hyperpolarized [$^{1-13}$C]pyruvate MRS with simultaneous $^{18}$F-2-fluoro-2-deoxy-D-glucose (FDG) PET in a cross-sectional study of canine cancer patients. Methods: Canine cancer patients underwent integrated PET/MRI using a clinical whole-body system. Hyperpolarized [$^{1-13}$C]pyruvate was obtained using dissolution-DNP. $^{18}$F-FDG PET, dynamic $^{13}$C MRS, $^{13}$C MRS Imaging (MRSI) and anatomical $^1$H MRI was acquired from 17 patients. Apparent pyruvate-to-lactate rate constants were estimated from dynamic $^{13}$C MRS. $^{18}$F-FDG Standard Uptake Values and maximum [$^{1-13}$C]lactate-to-total-$^{13}$C ratios were obtained from tumor regions of interest. Following inspection of data, patients were grouped according to main cancer type and linear regression between measures of lactate generation and $^{18}$FFDG uptake were tested within groups. Between groups, the same measures were tested for group differences. Results: The main cancer types of the 17 patients were sarcoma (n = 11), carcinoma (n = 5) and mastocytoma (n = 1). Significant correlations between pyruvate-to-lactate rate constants and $^{18}$FFDG uptake were found for sarcoma patients, whereas no significant correlations appeared for carcinoma patients. The sarcoma patients showed a non-significant trend towards lower $^{18}$FFDG uptake and higher lactate generation than carcinoma patients. However, the ratio of lactate generation to $^{18}$FFDG uptake was found to be significantly higher in sarcoma as compared to carcinoma. The results were found both when lactate generation was estimated as an apparent pyruvate-to-lactate rate constant from dynamic $^{13}$C MRS and as an [$^{1-13}$C]lactate to total $^{13}$C ratio from $^{13}$C MRSI. Conclusions: A comparison of hyperpolarized [$^{1-13}$C]pyruvate MRS with simultaneous $^{18}$F-FDG PET indicate that lactate generation and $^{18}$FFDG uptake in cancers can be related and that their relation depend on cancer type. This finding could be important for the interpretation and eventual clinical implementation of hyperpolarized $^{13}$C. In addition, the differences between the two modalities may allow for better metabolic phenotyping performing hybrid imaging in the form of hyperPET

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, University of Copenhagen
Compact high-speed envelope detector architecture for ultra-wideband communications

This article describes a Schottky diode based envelope detector architecture able to demodulate single-ended signals adopting a single balanced configuration without the use of an external balun. The proposed architecture combines the functionality of a balun and, simultaneously, the rectification of the input signal. The dual functionality of the Schottky diodes applied, leads to a compact configuration that, according to the authors’ knowledge, has not been shown before. The manufactured prototype is able to demodulate error free a 2.5 Gbps amplitude shift keying signal at 8 GHz carrier frequency, achieving a bitrate to frequency carrier ratio (b) of 31.25%.

General information

State: Published
Organisations: Metro-Access and Short Range Systems, Department of Electrical Engineering, Electromagnetic Systems, Department of Photonics Engineering, Technische Universität Darmstadt, Technische Hochschule Mittelhessen (THM) Giessen - University of Applied Sciences Mittelhessen, Eindhoven University of Technology, Technical University of Denmark
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Publication information

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Volume: 60
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.99 SJR 0.273 SNIP 0.599
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.87 SJR 0.278 SNIP 0.561
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.318 SNIP 0.506 CiteScore 0.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.347 SNIP 0.578 CiteScore 0.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.34 SNIP 0.63 CiteScore 0.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.333 SNIP 0.585 CiteScore 0.83
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.37 SNIP 0.612 CiteScore 0.83
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.386 SNIP 0.541
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.43 SNIP 0.601
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Comparison of computerized methods for rapid eye movement sleep without atonia detection

Rapid eye movement (REM) sleep without atonia detection is a prerequisite for diagnosis of REM sleep behavior disorder (RBD). As the visual gold standard method is time-consuming and subjective, several automated methods have been proposed. This study aims to compare their performances: The REM atonia index (RAI), the supra-threshold-REM-activity metric, the Frandsen index, the short/long muscle activity indices, and the Kempfner index algorithms were applied to 27 healthy control participants (C), 25 patients with Parkinson’s disease (PD) without RBD (PD-RBD), 29 patients with PD and RBD (PD + RBD), 29 idiopathic patients with RBD, and 36 patients with periodic limb movement disorder (PLMD). The indices were calculated in various configurations: (1) considering all muscle activities; (2) excluding the ones related to arousals; (3) excluding the ones during apnea events; (4) excluding the ones before and after apnea events; (5) combining configurations 2 and 3; and (6) combining configurations 2 and 4. For each of these configurations, the discrimination capability of the indices was tested for the following comparisons: (1) (C, PD-RBD, PLMD) vs (PD + RBD, RBD); (2) C vs RBD; (3) PLMD vs RBD; (4) C vs PD-RBD; (5) C vs PLMD; (6) PD-RBD vs PD + RBD; and (7) C vs PLMD vs RBD. Results showed varying methods’ performances across the different configurations and comparisons, making it impossible to identify the optimal method and suggesting the need of further improvements. Nevertheless, RAI seems the most sensible one for RBD detection. Moreover, apnea and arousal-related movements seem not to influence the algorithms’ performances in patients’ classification.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Biomedical Engineering, Paracelsus-Elena-Klinik, Kassel, Germany, Copenhagen University Hospital, Philips-Universität Marburg
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Scopus rating (2017): CiteScore 4.64 SJR 0.591 SNIP 1.783
Web of Science (2017): Indexed Yes
Comparison of two alternative sequences for human in-vivo brain MR Current Density Imaging (MRCDI)

MRCDI is a novel technique, utilizing different phase-sensitive MR methods for non-invasive measurements of weak currents in the human body, which is important in several neuroscience applications. Here, we compare the in-vivo performance of two different MR methods, multi-echo spin echo (MESE) and steady-state free precession free induction decay (SSFP-FID), with single- vs. multi-gradient-echo readouts. We demonstrate that multi-gradient-echo readouts improve both methods. We validate the linear dependence of the measured current-induced magnetic field on the injected current strength for both methods, and propose the more efficient SSFP-FID method as being well suited for highly sensitive single-slice human in-vivo MRCDI.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Copenhagen University Hospital, University of Tubingen
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Number of pages: 4
Publication date: 2018
Main Research Area: Technical/natural sciences
Electronic versions:
ISMRM18_5607_CihanSeqs.pdf
Source: PublicationPreSubmission
Source-ID: 149079143
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2018
Comprehensive Power Losses Model for Electronic Power Transformer

The electronic power transformer (EPT) has higher power losses than the conventional transformer. However, the EPT can correct the power factor, compensate the unbalanced current and reduce the line power losses in the distribution network. Therefore, the higher losses of the EPT and the consequent reduced power losses in the distribution network require a comprehensive consideration when comparing the power losses of the EPT and conventional transformer. In this paper, a comprehensive power losses analysis model for the EPT in distribution networks is proposed. By analyzing the EPT self-losses and considering the impact of the non-unity power factor and the three-phase unbalanced current, the overall power losses in the distribution network when using the EPT to replace the conventional transformer is analyzed, and the conditions in which the application of the EPT can cause less power losses are obtained. Based on this, the sensitivity analysis for the EPT comprehensive power losses model is carried out by comparing the value of each parameter variation impact on the EPT losses model. In case study, the validity of the comprehensive power losses model is verified.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hunan University
Authors: Yue, Q. (Ekstern), Li, C. (Ekstern), Cao, Y. (Ekstern), He, Y. (Ekstern), Cai, B. (Ekstern), Wu, Q. (Intern), Zhou, B. (Ekstern)
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Compressive acoustic holography with block-sparse regularization
Sparse reconstruction methods, such as Compressive Sensing, are powerful methods in acoustic array processing, as they make wideband reconstruction possible. However, when addressing sound fields that are not necessarily sparse (e.g., in acoustic near-fields, reflective environments, extended sources, etc.), the methods can lead to a poor reconstruction of the sound field. This study examines the use of sparse analysis priors to promote block-sparse solutions. In particular, a Fused Total Generalized Variation (F-TGV) method is developed, to analyze the sound field in the near-field of acoustic sources. The method promotes sparsity both on the spatial derivatives of the solution and on the solution itself, thus seeking solutions where the non-zero coefficients are grouped together. The performance of the method is examined numerically and experimentally, and compared with established methods. The results indicate that the F-TGV method is suitable to examine both compact and spatially extended sources. The method is promising for its generality, robustness to noise, and the capability to provide a wideband reconstruction of sound fields that are not necessarily sparse.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, University Paris Diderot - Paris 7
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Pages: 3737-3746
Publication date: 2018
Main Research Area: Technical/natural sciences
Computational reduction techniques for numerical vibro-acoustic analysis of hearing aids

Numerical modelling is a key point for vibro-acoustic analysis and optimization of hearing aids. The great number of small components constituting the devices, and the strong structure-acoustic coupling of the system make it a challenge to obtain accurate and computationally efficient models. In this thesis, several challenges encountered in the process of modelling and optimizing hearing aids are addressed. Firstly, a strategy for modelling the contacts between plastic parts for harmonic analysis is developed. Irregularities in the contact surfaces, inherent to the manufacturing process of the parts, introduce variations on the final contact points in practice, making the contact properties unknown. The suggested technique aims at characterising the contact in terms of distributed stiffness values, which are identified by means of a model updating method that matches simulation to experimental data. Secondly, the applicability of Model Order Reduction (MOR) techniques to lower the computational complexity of hearing aid vibro-acoustic models is studied. For fine frequency response calculation and optimization, which require solving the numerical model repeatedly, a computational challenge is encountered due to the large number of Degrees of Freedom (DOFs) needed to represent the complexity of the hearing aid system accurately. In this context, several MOR techniques are discussed, and an adaptive reduction method for vibro-acoustic optimization problems is developed as a main contribution. Lastly, topology optimization techniques for structure acoustic interaction problems are investigated with the aim of evaluating their applicability to the design of hearing aid parts. The strong fluid-structure interaction between the air and some of the thin, soft parts makes it necessary to include the effects of the interface variations in the optimization, which poses a challenge due to the need of interpolating between solid and fluid elements. Two techniques are compared in this context for a 2D hearing aid suspension design problem.

Condition monitoring of spar-type floating wind turbine drivetrain using statistical fault diagnosis

Operation and maintenance costs are significant for large-scale wind turbines, and particularly so for offshore. A well-organized operation and maintenance strategy is vital to ensure the reliability, availability, and cost-effectiveness of a system. The ability to detect, isolate, estimate and perform prognoses on component degradation could become essential to reduce unplanned maintenance and downtime. Failures in gearbox components are in focus since they account for a large share of wind turbine (WT) downtime. This study considers detection and estimation of wear in the downwind main shaft bearing of a 5 MW spar-type floating turbine. Using a high-fidelity gearbox model, we show how the downwind main bearing and nacelle axial accelerations can be used to evaluate the condition of the bearing. The paper shows how relative acceleration can be evaluated using statistical change detection methods to perform a reliable estimation of wear of the bearing. It is shown in the paper that the amplitude distribution of the residual accelerations follows a t-distribution and a change detection test is designed for the specific changes we observe when the main bearing becomes worn. The generalized likelihood ratio (GLR) test is extended to fit the particular distribution encountered in this problem,
closedform expressions are derived for shape and scale parameter estimation, which are indicators for wear and extent of wear in the bearing. The results in this paper show how the proposed approach can detect and estimate wear in the bearing according to desired probabilities of detection and false alarm.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Norwegian University of Science and Technology
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.201 SNIP 2.165 CiteScore 3.06
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.209 SNIP 3.688 CiteScore 3.42
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.235 SNIP 2.486 CiteScore 2.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.062 SNIP 2.297 CiteScore 2.36
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.892 SNIP 2.582 CiteScore 2.49
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.364 SNIP 2.026
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.885 SNIP 1.439
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.743 SNIP 1.555
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.942 SNIP 1.42
Web of Science (2007): Indexed yes
Constrained Multi-Body Dynamics for Modular Underwater Robots — Theory and Experiments

This paper investigates the problem of modelling a system of interconnected underwater robots with highly coupled dynamics. The objective is to develop a mathematical description of the system that captures its most significant dynamics. The proposed modelling method is based on active constraint enforcement by utilising the Udwadia-Kalaba Formulation for multi-body dynamics. The required description of a rigid constraint is defined, derived and implemented into a system of interconnected sub-models. An exhaustive experimental validation is conducted on a two-vehicle system, including towing tank tests on a BlueROV vehicle to determine the model parameters. The applicability of the modelling approach is assessed by comparing experimental data to simulations of an equivalent model synthesised using the proposed theory.

General information
State: Published
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Main Research Area: Technical/natural sciences

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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46 SJR 1.258 SNIP 1.975
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.235 SNIP 1.908 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.188 SNIP 2.249 CiteScore 2.11
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.129 SNIP 2.719 CiteScore 2.2
Variability in the dynamic response of assembled structures can arise due to variations in the contact conditions between the parts that conform them. Contact conditions are difficult to model accurately due to randomness in physical properties such as contact surface, load distribution or geometric details. Those properties can vary for a given structure due to the assembly and disassembly process, and also across nominally equal items that are produced in series. This work focuses on modeling the contact between small light-weight plastic pieces such as those used in the hearing aid industry, where the vibrational behavior of the structures within the hearing frequency range is critical for the performance of the devices.

A procedure to localize the most probable contact areas and determine the most sensitive contact points with respect to variations in the modes of vibration of the assembled plastic parts is presented. The procedure uses a gradient-based optimization strategy that updates the stiffness constants of a number of contact spring elements to match experimental data. By identifying the contact parameters for several sets of experimental data measured under varying contact conditions, the variability of the contact parameters can be characterized.
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.33 SJR 0.846 SNIP 1.669
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.668 SNIP 1.716 CiteScore 1.85
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.705 SNIP 1.885 CiteScore 1.67
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.778 SNIP 2.288 CiteScore 1.64
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.76 SNIP 2.191 CiteScore 1.66
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.772 SNIP 1.796 CiteScore 1.38
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.639 SNIP 1.542
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.793 SNIP 1.506
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.665 SNIP 1.761
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.642 SNIP 1.324
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.645 SNIP 1.314
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.614 SNIP 1.258
Scopus rating (2004): SJR 0.594 SNIP 1.071
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.794 SNIP 1.218
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.874 SNIP 0.959
Scopus rating (2001): SJR 0.62 SNIP 0.92
Scopus rating (2000): SJR 0.323 SNIP 0.874
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.322 SNIP 0.58
Continuous vital sign monitoring after major abdominal surgery—Quantification of micro events

Introduction: Millions of patients undergo major abdominal surgery worldwide each year, and the post-operative phase carries a high risk of respiratory and circulatory complications. Standard ward observation of patients includes vital sign registration at regular intervals. Patients may deteriorate between measurements, and this may be detected by continuous monitoring. The aim of this study was to compare the number of micro events detected by continuous monitoring to those documented by the widely used standardized Early Warning Score (EWS). Methods: Fifty patients were continuously monitored with peripheral arterial oxygen saturation (SpO2), heart rate (HR), and respiratory rate (RR) the first 4 days after major abdominal cancer surgery. EWS was monitored as routine practice. Number and duration of events were analyzed using Fisher’s exact test and Wilcoxon rank sum test. Results: Continuous monitoring detected a SpO2 <92% in 98% of patients vs 16% of patients detected by EWS (P < .0001). Micro events of SpO2 <92% lasting longer than 60 minutes were found in 58% of patients by continuous monitoring vs 16% by the EWS (P < .0001). Fifty-two percent of patients had micro events of SpO2 <85% lasting longer than 10 minutes. Continuous monitoring found tachycardia in 60% of patients vs 6% by the EWS. Frequency of events for bradycardia, tachypnea, and bradypnea showed similar patterns. Conclusion: Very low SpO2 and tachycardia in post-operative patients are common and under-diagnosed by the EWS. Continuous monitoring can discover these micro events and potentially contribute to earlier detection and, potentially, result in prevention of clinical complications.
Contributed review: camera-limits for wide-field magnetic resonance imaging with a nitrogen-vacancy spin sensor

Sensitive, real-time optical magnetometry with nitrogen-vacancy centers in diamond relies on accurate imaging of small (≪10−2), fractional fluorescence changes across the diamond sample. We discuss the limitations on magnetic field sensitivity resulting from the limited number of photoelectrons that a camera can record in a given time. Several types of camera sensors are analyzed, and the smallest measurable magnetic field change is estimated for each type. We show that most common sensors are of a limited use in such applications, while certain highly specific cameras allow achieving nanotesla-level sensitivity in 1 s of a combined exposure. Finally, we demonstrate the results obtained with a lock-in camera that paves the way for real-time, wide-field magnetometry at the nanotesla level and with a micrometer resolution.

General information
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Organisations: Department of Physics, Department of Electrical Engineering, Center for Magnetic Resonance, Quantum Physics and Information Technology, University of Ulm, University of Leipzig
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.2 SJR 0.703 SNIP 1.048
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.686 SNIP 0.908 CiteScore 1.11
Web of Science (2015): Indexed yes
Controlling entity ICT reference architecture: distributed control architecture for distributed systems

Automatic control by controlling entities (aggregators and local controllers) enables Distributed Energy Resources (DERs) to participate in the operation of the power grid. This helps to solve the problems of reliability and efficiency caused by the intermittent production of weather dependent energy sources, and the lack of control by system operators, caused by the increasing share of distributed energy sources. A DER ICT architecture and controlling entity ICT architecture are required to enable automatic control. The paper aims to describe the software components required for a generic scalable controlling entity ICT architecture, which does not require additional work for additional DERs and DER types. The paper presents concepts and ideas for the ICT architecture, and a case study illustrating the use of the ICT architecture, and the capabilities of the architecture. The plug ‘n’ play section describes self-healing and topology filtering for automatic setup.
and robust operation of control algorithms as part of the controlling entity ICT architecture.

**General information**
State: Published
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Smart grid, Distributed systems, Communication infrastructure, Network discovery, Communication negotiation, Service discovery, Capability discovery, IEC 61850, OpenADR, Serialization, Communication middleware, Control algorithms, Case study, Plug 'n' play, Self-healing, Topology filtering
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Source: FindIt
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**Control of a Three-Port DC-DC Converter for Grid Connected PV-Battery Applications**
A control strategy for an energy management system (EMS) of a household nanogrid is presented in this paper. The proposed EMS is based on a state diagram. A three port converter (TPC) with direct storage capability is chosen and the states together with the state transitions are defined. The state diagram signals to two algorithms of which one calculates the battery current reference and the other allows the photovoltaic (PV) system to operate at the maximum power point (MPP) at all times. An extensive model has been implemented in MATLAB/Simulink using generic models to test the proposed control method. Results show a system which at all times follows a specified power exchange with the grid with a overshoot in power of 500W and worst case settling time of 500ms.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Karstensen, P. I. H. (Ekstern), Tomas Manez, K. (Intern), Zhang, Z. (Intern)
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EMS, PV-battery application, State diagram, Three port converter
Electronic versions: 270086_FP.pdf
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Source: PublicationPreSubmission
Source-ID: 148019700
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**Control parameterization for power oscillation damping via software-in-the-loop simulation**
The parameter optimization of designed controllers for power systems is always a big concern and needs a lot of effort of researchers especially when the electricity grid becomes larger and more complex. The paper proposes a control parameterization using genetic algorithms (GA) for power oscillation damping (POD) incorporating in synchronous condensers via software-in-the-loop simulation to enhance the damping and frequency stability for low inertia systems. A closed-loop interfaced setup among real-time digital simulator (RTDS), Matlab, and OLE for Process Communication
(OPC) running in real time is analyzed and implemented to optimize the POD parameters of a synchronous condenser. Furthermore, a Prony technique based on the system measurement is applied to find out the frequency and damping ratio of the dominant oscillation mode. The POD optimal parameters are determined by the GA objective function that maximizes the damping ratio of the dominant oscillation mode. The effectiveness of the proposed method in damping power oscillations and frequency stability improvement is verified through simulation results of the future Western Danish power system. Simulation results demonstrate that the proposed approach offers a good performance for parameter optimization of the POD.

Control Strategies for Microgrids with Distributed Energy Storage Systems: An Overview

This paper presents an overview of the state of the art control strategies specifically designed to coordinate distributed energy storage (ES) systems in microgrids. Power networks are undergoing a transition from the traditional model of centralised generation towards a smart decentralised network of renewable sources and ES systems, organised into autonomous microgrids. ES systems can provide a range of services, particularly when distributed throughout the power network. The introduction of distributed ES represents a fundamental change for power networks, increasing the network control problem dimensionality and adding long time-scale dynamics associated with the storage systems’ state of charge levels. Managing microgrids with many small distributed ES systems requires new scalable control strategies that are robust to power network and communication network disturbances. This paper reviews the range of services distributed ES systems can provide, and the control challenges they introduce. The focus of this paper is a presentation of the latest decentralised, centralised and distributed multi-agent control strategies designed to coordinate distributed microgrid ES systems. Finally, multi-agent control with agents satisfying Wooldridge’s definition of intelligence is proposed as a promising direction for future research.
Convex Relaxations of Security Constrained AC Optimal Power Flow under Uncertainty

System operators have to ensure an N-1 secure operation, while dealing with higher degrees of uncertainty. This paper proposes a semidefinite relaxation of the chance and security constrained optimal power flow (SCOPF). Our main contributions are the introduction of systematic methods to obtain zero relaxation gap, providing a tractable chance constrained SCOPF formulation, and addressing scalability. We introduce a systematic procedure to obtain zero relaxation gap using a penalty term on power losses. To achieve tractability of the joint chance constraint, a piecewise affine approximation, and a combination of randomized and robust optimization is used. To address scalability, we propose an iterative solution algorithm to identify binding constraints, and we apply a chordal decomposition of the semidefinite constraints. We demonstrate the performance of our approach on IEEE 24 and IEEE 118 bus system using realistic day-ahead forecast data and obtain tight near-global optimality guarantees.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Venzke, A. (Intern), Chatzivasileiadis, S. (Intern)
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Cooperative Rendezvous and Docking for Underwater Robots Using Model Predictive Control and Dual Decomposition

This paper considers the problem of rendezvous and docking with visual constraints in the context of underwater robots with camera-based navigation. The objective is the convergence of the vehicles to a common point while maintaining visual contact. The proposed solution includes the design of a distributed model predictive controller based on dual decomposition, which allows for optimization in a decentralized fashion. The proposed distributed controller enables rendezvous and docking between vehicles while maintaining visual contact.

General information
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Organisations: Department of Electrical Engineering, Automation and Control, Norwegian University of Science and Technology
Authors: Nielsen, M. C. (Intern), Johansen, T. A. (Ekstern), Blanke, M. (Intern)
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Source: PublicationPreSubmission
Source-ID: 144263799
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Coordinated Pitch & Torque Control of Large-Scale Wind Turbine Based on Pareto Efficiency Analysis

For the existing pitch and torque control of the wind turbine generator system (WTGS), further development on coordinated control is necessary to improve effectiveness for practical applications. In this paper, the WTGS is modeled as a coupling combination of two subsystems: the generator torque control subsystem and blade pitch control subsystem. Then, the pole positions in each control subsystem are adjusted coordinately to evaluate the controller participation and used as the objective of optimization. A two-level parameters-controllers coordinated optimization scheme is proposed and applied to optimize the controller coordination based on the Pareto optimization theory. Three solutions are obtained through optimization, which includes the optimal torque solution, optimal power solution, and satisfactory solution. Detailed comparisons evaluate the performance of the three selected solutions and provide the optimized controller coordination suggestions according to different requirements.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, North China Electric Power University, Technical University of Denmark
Authors: Lin, Z. (Ekstern), Chen, Z. (Ekstern), Wu, Q. (Intern), Yang, S. (Ekstern), Meng, H. (Ekstern)
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Web of Science (2015): Indexed yes
Core functions of the Web-of-Cells control scheme

In order to maintain frequency (balancing) and voltage control in the future power system, the ELECTRA Web-of-Cells (WoC) control scheme introduces six high-level use cases, which are Balance Restoration Control (BRC), Frequency Containment Control (FCC), Inertia Response Power Control (IRPC), Balance Steering Control (BSC), Primary Voltage Control (PVC) and Post Primary Voltage Control (PPVC). This document presents the detailed description of the core functions that are needed and sufficient for controlling the grid in a Web-of-Cells architecture.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources, VTT - Technical Research Centre of Finland, VTT Technical Research Center of Finland, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, Centre for Renewable Energy Sources,
Correlation-constrained and sparsity-controlled vector autoregressive model for spatio-temporal wind power forecasting

The ever-increasing number of wind farms has brought both challenges and opportunities in the development of wind power forecasting techniques to take advantage of interdependencies between hundreds of spatially distributed wind farms, e.g., over a region. In this paper, a Sparsity-Controlled Vector Autoregressive (SC-VAR) model is introduced to obtain sparse model structures in a spatio-temporal wind power forecasting framework by reformulating the original VAR model into a constrained Mixed Integer Non-Linear Programming (MINLP) problem. It allows controlling the sparsity of the coefficient matrices in a direct manner. However, this original SC-VAR is difficult to implement due to its complicated constraints and the lack of guidelines for setting its parameters. To reduce the complexity of this MINLP and to make it possible to incorporate prior expert knowledge to benefit model building and forecasting, the original SC-VAR is modified and a Correlation-Constrained SC-VAR (CCSC-VAR) is proposed based on spatial correlation information about wind farms. Our approach is evaluated based on a case study of very-short-term forecasting for 25 wind farms in Denmark. Comparison is performed with a set of traditional local methods and spatio-temporal methods. The results obtained show the proposed CCSC-VAR has better overall performance than both the original SC-VAR and other benchmark methods, taking into account all evaluation indicators, including sparsity control ability, sparsity, accuracy, and efficiency.
Correlation of mechanical and electrical properties with processing variables in MWCNT reinforced thermoplastic nanocomposites

The influence of the processing variables and nanotube content on the mechanical and electrical properties of polyamide 6.6-based nanocomposites reinforced with multi-walled carbon nanotubes is investigated. Results show that variation in the processing variables such as compounding method, injection melt temperature, injection speed, mold temperature, and holding pressure varies the properties significantly. In fact, composites containing similar contents of the nanofillers show variations in mechanical properties up to 30.0% and in the electrical properties up to three orders of magnitude. Different processing parameters required for achieving optimal mechanical and electrical performances are also found. Correlation between processing parameters and microstructure within the nanocomposites is studied. Results show that variation of the processing parameters defines the existence or absence of a nanotube network in the nanocomposite structure. Experimental and micromechanical modeling results show that less control over the nanocomposite morphology and nanotube alignment is achievable in higher nanofiller contents. The underlying mechanisms responsible for the modulation in the properties are also discussed using scanning and transmission electron microscopy, rheological and crystallization investigations. The research provides a recipe to manufacture the tailored nanocomposite with the specified properties for various industrial applications.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Solid Mechanics
Cortical oscillations and entrainment in speech processing during working memory load

Neuronal oscillations are thought to play an important role in working memory (WM) and speech processing. Listening to speech in real-life situations is often cognitively demanding but it is unknown whether WM load influences how auditory cortical activity synchronizes to speech features. Here, we developed an auditory n-back paradigm to investigate cortical entrainment to speech envelope fluctuations under different degrees of WM load. We measured the electroencephalogram, pupil dilations and behavioural performance from 22 subjects listening to continuous speech with an embedded n-back task. The speech stimuli consisted of long spoken number sequences created to match natural speech in terms of sentence intonation, syllabic rate and phonetic content. To burden different WM functions during speech processing, listeners performed an n-back task on the speech sequences in different levels of background noise. Increasing WM load at higher n-back levels was associated with a decrease in posterior alpha power as well as increased pupil dilations. Frontal theta power increased at the start of the trial and increased additionally with higher n-back level. The observed alpha-theta power changes are consistent with visual n-back paradigms suggesting general oscillatory correlates of WM processing load. Speech entrainment was measured as a linear mapping between the envelope of the speech signal and low-frequency cortical activity.
Cost-Optimal ATCs in Zonal Electricity Markets

In contrast to existing frameworks for Available Transfer Capacity (ATC) determination, we propose to define ATCs in an integrated and data-driven manner, optimizing for expected operational costs of the whole system to derive cost-optimal ATCs. These ATCs are purely financial parameters, separate from the physical ATCs based on security indices only typically used in zonal electricity markets today. Determining cost-optimal ATCs requires viewing ATCs as an endogenous market construct, and leads naturally to the definition of a market entity whose responsibility is to optimize ATCs. The optimization problem which this entity solves is a stochastic bilevel problem, which we decompose to yield a computationally tractable formulation. We show that cost-optimal ATCs depend non-trivially on the underlying network structure, and the problem of finding a set of cost-optimal ATCs is in general non-convex. On a European scale test system, cost-optimal ATCs achieve expected total costs midway between those for non-integrated ATCs and a fully stochastic nodal setup. This benefit comes from qualitatively different ATCs compared to typical definitions, with ATCs which exceed the physical cross-border capacity by a factor of 2 or more, and ATCs which are zero between well-connected areas. Our results indicate that the perceived efficiency gap between zonal and nodal markets may be exaggerated if non-optimal ATCs are used.
Curvilinear 3-D Imaging Using Row–Column Addressed 2-D Arrays with a Diverging Lens: Phantom Study

A double-curved diverging lens over the flat row–column-addressed (RCA) 2-D array can extend its inherent rectilinear 3-D imaging field-of-view (FOV) to a curvilinear volume region, which is necessary for applications such as abdominal and cardiac imaging. Two concave lenses with radii of 12.7mm and 25.4mm were manufactured using RTV664 silicone. The diverging properties of the lenses were evaluated based on simulations and measurements on several phantoms. The measured FOV for both lenses in contact with tissue mimicking phantom were less than 15% different from the theoretical predictions, i.e., a curvilinear FOV of 32°×32° and 24°×24° for the 12.7mm and 25.4mm radii lenses. A synthetic aperture imaging sequence with single element transmissions was designed for imaging down to 140mm at a volume rate of 88 Hz. The performance was evaluated in terms of signal-to-noise ratio (SNR), FOV, and full-width-at-half-maximum (FWHM) of a focused beam. The penetration depths in a tissue mimicking phantom with 0.5 dB/(cm MHz) attenuation were 100mm and 125mm for the lenses with radii of 12.7mm and 25.4 mm. The azimuth, elevation, and radial FWHM at 43mm depth were (5.8, 5.8, 1)λ and (6, 6, 1)λ. The results of this study confirm that the proposed lens approach is an effective method for increasing the FOV, when imaging with RCA 2-D arrays.
**Damping Behavior of Carbon Nanotube Reinforced Nanocomposites: Micromechanical Modeling and Experiments**

The damping characteristics of polymeric nanocomposites reinforced with carbon nanotubes is studied using micromechanical modeling and experiments. Two damage dissipation mechanisms namely interfacial and viscoelastic damping contribute to the damping properties of the polymeric nanocomposites. Incorporation of stiff fillers in the structure of the polymeric materials leads to a reduction of viscoelastic damping in the composites. However, inclusion of the nanotubes in the polymeric matrix also introduces a new dissipation mechanism along the interface with the polymeric phase. In order to study the dynamic behavior of the nanocomposites, normal and shear stress distributions along the nanotubes as the function of their orientation to the loading were achieved based on a shear-lag Cox model. Consequently, the slippage of the nanotube surrounded by polymeric phase as function of external loading and orientation of fibers was determined. Contribution of the viscoelastic damping to the nanocomposite behavior as the function of nanotube orientation and content was also studied. The total damping property of the nanocomposites represent the combined action of the two involved mechanisms. Nanocomposite specimens containing 0.5, 1.0, 3.0, 5.0, and 6.0 wt. % of the nanotubes were prepared. The damping and energy dissipation in the produced specimens were studied using dynamic mechanical experiments. Experimental results showed good agreement with the results abstained from the modeling.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Solid Mechanics
Authors: Doagou-Rad, S. (Intern), Jensen, J. S. (Intern), Islam, A. (Intern)
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Main Research Area: Technical/natural sciences
Polymeric composites, Micromechanics, Damping, Modeling, Carbon nanotubes
Electronic versions: ECCM18_4_submission_1.pdf
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**Data-driven Security-Constrained AC-OPF for Operations and Markets**

In this paper, we propose a data-driven preventive security-constrained AC optimal power flow (SC-OPF), which ensures small-signal stability and N-1 security. Our approach can be used by both system and market operators for optimizing redispatch or AC based market-clearing auctions. We derive decision trees from large datasets of operating points, which capture all security requirements and allow to define tractable decision rules that are implemented in the SC-OPF using mixed-integer nonlinear programming (MINLP). We propose a second-order cone relaxation for the non-convex MINLP, which allows us to translate the non-convex and possibly disjoint feasible space of secure system operation to a convex mixed-integer OPF formulation. Our case study shows that the proposed approach increases the feasible space represented in the SC-OPF compared to conventional methods, can identify the global optimum as opposed to tested MINLP solvers and significantly reduces computation time due to a decreased problem size.

**General information**

State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Electric Power Systems
Authors: Halilbasic, L. (Ekstern), Thams, F. (Intern), Venzke, A. (Intern), Chatzivasileiadis, S. (Intern), Pinson, P. (Intern)
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Security-constrained OPF, Small-signal stability, Convex relaxation, Mixed-integer non-linear programming
Source: PublicationPreSubmission
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**Decentralized Coordinated Voltage Control for VSC-HVDC Connected Wind Farms Based on ADMM**

This paper proposes a decentralized coordinated voltage control scheme (DCVCS) for voltage-source-converter high voltage direct current (VSC-HVDC) connected wind farms based on the Model Predictive Control (MPC) which regulates the voltage profile across the wind farm network within the feasible range by optimally coordinating the VSC and wind

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Electric Power Systems
Authors: Halilbasic, L. (Ekstern), Thams, F. (Intern), Venzke, A. (Intern), Chatzivasileiadis, S. (Intern), Pinson, P. (Intern)
Number of pages: 7
Publication date: 2018

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Title of host publication: Proceedings of 20th Power Systems Computation Conference
Main Research Area: Technical/natural sciences
Security-constrained OPF, Small-signal stability, Convex relaxation, Mixed-integer non-linear programming
Source: PublicationPreSubmission
Source-ID: 149384707
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018
turbines (WTs). Firstly, the centralized voltage control problem based on the MPC is formulated to minimize voltage deviations and reactive power output fluctuations of WTs. Secondly, the decentralized solution methodology based on Alternating Direction Method of Multipliers (ADMM) with fast convergency is used to solve the MPC problem in a decentralized manner without losing the optimality of the primal problem. A wind farm with 64 WTs was used to validate the effectiveness and optimality of the proposed DCVCS.

**General information**

State: Accepted/In press

Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University, North China Electric Power University, Hangzhou Dianzi University

Authors: Guo, Y. (Ekstern), Gao, H. (Ekstern), Xing, H. (Ekstern), Wu, Q. (Intern), Lin, Z. (Ekstern)

Number of pages: 11

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Scopus rating (2013): SJR 2.043 SNIP 3.712 CiteScore 7.03

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Scopus rating (2012): SJR 1.243 SNIP 3.744 CiteScore 6.58

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Alternating direction method of multiplier (ADMM), Decentralized control, Model predictive control (MPC), Voltage control, Voltage-source-converter-based high voltage direct current (VSC-HVdc), Wind farm

**Decoding the auditory brain with canonical component analysis**

The relation between a stimulus and the evoked brain response can shed light on perceptual processes within the brain. Signals derived from this relation can also be harnessed to control external devices for Brain Computer Interface (BCI) applications. While the classic event-related potential (ERP) is appropriate for isolated stimuli, more sophisticated "decoding" strategies are needed to address continuous stimuli such as speech, music or environmental sounds. Here we describe an approach based on Canonical Correlation Analysis (CCA) that finds the optimal transform to apply to both the stimulus and the response to reveal correlations between the two. Compared to prior methods based on forward or backward models for stimulus-response mapping, CCA finds significantly higher correlation scores, thus providing increased sensitivity to relatively small effects, and supports classifier schemes that yield higher classification scores. CCA
strips the brain response of variance unrelated to the stimulus, and the stimulus representation of variance that does not affect the response, and thus improves observations of the relation between stimulus and response.
Demand response with residential and commercial loads for phase balancing in secondary distribution networks

Current demand response (DR) programs are designed for wholesale markets and utility level issues, neglecting the local challenges that distribution network operators face during daily operations. On the other hand, deployment of DR in specific parts of a distribution network can enable additional services and benefits. Phase balancing, as a distribution system management requirement, is among them. This study is one of the first efforts on field testing of phase balancing through load management in residential and commercial buildings. Tests were conducted in an experimental facility to quantify the impact of corrective management actions on phase loadings.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Automation and Control, Western Macedonia University of Applied Sciences, Istanbul Technical University, National Technical University of Athens
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Demonstration of decision support for real time operation
ELECTRA Deliverable 8.2 reports on the demonstration of decision support within the future control room in light of voltage and frequency control in the 2030+ power system. The decision support must identify key threats and vulnerabilities, and propose and prioritise appropriate interventions.

General information
State: Published
Density based topology optimization of turbulent flow heat transfer systems

The focus of this article is on topology optimization of heat sinks with turbulent forced convection. The goal is to demonstrate the extendibility, and the scalability of a previously developed fluid solver to coupled multi-physics and large 3D problems. The gradients of the objective and the constraints are obtained with the help of automatic differentiation applied on the discrete system without any simplifying assumptions. Thus, as demonstrated in earlier works of the authors, the sensitivities are exact to machine precision. The framework is applied to the optimization of 2D and 3D problems. Comparison between the simplified 2D setup and the full 3D optimized results is provided. A comparative study is also provided between designs optimized for laminar and turbulent flows. The comparisons highlight the importance and the benefits of full 3D optimization and including turbulence modeling in the optimization process, while also demonstrating extension of the methodology to include coupling of heat transfer with turbulent flows.
Fault diagnosis of closed-loop systems is extremely relevant for high-precision equipment and safety critical systems. Fault diagnosis is usually divided into 2 schemes: active and passive fault diagnosis. Recent studies have highlighted some advantages of active fault diagnosis based on dual Youla-Jabr-Bongiorno-Kucera parameters. In this paper, a method for closed-loop active fault diagnosis based on statistical detectors is given using dual Youla-Jabr-Bongiorno-Kucera parameters. The goal of this paper is 2-fold. First, the authors introduce a method for measuring a residual signal subject to white noise. Second, an optimal detector design is presented for single and multiple faults using the amplitude and phase shift of the residual signal to conduct diagnosis. Here, both the optimal case of a perfect model and the suboptimal case of a model with uncertainties are discussed. The method is successfully tested on a simulated system with parametric faults.
Difficulties in comparing diffuse sound field measures and data/code sharing for future collaboration

Although there have been a number of measures for quantifying the required diffuseness condition in reverberation chambers, each indicator has been limitedly validated in the authors’ laboratory setup or a couple of chambers more. Moreover, it is less common to compare the acoustics of reverberation chambers. In this paper, diffuseness measures and required raw data to calculate the measures are summarized. Furthermore, some considerations for data/code sharing methods for inter-chamber comparisons are discussed. The collected reverberation chamber datasets and software will facilitate to compare the effectiveness of traditional diffuseness measures and to test newly proposed measures for diffuse sound field.
Direct fabrication of bio-inspired gecko-like geometries with vat polymerization additive manufacturing method

Functional surfaces have proven their potential to solve many engineering problems, attracting great interest among the scientific community. Bio-inspired multi-hierarchical micro-structures grant the surfaces with new properties, such as hydrophobicity, adhesion, unique optical properties and so on. The geometry and fabrication of these surfaces are still under research. In this study, the feasibility of using direct fabrication of microscale features by Additive Manufacturing (AM) processes was investigated. The investigation was carried out using a specifically designed vat photopolymerization AM machine-tool suitable for precision manufacturing at the micro dimensional scale which has previously been developed, built and validated at the Technical University of Denmark. It was shown that it was possible to replicate a simplified surface inspired by the Tokay gecko, the geometry was previously designed and replicated by a complex multi-step micromanufacturing method extracted from the literature and used as benchmark. Ultimately, the smallest printed features were analyzed by conducting a sensitivity analysis to obtain the righteous parameters in terms of layer thickness and exposure time. Moreover, two more intricate designs were fabricated with the same parameters to assess the surfaces functionality by its wettability. The surface with increased density and decreased feature size showed a water contact angle (CA) of $124^\circ \pm 0.10^\circ$, agreeing with the Cassie-Baxter model. These results indicate the possibility of using precision AM for a rapid, easy and reliable fabrication method for functional surfaces.
Using dissolution dynamic nuclear polarization, the sensitivity of single scan solution state C-13 NMR can be improved up to 4 orders of magnitude. In this study, the enzyme lacZ beta-galactosidase from Escherichia coli was subjected to hyperpolarized substrate, and previously unknown reaction intermediates were observed, including a 1,1-linked disaccharide. The enzyme is known for making 1,6-transglycosylation, producing products like allolactose, that are also substrates. To analyze the kinetics, a simple kinetic model was developed and used to determine relative transglycosylation and hydrolysis rates of each of the intermediates, and the novel transglycosylation intermediates were determined as better substrates than the 1,6-linked one, explaining their transient nature. These findings suggest that hydrolysis and transglycosylation might be more complex than previously described.

**Discovery of Intermediates of lacZ beta-Galactosidase Catalyzed Hydrolysis Using dDNP NMR**

**General information**

State: Published
Organisations: Department of Chemistry, Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Organic Chemistry
Using dissolution dynamic nuclear polarization, the sensitivity of single scan solution state 13C NMR can be improved up to 4 orders of magnitude. In this study, the enzyme lacZ β-galactosidase from Escherichia coli was subjected to hyperpolarized substrate, and previously unknown reaction intermediates were observed, including a 1,1-linked disaccharide. The enzyme is known for making 1,6-transglycosylation, producing products like allolactose, that are also substrates. To analyze the kinetics, a simple kinetic model was developed and used to determine relative transglycosylation and hydrolysis rates of each of the intermediates, and the novel transglycosylation intermediates were determined as better substrates than the 1,6-linked one, explaining their transient nature. These findings suggest that hydrolysis and transglycosylation might be more complex than previously described.

**General information**

State: Published
Organisations: Department of Chemistry, Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, Organic Chemistry
Authors: Kjeldsen, C. (Intern), Ardenkjær-Larsen, J. H. (Intern), Duus, J. Ø. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 6.775 SNIP 2.63 CiteScore 12.81
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.294 SNIP 2.587 CiteScore 11.92
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Scopus rating (2013): SJR 5.993 SNIP 2.466 CiteScore 11.38
ISI indexed (2013): ISI indexed yes
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Distributed coordinated active and reactive power control of wind farms based on model predictive control

This paper proposes a distributed coordinated active and reactive power control scheme for wind farms based on the model predictive control (MPC) along with the consensus-based distributed information synchronization and estimation, which can optimally dispatch the active power of wind turbines (WTs) and regulate the voltages within the wind farm. For the active power control, the pitch angle and generator torque of WTs are optimally controlled to alleviate fatigue loads of WTs while tracking the power reference of the wind farm required by system operators. For the reactive power/voltage control, the reactive power outputs of WTs are controlled to mitigate the voltage deviations and simultaneously optimize reactive power sharing. Considering the high ratio of the wind farm collector systems, the impact of active power variations on voltages is taken into account to improve the voltage regulation. The proposed scheme is center-free and only requires a sparse communication network. Each WT only exchanges information with its immediate neighbors and the local optimal control problems are solved in parallel, implying good scalability and flexibility for large-scale wind farms. The predictive model of a WT is derived and then the MPC problem is formulated. A wind farm with ten WTs was used to verify the proposed control scheme.

General information
State: Published
Distributed Model Predictive Active Power Control of Wind Farms
This chapter explores a distributed model predictive control (D-MPC) approach for optimizing active power of a wind farm. The control scheme is based on the fast gradient method via dual decomposition. The developed D-MPC approach is implemented using the clustering-based piecewise affine (PWA) wind turbine model. Wind farm control can be implemented either by the utilization of a separate energy storage device or through derated operation of the wind turbines. Model predictive control (MPC) is an effective scheme for multi-objective wind farm control. The chapter describes the key properties required to apply the fast dual gradient method. Due to their flexible charging and discharging characteristics, energy storage systems (ESSs) are considered effective tools to enhance the flexibility and controllability of wind farms. The chapter presents a case study of a wind farm comprising ten 5-MW wind turbines that is used as the test system.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Wuhan University
Authors: Wu, Q. (Intern), Sun, Y. (Ekstern)
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DOIs: 10.1002/9781119236382.ch8
Publication: Research - peer-review » Book chapter – Annual report year: 2018

Distribution Locational Marginal Pricing for Optimal Electric Vehicle Charging through Chance Constrained Mixed-Integer Programming
This paper presents a distribution locational marginal pricing (DLMP) method through chance constrained mixed-integer programming designed to alleviate the possible congestion in the future distribution network with high penetration of electric vehicles (EVs). In order to represent the stochastic characteristics of the EV driving patterns, a chance constrained optimization of the EV charging is proposed and formulated through mixed-integer programming (MIP). With the chance constraints in the optimization formulations, it guarantees that the failure probability of the EV charging plan fulfilling the driving requirement is below the predetermined confidence parameter. The efficacy of the proposed approach was demonstrated by case studies using a 33-bus distribution system of the Bornholm power system and the Danish driving data. The case study results show that the DLMP method through chance constrained MIP can successfully alleviate the congestion in the distribution network due to the EV charging while keeping the failure probability of EV charging not meeting driving needs below the predefined confidence.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of California at Berkeley, Tsinghua University
Authors: Liu, Z. (Intern), Wu, Q. (Intern), Oren, S. S. (Ekstern), Huang, S. (Intern), Li, R. (Ekstern), Cheng, L. (Ekstern)
Number of pages: 10
Dynamic coronary MR angiography in a pig model with hyperpolarized water

To investigate dynamic coronary MR angiography using hyperpolarized water as a positive contrast agent. Hyperpolarization can increase the signal by several orders of magnitude, and has recently been translated to human cardiac application. The aim was to achieve large 1 H signal enhancement to allow high-resolution imaging of the coronary arteries. Protons in D2 O were hyperpolarized by dissolution dynamic nuclear polarization. A total of 18mL of hyperpolarized water was injected into the coronary arteries of healthy pigs (N=9; 3 injections in 3 animals). The MRI images were acquired with a gradient-echo sequence in an oblique slab covering the main left coronary arteries with 0.55 mm in-plane resolution. The acquisition time was 870 ms per frame. A more than 200-fold signal enhancement compared with thermally polarized water at 3 T was obtained. Coronary angiographic images with a signal-to-noise ratio from the left main stem of 269±169 and coronary sharpness from the proximal left anterior descending coronary artery of 0.31±0.086 mm-1 were obtained. Dynamic images were acquired over a 10 s time window. Hyperpolarized water MR angiography of the coronary arteries in a large animal model with high signal-to-noise ratio and high spatial and temporal resolution was obtained. Magn Reson Med, 2018. © 2018 International Society for Magnetic Resonance in Medicine.
Dynamic Power Tariff for Congestion Management in Distribution Networks

This paper proposes dynamic power tariff (DPT), a new concept for congestion management in distribution networks with high penetration of electric vehicles (EVs), and heat pumps (HPs). The DPT concept is proposed to overcome a drawback of the dynamic tariff (DT) method, i.e., DPT can replace the price sensitivity parameter in the DT method, which is relatively unrealistic in practice. Based on the control theory, a control model with two control loops, i.e., the power flow control and voltage control, is established to analyze the congestion management process by the DPT method. Furthermore, an iterative method based on distributed optimization is proposed to determine the DPT rates, which enables active participation of aggregators in the congestion management. The case studies demonstrate the efficacy of the DPT method for congestion management in distribution networks, and show its ability to save congestion management cost compared to the DT methods.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Illinois Institute of Technology
Authors: Huang, S. (Intern), Wu, Q. (Intern), Shahidehpour, M. (Ekstern), Liu, Z. (Intern)
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Scopus rating (2016): CiteScore 7.92 SJR 2.73 SNIP 2.837
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Scopus rating (2015): SJR 3.424 SNIP 3.284 CiteScore 8.48
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Scopus rating (2014): SJR 2.582 SNIP 3.687 CiteScore 7.77
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.581 SNIP 4.642 CiteScore 9.88
ISI indexed (2013): ISI indexed no
Effect of harmonic rank on sequential sound segregation

The ability to segregate sounds from different sound sources is thought to depend on the perceptual salience of differences between the sounds, such as differences in frequency or fundamental frequency (F0). F0 discrimination of complex tones is better for tones with low harmonics than for tones that only contain high harmonics, suggesting greater pitch salience for the former. This leads to the expectation that the sequential stream segregation (streaming) of complex tones should be better for tones with low harmonics than for tones with only high harmonics. However, the results of previous studies are conflicting about whether this is the case. The goals of this study were to determine the effect of harmonic rank on streaming and to establish whether streaming is related to F0 discrimination. Thirteen young normal-hearing participants were tested. Streaming was assessed for pure tones and complex tones containing harmonics with various ranks using sequences of ABA triplets, where A and B differed in frequency or in F0. The participants were asked to try to hear two streams and to indicate when they heard one and when they heard two streams. F0 discrimination was measured for the same tones that were used as A tones in the streaming experiment. Both streaming and F0 discrimination worsened significantly with increasing harmonic rank. There was a significant relationship between streaming and F0 discrimination, indicating that good F0 discrimination is associated with good streaming. This supports the idea that the extent of stream segregation depends on the salience of the perceptual difference between successive sounds.
This paper reports an investigation of the effects of process parameters on the quality characteristics of polymeric parts produced by micro injection moulding (µIM) with two different materials. Four injection moulding process parameters (injection velocity, holding pressure, melt temperature and mould temperature) were investigated using Polypropylene (PP) and Acrylonitrile Butadiene Styrene (ABS). Three key characteristics of the mouldings were evaluated with respect to process settings and the material employed: part mass, flow length and flash formation. The experimentation employs a test part with four micro fingers with different aspect ratios (from 21 up to 150) and was carried out according to the Design of Experiments (DOE) statistical technique. The results show that holding pressure and injection velocity are the most influential parameters on part mass with a direct effect for both materials. Both parameters have a similar effect on flow length for both PP and ABS at all aspect ratios and have higher effects as the feature thickness decreased below 300 µm. The study shows that for the investigated materials the injection speed and packing pressure were the most influential parameters for increasing the amount of flash formation, with relative effects consistent for both materials. Higher melt and mould temperatures settings were less influential parameters for increasing the flash amount when moulding with both materials. Of the two investigated materials, PP was the one exhibiting more flash formation as compared with ABS, when corresponding injection moulding parameters settings for both materials were considered.

**General information**

**State:** Published  
**Organisations:** Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Mansoura University
Effects of Expanding Envelope Fluctuations on Consonant Perception in Hearing-Impaired Listeners

This study examined the perceptual consequences of three speech enhancement schemes based on multiband nonlinear expansion of temporal envelope fluctuations between 10 and 20 Hz: (a) “idealized” envelope expansion of the speech before the addition of stationary background noise, (b) envelope expansion of the noisy speech, and (c) envelope expansion of only those time-frequency segments of the noisy speech that exhibited signal-to-noise ratios (SNRs) above 10 dB. Linear processing was considered as a reference condition. The performance was evaluated by measuring consonant recognition and consonant confusions in normal-hearing and hearing-impaired listeners using consonant-vowel nonsense syllables presented in background noise. Envelope expansion of the noisy speech showed no significant effect on the overall consonant recognition performance relative to linear processing. In contrast, SNR-based envelope expansion of the noisy speech improved the overall consonant recognition performance equivalent to a 1- to 2-dB improvement in SNR, mainly by improving the recognition of some of the stop consonants. The effect of the SNR-based envelope expansion was similar to the effect of envelope-expanding the clean speech before the addition of noise.

General information

State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Wiinberg, A. (Intern), Zaar, J. (Intern), Dau, T. (Intern)
Number of pages: 12
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Main Research Area: Technical/natural sciences
Effects of Hearing Loss and Fast-Acting Compression on Amplitude Modulation Perception and Speech Intelligibility

Objective: The purpose was to investigate the effects of hearing-loss and fast-acting compression on speech intelligibility and two measures of temporal modulation sensitivity.

Design: Twelve adults with normal hearing (NH) and 16 adults with mild to moderately severe sensorineural hearing loss were tested. Amplitude modulation detection and modulation-depth discrimination (MDD) thresholds with sinusoidal carriers of 1 or 5kHz and modulators in the range from 8 to 256 Hz were used as measures of temporal modulation sensitivity. Speech intelligibility was assessed by obtaining speech reception thresholds in stationary and fluctuating background noise. All thresholds were obtained with and without compression (using a fixed compression ratio of 2:1).

Results: For modulation detection, the thresholds were similar or lower for the group with hearing loss than for the group with NH. In contrast, the MDD thresholds were higher for the group with hearing loss than for the group with NH. Fast-acting compression increased the modulation detection thresholds, while no effect of compression on the MDD thresholds was observed. The speech reception thresholds obtained in stationary noise were slightly increased in the compression condition relative to the linear processing condition, whereas no difference in the speech reception thresholds obtained in fluctuating noise was observed. For the group with NH, individual differences in the MDD thresholds could account for 72% of the variability in the speech reception thresholds obtained in stationary noise, whereas the correlation was insignificant for the hearing-loss group.

Conclusions: Fast-acting compression can restore modulation detection thresholds for listeners with hearing loss to the values observed for listeners with NH. Despite this normalization of the modulation detection thresholds, compression does not seem to provide a benefit for speech intelligibility. Furthermore, fast-acting compression may not be able to restore MDD thresholds to the values observed for listeners with NH, suggesting that the two measures of amplitude modulation sensitivity represent different aspects of temporal processing. For listeners with NH, the ability to discriminate modulation depth was highly correlated with speech intelligibility in stationary noise.
**Effects of musical training and hearing loss on pitch discrimination**

Our ability to perceive the pitch of complex sounds is essential for melody perception and for our enjoyment of music. It also plays an important role in speech perception to convey intonation and sometimes meaning, e.g., in tonal languages, and greatly helps segregation of competing sound sources. Humans are able to discriminate very small changes in the pitch of complex harmonic sounds, with fundamental frequency difference limens (F0DLs) that can be smaller than 1% of the fundamental frequency (F0). However, performance in such pitch discrimination tasks is known to depend on the harmonic content of the sound and whether the harmonics are resolved by the auditory frequency analysis operated by cochlear processing. F0DLs are also heavily influenced by the amount of musical training received by the listener and by the spectrotemporal auditory processing deficits that often accompany sensorineural hearing loss. This paper reviews the latest evidence for how musical training and hearing loss affect pitch discrimination performance, based on behavioral F0DL experiments with complex tones containing either resolved or unresolved harmonics, carried out in listeners with different degrees of hearing loss and musicianship. A better understanding of the interaction between these two factors is crucial to determine whether auditory training based on musical tasks or targeted towards specific auditory cues may be useful to hearing-impaired patients undergoing hearing rehabilitation.

**General information**

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Organisations: Department of Electrical Engineering, Hearing Systems

Authors: Santurette, S. (Intern), Bianchi, F. (Intern), Dau, T. (Intern)

Number of pages: 6

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Source-ID: 146459708

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**Effects of non-stationary noise on consonant identification**

Consonant perception has typically been measured using consonant-vowel (CV) syllables presented in a stationary noise masker at various signal-to-noise ratios (SNRs). Recently, a microscopic speech perception model was proposed (Zaar and Dau, 2017) and shown to account well for consonant perception data obtained in stationary noise. However, unlike stationary noise, real-life interfering sounds typically exhibit strong fluctuations. The present study therefore investigated the effects of highly non-stationary noise on consonant perception and assessed the predictive power of the model in such conditions. Normal-hearing listeners were presented with 15 Danish CVs in 5-Hz interrupted noise at SNRs of −20, −10, 0, and 10 dB. Five different CV onset times with respect to the noise bursts were considered, differing in the amount of induced simultaneous and forward masking. As expected, the consonant recognition scores were inversely related to the amount of simultaneous masking. However, even with minimum simultaneous masking, a substantial loss of consonant recognition was observed at low SNRs, suggesting a forward masking effect. The model, which employs adaptive processes in the front end, accounted for these experimental data to a large extent. The experimental paradigm and the model may be useful for assessing temporal effects of hearing-aid algorithms on consonant perception.

**General information**

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Organisations: Department of Electrical Engineering, Hearing Systems

Authors: Zaa, J. (Intern), Kowalewski, B. (Intern), Dau, T. (Intern)

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**Effects of transcranial direct current stimulation for treating depression: A modeling study**

Background: Transcranial direct current stimulation (tDCS) above the left dorsolateral prefrontal cortex (DLPFC) has been widely used to improve symptoms of major depressive disorder (MDD). However, the effects of different stimulation protocols in the entire frontal lobe have not been investigated in a large sample including patient data.

Methods: We used 38 head models created from structural magnetic resonance imaging data of 19 healthy adults and 19
MDD patients and applied computational modeling to simulate the spatial distribution of tDCS-induced electric fields (EFs) in 20 frontal regions. We evaluated effects of seven bipolar and two multi-electrode 4×1 tDCS protocols.

Results: For bipolar montages, EFs were of comparable strength in the IDLPFC and in the medial prefrontal cortex (MPFC). Depending on stimulation parameters, EF cortical maps varied to a considerable degree, but were found to be similar in controls and patients. 4×1 montages produced more localized, albeit weaker effects.

Limitations: White matter anisotropy was not modeled. The relationship between EF strength and clinical response to tDCS could not be evaluated.

Conclusions: In addition to IDLPFC stimulation, excitability changes in the MPFC should also be considered as a potential mechanism underlying clinical efficacy of bipolar montages. MDD-associated anatomical variations are not likely to substantially influence current flow. Individual modeling of tDCS protocols can substantially improve cortical targeting. We make recommendations for future research to explicitly test the contribution of IDLPFC vs. MPFC stimulation to therapeutic outcomes of tDCS in this disorder.
Efficient attenuation of beam vibrations by inertial amplification

We demonstrate efficient attenuation of flexural vibrations by attaching a simple inertial amplification (IA) mechanism to a slender elastic beam. The mechanism generates enhanced inertial forces between two attachment points, which effectively counteracts the elastic forces in the beam for certain anti-resonance frequencies. These anti-resonances may be generated in the low-frequency range, even for a small added mass. Furthermore, the hybrid structures are shown to exhibit two neighbouring anti-resonance dips providing wide and deep attenuation regions in the frequency domain. The obtained numerical results are validated with the experimental data.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering, Solid Mechanics, Warsaw University of Technology
Authors: Barys, M. (Ekstern), Jensen, J. S. (Intern), Frandsen, N. M. M. (Intern)
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Main Research Area: Technical/natural sciences

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Scopus rating (2016): CiteScore 2.7 SJR 1.487 SNIP 1.507
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ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.306 SNIP 1.817 CiteScore 1.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.216 SNIP 1.724 CiteScore 1.92
ISI indexed (2011): ISI indexed yes
Efficient sound barrier calculations with the BEM

The Boundary Element Method has been used for calculating the effect of introducing sound barriers for some decades. The method has also been used for optimizing the shape of the barrier and in some cases the effects of introducing sound absorption. However, numerical calculations are still quite time consuming and inconvenient to use, which is limiting their use for many practical problems. Moreover, measurements are mostly taken in one-third or full octave bands opposed to the numerical computations at specific frequencies, which then has to be conducted using a fine density in frequencies. This paper addresses some of the challenges and possible solutions for developing BEM into a more efficient tool for sound barrier calculations.

Ellipsoidal prediction regions for multivariate uncertainty characterization

While substantial advances are observed in probabilistic forecasting for power system operation and electricity market applications, most approaches are still developed in a univariate framework. This prevents from informing about the interdependence structure among locations, lead times and variables of interest. Such dependencies are key in a large share of operational problems involving renewable power generation and electricity prices for instance. The few methods that account for dependencies translate to sampling scenarios based on given marginals and dependence structures.
However, for classes of decision-making problems based on robust, interval chance-constrained optimization, necessary inputs take the form of multivariate prediction regions rather than scenarios. The current literature is at very primitive stage of characterizing multivariate prediction regions to be employed in these classes of optimization problems. To address this issue, we introduce a new class of multivariate forecasts which form as multivariate ellipsoids for non-Gaussian variables. We propose a data-driven systematic framework to readily generate and evaluate ellipsoidal prediction regions, with predefined probability guarantees and minimum conservativeness. A skill score is proposed for quantitative assessment of the quality of prediction ellipsoids. A set of experiments is used to illustrate the discrimination ability of the proposed scoring rule for potential misspecification of ellipsoidal prediction regions. Application results based on three datasets with wind, PV power and electricity prices, allow us to assess the skill of the resulting ellipsoidal prediction regions, in terms of calibration, sharpness and overall skill.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets , University of Manchester, Nanyang Technological University
Authors: Golestaneh, F. (Ekstern), Pinson, P. (Intern), Azizipanah-Abarghooeee , R. (Ekstern), Beng Gooi, H. (Ekstern)
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BFI (2016): BFI-level 2
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Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
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BFI (2014): BFI-level 2
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ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 2
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Scopus rating (2009): SJR 1.622 SNIP 2.675
EM simulation assisted parameter extraction for transferred-substrate InP HBT modeling

In this paper, an electromagnetic (EM) simulation assisted parameter extraction procedure is demonstrated for accurate modeling of down-scaled transferred-substrate InP HBTs. The external parasitic network associated with via transitions and device electrodes is carefully extracted from calibrated three-dimensional EM simulations up to 325 GHz. Following an on-wafer multi-line Through-Reflect-Line calibration procedure, the external parasitic network is de-embedded from the transistor measurements and the active device parameters are extracted in a reliable way. The small-signal model structure augmented with the distributed parasitic network provides accurate small-signal prediction up to 220 GHz.

General information
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Organisations: Department of Electrical Engineering, Electromagnetic Systems, Ferdinand-Braun-Institut
Authors: Johansen, T. K. (Intern), Doerner, R. (Ekstern), Weimann, N. (Ekstern), Hossain, M. (Ekstern), Krozer, V. (Ekstern), Heinrich, W. (Ekstern)
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Web of Science (2016): Indexed yes
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Emulated Inertia and Frequency Support from Fast Acting Reserves

Environmental concerns are increasingly driving the evolution of the energy sector. A high share of renewable energy sources (RES) into the power system will potentially support the reduction of CO2 emissions; however, this presents considerable challenges for the power system operators. Currently, transmission system operators (TSOs) and distribution system operators (DSOs) are facing substantial change in the power system architecture, moving from centralized architecture

where electricity is generated from large power plants by conventional synchronous generators, centrally located and connected to the transmission network into a distributed architecture, where electricity is generated by distributed energy resources (DER) converter connected to distribution networks. The transition towards a higher share of DER replacing conventional power plants, brings to the DSO new responsibilities and also new challenges to TSOs. The TSOs are no longer able to monitor the total generation because the majority of DERs are connected to the distribution network. Therefore, new requirements on control and supervision functionality to be integrated into distribution management systems (DMS) need to be identified. Moreover, the displacement of conventional generation by inertia-less resources (i.e. converter connected) entails an upsurge in the requirement for balancing and system stabilization services. The reduction of system inertia is leading to faster rate of change of frequency (RoCoF), resulting in possible cascade tripping of embedded renewable generation and also higher frequency deviations (nadir/zenith), which can potentially lead to load shedding and, in the worst case, system collapse. This thesis deals with the requirements and challenges that TSOs and DSOs are facing due to the high integration of distributed and inertia-less resources, and it sets out the various solutions. Some of the new requirements and related functions to be integrated into the DMS platform to cope with these challenges are summarized. This thesis focuses on the challenges and solutions of the reduction of system inertia and the potential benefits of specialized control schemes to utilize fast acting reserves (FAR) to compensate for the lack of inertia. State-of-the-art of control schemes and technologies that could potentially compensate for reduction in system inertia and assist the transition toward a RES based power system are presented and analyzed, emphasizing the benefits and drawbacks of each solution. The two main control schemes that will be analyzed during the course of the thesis are synthetic inertia control (SIC) (i.e. RoCoF based control) and fast frequency control (FFC) (i.e. frequency deviation based control). A trade-off analysis between SIC and FFC in a converter dominated network employing energy storage systems is presented, using the power system simulation software PowerFactory. This aims to define the constraints and abilities of the two controllers to improve the frequency performance, in general, and limiting the RoCoF, in particular. Moreover, the potential benefits and drawbacks of providing such services from electric vehicles (EVs) are investigated and analyzed. Experimental activities were conducted to validate the technical feasibility of series produced EVs to provide these frequency services, namely, SIC and FFC. Emphasis was placed on assessing the two controllers’ ability to mitigate the RoCoF and improve the frequency performance, including assessing several EVs’ parameters, such as EVs’ response time and EVs’ accuracy in following the desired set-point. Adopting the All Island Power System (AIPS) of Ireland as a test case, and employing the TSO’s data and models, the ability of SIC and FFC to mitigate the RoCoF and compensate for the reduction in system inertia is investigated. Exploiting more than 700 simulated dispatches of the all island power system, a model based approach is proposed to quantify the relationship between FAR (employing SIC or FFC) and synchronous inertia. The application of this methodology will assist the system operator in increasing the penetration of converter connected resources while respecting the grid code constraint of maximum RoCoF. Overall it is shown that SIC or FFC can help to mitigate the RoCoF. It was demonstrated that SIC does provide a slightly better performance in terms of RoCoF compared to FFC. Meanwhile, the FFC performed better in terms of frequency nadir and steady state values. Moreover, it was shown that SIC was more sensitive to time delays in low inertia systems, which can easily lead to system oscillation.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Rezkalla, M. M. N. (Intern)
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Authors: Liu, H. (Ekstern), Wang, B. (Ekstern), Wang, N. (Ekstern), Wu, Q. (Intern), Yang, Y. (Ekstern), Wei, H. (Ekstern), Li, C. (Ekstern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.835 SNIP 2.593 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.158 SNIP 3.218 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.06 SNIP 3.346 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.778 SNIP 3.076 CiteScore 5.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.416 SNIP 2.827 CiteScore 5.5
ISI indexed (2011): ISI indexed yes
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End-to-End Deep Learning Model For Automatic Sleep Staging Using Raw PSG Waveforms

Deep learning has seen significant progress over the last few years, especially in computer vision, where competitions such as the ImageNet challenge have been the driving factor behind many new model architectures far superior to humans in image recognition. We propose a novel method for automatic sleep staging, which relies on current advances in computer vision models eliminating the need for feature engineering or other transformations of input data. By exploiting the high capacity for complex learning in a state of the art object recognition model, we can effectively use raw PSG signals to detect and classify sleep stages in a robust and reliable way.

Methods:
A total of 2322 PSG studies from the Wisconsin Sleep Cohort were used in this study. Central and occipital EEG, left and right EOG, and chin EMG signals were extracted from all PSGs and subjected to initial pre-processing of zero-phase Butterworth bandpass filters with AASM-specified cutoffs. The raw signals were then segmented into 30 s epochs and fed as inputs to a novel deep neural network model based on the ResNet-50 architecture. The model was optimized over cross-entropy loss with respect to annotated scorings using the Adam optimizing algorithm and trained on a subset of 1858 PSGs. Hyperparameters were tuned using 40 iterations of random search in relevant hyperparameter intervals. Best performing model was selected based on performance measured by overall accuracy on a hold-out validation set of 232 PSGs.

Results:
Training accuracy, precision and recall were 84.93%, 97.42% and 97.02%, respectively. Evaluating on the validation set yielded an overall accuracy of 85.07% and overall precision/recall of 98.54% and 95.72%, respectively.

Conclusion:
Preliminary results indicate that state of the art deep learning models can effectively be used to classify sleep stages using untransformed PSG signals. We will perform further testing on independent datasets to enhance the model's utility.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, University of Wisconsin, Copenhagen University Hospital, Stanford University
Authors: Olesen, A. N. (Intern), Peppard, P. E. (Ekstern), Sorensen, H. B. (Intern), Jennum, P. J. (Ekstern), Mignot, E. (Ekstern)
Pages: A121-A121
Energy Collectives: a Community and Fairness based Approach to Future Electricity Markets

While power system organization has evolved from a hierarchical structure to a more decentralized model, electricity markets are still not up to date with the ongoing transformation towards more consumer-centric economies. As Information and Communication Technologies (ICT) are broadly adopted, they allow prosumers to have a more proactive role in power system operation. This work introduces the concept of energy collectives, as a community-based electricity market structure. We find that when prosumers are allowed to share energy at community level, overall electricity procurement for the community reflects prosumers’ preferences. We show that community members can be influenced by a supervisory third-party in charge of interfacing with the market and system operator and of guaranteeing the collective common agreements. We simulate a number of test cases and we apply typical principles from analysis of communication networks and distributed systems to assess community fairness.
Energy decay curves in reverberation chambers and the influence of scattering objects on the absorption coefficient of a sample

This work deals with the multi-exponential nature of energy decay curves in reverberation chambers. Impulse response measurements have been carried out with different room and sample configurations to investigate the effect of scattering elements and the position of the absorber on the slopes and bending points of the energy decay curve. In this context Annex A of ISO 354 is discussed also. The reverberation time is calculated by fitting a sum of exponentials to the data instead of using conventional parameters obtained with linear regression. The absorption coefficient is calculated with the reverberation time obtained from the initial part of the energy decay. The results are compared with theoretically obtained values, also considering the size effect.

Enhanced Voltage Control of VSC-HVDC Connected Offshore Wind Farms Based on Model Predictive Control

This paper proposes an enhanced voltage control strategy (EVCS) based on model predictive control (MPC) for voltage source converter based high voltage direct current (VSC-HVDC) connected offshore wind farms (OWFs). In the proposed MPC based EVCS, all wind turbine generators (WTGs) as well as the wind farm side VSC are optimally coordinated to keep voltages within the feasible range and reduce system power losses. Considering the high ratio of the OWF collector system, the effects of active power outputs of WTGs on voltage control are also taken into consideration. The predictive model of VSC with a typical cascaded control structure is derived in details. The sensitivity coefficients are calculated by an analytical method to improve the computational efficiency. A VSC-HVDC connected OWF with 64 WTGs was used to validate the proposed voltage control strategy.
Estimates of peripheral compression using envelope following responses

The ability to compress the large input level range of incoming sounds into a smaller range of vibrations on the basilar membrane (BM) is an important property of the healthy auditory system. Sensorineural hearing impairment typically leads to a decrease in sensitivity to sound and a reduction of the amount of compression observed in the BM input-output (I/O) functions. While sensitivity loss can be measured efficiently via audiometry, no measure has yet been provided that represents fast and reliable compression estimates in the individual listener. In the present study, magnitude-level functions obtained from envelope following responses (EFR) to four simultaneously presented amplitude modulated tones were measured in normal hearing (NH) and hearing-impaired (HI) listeners. EFRs at the chosen amplitude modulation rates (81-98 Hz) were considered to represent neural activity originating from the auditory brainstem and midbrain. In addition, magnitude-level functions of distortion-product otoacoustic emissions (DPOAE), originating at the level of the BM, were measured in the same NH listeners. The median values of the compression estimates from the EFRs in the NH listeners were found to be consistent with previously reported compression estimates based on psychoacoustical measures and group-averaged DPOAE magnitude-level functions in human listeners and similar to BM compression values measured invasively in non-human mammals. The EFR magnitude-level functions for the HI listeners were less compressive than those for the NH listeners, indicating that EFR might be sensitive to a reduction of BM and/or postBM compression. The compression estimates based on the DPOAEs were lower than the compression estimates based on the EFRs from the same individual NH listeners. Overall, the results suggest that EFR magnitude-level functions reflect BM and postBM compression, although the place-specificity of the
compression estimates may be compromised due to contributions from off-frequency neural populations to the EFR.
**Estimating the Density of Fluid in a Pipeline System with an Electropump**

To transfer petroleum products, a common pipeline is often used to continuously transfer various products in batches. Separating the different products requires detecting the interface between the batches at the storage facilities or pump stations along the pipelines. The conventional technique to detect the product in the pipeline is to sample the fluid in a laboratory and perform an offline measurement of its physical characteristics. The measurement requires sophisticated laboratory equipment and can be time-consuming and susceptible to human error. In this paper, for performing the online detection and separation of the batches, two methods are suggested that do not need extra equipment and are more practical. Because different petroleum products have different densities, the goal of both methods was to estimate the density of each product to detect its type. To estimate the fluid density, the first method used a recursive Kalman filtering algorithm and a model that defined the relationship among the pump's differential pressure, the volume flow rate, and the rotational speed. The second method was suggested for the cases when the measurement of pressure and flow rate are not possible but the motor current and rotational speed are directly measurable. For that purpose, first the load torque was estimated. Then, by using a model that has parameters that depend on the density and that defines the relationship between the required pump torque and its rotational speed, the parameters of this model and consequently the density of the fluid were estimated. (C) 2018 American Society of Civil Engineers.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Electrical Engineering, Automation and Control, Iran University of Science and Technology
Authors: Sadeghi, H. (Ekstern), Poshtan, J. (Ekstern), Poulsen, N. K. (Intern), Niemann, H. H. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

**Evaluation of custom-designed lateral power transistors in a silicon-on-insulator process in a synchronous buck converter**

Most of today's power converters are based on power semiconductors, which are built in vertical power semiconductor processes. These devices result in limited packaging possibilities, which lead to physically long galvanic connections and therefore high external electromagnetic fields. These fields compromise power quality significantly. Therefore this paper examines the possibility to use lateral silicon-on-insulator power MOSFETs and uses the custom-made devices in a 48 V to 12 V synchronous buck converter in continuous conduction mode. The converter is designed based on custom made power transistors, implemented and verified by experimental results. The resulting efficiency of the 1 W converter is around 93 % across a wide load range and its temperature rise is less the 10 °C. This leads to the conclusion, that modern lateral silicon-on-insulator power processes allow high integration of power stages and therefore promise lower emissions, leading to higher power quality.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Okumus, S. (Ekstern), Fan, L. (Intern), Nour, Y. (Intern), Knott, A. (Intern)
Number of pages: 6
Evaluation of Factorization Methods for Thévenin Equivalent Computations in Real-Time Stability Assessment

Thévenin equivalents are used by a range of power system stability indicators, such as the L-index for voltage stability and the aperiodic small signal rotor angle stability indicator. This paper investigates the effect of using different factorization methods for computing coefficients for wide-area Thévenin equivalents. Direct and incomplete factorization methods are compared with respect to runtime, accuracy and amount of fill-in. The paper introduces a proof that the block triangular form of bus admittance matrices will have no non-zero entries in the off-diagonal. KLU factorization is found to perform almost twice as fast as the standard LU factorization with no cost of accuracy. It is, however, shown that the largest computational workload is associated with dense matrix multiplications. An incomplete method reduces the fill-in of coefficient matrices at the cost of accuracy in Thévenin voltages. It is shown, that inaccuracies are amplified as the L-index approaches the stability limit.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Electric Equipment Technologies
Authors: Hildebrandt, C. B. (Intern), Karatas, B. C. (Intern), Møller, J. G. (Intern), Jóhannsson, H. (Intern)
Number of pages: 7
Publication date: 2018

Evaluation of supra-threshold hearing following an event of recreational acoustic exposure

Studies with small rodents have exhibited physiological evidence of noise-induced cochlear synaptopathy prior to outer-hair-cell loss following noise-induced large temporary threshold shifts (TTS). The auditory system may thus not fully recover after a TTS. If this noise-induced damage also occurs in humans, this may have consequences for sound processing at supra-threshold levels, especially speech in background noise, and may also challenge current noise regulations. The aim of this study was to investigate if human listeners with normal hearing sensitivity show signs of cochlear synaptopathy after participating in a concert. Young adult listeners with hearing thresholds ≤ 20 dB HL between 0.25-8 kHz were recruited and divided into two groups: listeners voluntarily participating in concerts and control listeners with no concert participation during the study. Exposure was assessed with dosimeters in both groups for one event duration. Concert participants were advised to use hearing protectors and exposure levels were determined from actual use. Listeners performed three sessions of audiometry, auditory brainstem response (ABR), and speech in noise measurements. Session 1 was performed within a week up to the concert, session 2 within 24 hours after the concert, and session 3 approximately 4 weeks after the concert. We hypothesized that concert participants would show reduced level-growth of ABR wave I and that wave-I level-growth would be a predictor of speech discrimination score. The data indicate that postexposure wave-I level-growth was not reduced compared to pre-exposure values, and that neither were speech scores. Therefore, the results might suggest that: a) concert goers do not develop cochlear synaptopathy in response to typical exposure from one event, or b) synaptopathy occurs only for more severe exposure in humans, or c) the utilized measures are not sensitive enough to detect the damage.
Examining the business incentives for investments in coupled wind – storage systems

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Acoustic Technology, Technical University of Denmark
Authors: Smits, B. (Ekstern), Holtegaard, P. (Intern), Jeong, C. (Intern), Santurette, S. (Intern)
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Conference: Baltic-Nordic Acoustics Meeting 2018, Reykjavik, Iceland, 15/04/2018 - 15/04/2018
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Source-ID: 146459729
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Experimental Evaluation of Discharge Characteristics in Inhomogeneous Fields under Air Flow
The impact of high velocity air flow on discharge characteristics generated in strongly inhomogeneous electrical fields has been investigated under DC and combined DC + impulse voltages. In the laboratory, a needle plane electrode configuration with a gap distance of 20 cm was exposed to high voltages and a laminar air flow up to 22 m/s. In the first setup, the gap was exposed to a variable DC potential of up to 100 kV in order to create space charges in the vicinity of the electrode. The impact of the air flow on partial discharges and the dynamic behavior of the space charges is evaluated by means of partial discharge measurement and ultraviolet photography. The results show that the air flow increases the frequency of partial discharges in the gap due to an increased rate of space charge removal in the high field area around the tip of the electrode. The partial discharge behavior shows higher dependency on air flow at positive tip polarity as compared to the negative polarity. In the second setup, the standard impulse voltage created by a multistage impulse voltage generator was superimposed to a DC voltage, which continuously created corona and space charges around the tip of the electrode. Breakdown of the gap was triggered by means of the impulse voltage. The DC offset was varied from 0 kV to 100 kV in 20 kV steps and the 50 % flashover voltage was determined for both polarities. The results show that the impact of the air flow is highest at negative DC potential with negative impulse voltage, with an increase in flashover voltage of 40 % when air flow is applied. At positive polarity, the impact of air flow is only observable at 100 kV when the wind extinguishes the stable streamer stem.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, National Renewable Energy Laboratory, Aarhus University
Authors: Enevoldsen, P. (Ekstern), Hou, P. (Intern), Eichman, J. (Ekstern)
Publication date: 2018
Main Research Area: Technical/natural sciences
Source: FindIt
Source-ID: 2434538732
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2018

Experimental Evaluation of Discharge Characteristics in Inhomogeneous Fields under Air Flow
The impact of high velocity air flow on discharge characteristics generated in strongly inhomogeneous electrical fields has been investigated under DC and combined DC + impulse voltages. In the laboratory, a needle plane electrode configuration with a gap distance of 20 cm was exposed to high voltages and a laminar air flow up to 22 m/s. In the first setup, the gap was exposed to a variable DC potential of up to 100 kV in order to create space charges in the vicinity of the electrode. The impact of the air flow on partial discharges and the dynamic behavior of the space charges is evaluated by means of partial discharge measurement and ultraviolet photography. The results show that the air flow increases the frequency of partial discharges in the gap due to an increased rate of space charge removal in the high field area around the tip of the electrode. The partial discharge behavior shows higher dependency on air flow at positive tip polarity as compared to the negative polarity. In the second setup, the standard impulse voltage created by a multistage impulse voltage generator was superimposed to a DC voltage, which continuously created corona and space charges around the tip of the electrode. Breakdown of the gap was triggered by means of the impulse voltage. The DC offset was varied from 0 kV to 100 kV in 20 kV steps and the 50 % flashover voltage was determined for both polarities. The results show that the impact of the air flow is highest at negative DC potential with negative impulse voltage, with an increase in flashover voltage of 40 % when air flow is applied. At positive polarity, the impact of air flow is only observable at 100 kV when the wind extinguishes the stable streamer stem.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies
Authors: Vogel, S. (Intern), Holbøll, J. (Intern)
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Volume: 25
Issue number: 2
ISSN (Print): 1070-9878
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BFI (2018): BFI-level 1
We report a fabrication technology for 3D air-core inductors for small footprint and very-high-frequency power conversions. Our process is scalable and highly generic for fabricating inductors with a wide range of geometries and core shapes. We demonstrate spiral, solenoid, and toroidal inductors, a toroidal transformer and inductor with advanced geometries that cannot be produced by wire winding technology. The inductors are embedded in a silicon substrate and consist of through-silicon vias and suspended windings. The inductors fabricated with 20 and 25 turns and 280-350 μm heights on 4-16 mm² footprints have an inductance from 34.2 to 44.6 nH and a quality factor from 10 to 13 at frequencies ranging from 30 to 72 MHz. The air-core inductors show threefold lower parasitic capacitance and up to a 140% higher-quality factor and a 230% higher-operation frequency than silicon-core inductors. A 33 MHz boost converter mounted with an air-core toroidal inductor achieves an efficiency of 68.2%, which is better than converters mounted with a Si-core inductor (64.1%). Our inductors show good thermal cycling stability, and they are mechanically stable after vibration and 2-m-drop tests.
Fast CSF MRI for brain segmentation; Cross-validation by comparison with 3D T1-based brain segmentation methods

Objective In previous work we have developed a fast sequence that focusses on cerebrospinal fluid (CSF) based on the long T2 of CSF. By processing the data obtained with this CSF MRI sequence, brain parenchymal volume (BPV) and intracranial volume (ICV) can be automatically obtained. The aim of this study was to assess the precision of the BPV and ICV measurements of the CSF MRI sequence and to validate the CSF MRI sequence by comparison with 3D T1-based brain segmentation methods.

Materials and methods Ten healthy volunteers (2 females; median age 28 years) were scanned (3T MRI) twice with repositioning in between. The scan protocol consisted of a low resolution (LR) CSF sequence (0:57min), a high resolution (HR) CSF sequence (3:21min) and a 3D T1-weighted sequence (6:47min). Data of the HR 3D-T1-weighted images were downsampled to obtain LR T1-weighted images (reconstructed imaging time: 1:59 min).

Data of the CSF MRI sequences was automatically segmented using in-house software. The 3D-T1-weighted images were segmented using FSL (5.0), SPM12 and FreeSurfer (5.3.0). Results The mean absolute differences for BPV and ICV between the first and second scan for CSF LR (BPV/ICV: 12 +/- 9/7 +/- 4cc) and CSF HR (5 +/- 5/4 +/- 2cc) were comparable to FSL HR (9 +/- 11/9 +/- 23cc), FSL LR (7 +/- 4,6 +/- 5cc), FreeSurfer HR (5 +/- 3/14 +/- 8cc), FreeSurfer LR (9 +/- 8,12 +/- 10cc), and SPM HR (5 +/- 3/4 +/- 7cc), and SPM LR (5 +/- 4,5 +/- 3cc). The correlation between the measured volumes of the CSF sequences and that measured by FSL, FreeSurfer and SPM HR and LR was very good (all Peareon’s correlation coefficients >0.83, R^2: 67-97). The results from the downsampled data and the high-resolution data were similar.

Conclusion Both CSF MRI sequences have a precision comparable to, and a very good correlation with established 3D T1-based automated segmentations methods for the segmentation of BPV and ICV. However, the short imaging time of the fast CSF MRI sequence is superior to the 3D T1 sequence on which segmentation with established methods is performed.
Fatigue load minimization in an operation of a wind farm

The present disclosure relates to a method and system for controlling an operation of a wind farm connected to a grid, the wind farm comprising a central controller and a plurality of wind turbines, each wind turbine having a local controller, the method comprising the steps of: calculating a load sensitivity in the local controller of each wind turbine based on fluctuations of at least one fatigue load parameter of said wind turbine; providing an exchange signal between each of the local controllers and the central controller, said exchange signal comprising the calculated load sensitivity; solving an optimal dispatch algorithm for minimizing an overall fatigue load of the wind turbines in the central controller based on the calculated load sensitivities of the wind turbines and power reference tracking provided by the grid, thereby providing local power references to each of the local controllers. The disclosure further relates to system for controlling an operation of a wind farm connected to a grid, the system comprising: at least one central controller comprising a central hardware processor and at least a first non-transitive, computer-readable storage device for storing instructions that, when executed by the central hardware processor, causes the at least one central hardware processor to perform the step of solving an optimal dispatch algorithm for minimizing an overall fatigue load of the wind turbines according to the disclosed method,
thereby providing local power references to each of the local controllers; and local controllers, each local controller comprising a local hardware processor for each of a plurality of local wind turbines, and secondary non-transitive, computer-readable storage devices associated with the local hardware processors for storing instructions that, when executed by the local hardware processors, perform the step of calculating load sensitivities according to the disclosed method.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Zhao, H. (Intern), Wu, Q. (Intern), Huang, S. (Intern), Liu, Z. (Intern)
Publication date: 2018

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Main Research Area: Technical/natural sciences
Publication: Research › Patent – Annual report year: 2018

Fault Analysis Method Considering Dual-Sequence Current Control of VSCs under Unbalanced Faults
Voltage source converters (VSCs) are able to provide both positive- and negative-sequence short circuit currents under unbalanced faults. Their short circuit responses can be significantly different from those of conventional synchronous generators. This paper developed a static fault analysis method by considering dual-sequence current control of VSCs under unbalanced faults where VSCs are treated as voltage-dependent current sources in both positive- and negative-sequence networks. Since the control strategy of VSCs varies, flexible parameters are included in the model to reflect their diverse short circuit behaviours. The proposed method is verified through a modified IEEE 9-bus system and a simplified western Danish power system with real time simulations. This analytical method can be used to help understand and evaluate the impact of dual-sequence current control of VSCs on future converter-dominated power systems.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Jia, J. (Intern), Yang, G. (Intern), Nielsen, A. H. (Intern)
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.11 SJR 0.67 SNIP 1.34
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.5 SJR 0.662 SNIP 1.106
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.785 SNIP 1.399 CiteScore 2.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Fault Diagnosis and Identification of Electro Mechanical Systems - Methods for Closed Loop Systems.

We are on the verge of the fourth industrial revolution also known as industry 4.0\(^{[1]}\). The goal of industry 4.0 is to increase the incorporation of sensor information into decision making for machinery. This in turn increases the popularity of feedback control, and by extension, closed loop schemes. With the increasing popularity of closed loop control it is important that the impact of the feedback loop is handled appropriately. Because of the feedback loop, signals that might normally be uncorrelated are suddenly not and assumptions often used for identification and fault diagnosis schemes are no longer realistic to achieve.

The thesis aims at introducing the reader to design methods with proper handling of noise for closed loop systems. In order to achieve this goal, it is investigated how to transform a closed loop identification problem into an open loop identification problem. Such a transformation is already well known, however the excitation signal design is not intuitive when applying such a transformation. The shape of the excitation signal is of paramount importance for the quality of the identified model. By making the design of the excitation signal more intuitive, it should be possible to increase the quality of identified models.

Another interesting closed loop application is fault diagnosis. More and more systems will be part of a closed loop scheme in the future in accordance with industry 4.0. Often, systems are designed without sensor redundancy, and with disturbance rejecting controllers. Methods which are not limited in isolability due to sensor redundancy, and which decouple the effect of the disturbance rejecting controller, are therefore of huge interest. Active fault diagnosis obtains the required information through a known excitation signal instead of the sensor redundancy. Design of detectors based on active fault diagnosis can therefore make fault diagnosis possible for systems where installation of extra sensors are too cost demanding.

The methods were developed with a piezoelectric rotor-bearing application in mind. The bearing is using air as the lubricant between the bearing and the shaft and is therefore referred to as a gas bearing. Gas bearings have relative low damping compared to high friction bearings such as ball bearings. Feedback control is therefore employed to increase the damping of the Gas Bearing. This makes Gas Bearings a prime example of technology following with the industry 4.0 standard.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Automation and Control
Authors: Sekunda, A. K. (Intern)
Number of pages: 240
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**Publication information**

Publisher: DTU Elektro
Original language: English
Fault Diagnosis for Satellite Sensors and Actuators using Nonlinear Geometric Approach and Adaptive Observers

This paper presents a novel scheme for diagnosis of faults affecting sensors that measure the satellite attitude, body angular velocity, flywheel spin rates, and defects in control torques from reaction wheel motors. The proposed methodology uses adaptive observers to provide fault estimates that aid detection, isolation and estimation of possible actuator and sensor faults. The adaptive observers do not need a-priori information about fault internal models. A nonlinear geometric approach is used to avoid that aerodynamic disturbance torques have unwanted influence on the fault estimates. An augmented high fidelity spacecraft model is exploited during design and validation to replicate faults. This simulation model includes disturbance torques as experienced in low Earth orbits. The paper includes an analysis to assess robustness properties of the method with respect to parameter uncertainties and disturbances. The results document the efficacy of the suggested methodology.
Fault diagnosis, Nonlinear geometric approach, Adaptive observer, Structural Analysis, Actuators and sensors

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Source-ID: 144368207
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Fault Ride Through Enhancement of VSC-HVDC Connected Offshore Wind Power Plants
Voltage source converter-high voltage direct current (VSC-HVDC) connections have become a new trend for long-distance offshore wind power transmission. In order to facilitate the derivation of the feedforward DC voltage control based fault ride through (FRT) technique, this chapter describes the model of a VSC-HVDC-connected offshore wind power plant (WPP) with an external grid. It proposes a feedforward DC voltage control based FRT technique to control the AC voltage at the WPP collector network during grid-side faults. Time-domain simulations have been used to verify the efficacy of the proposed feedforward DC voltage control based FRT technique for VSC-HVDC-connected WPPs. Time-domain simulation results shows that the proposed FRT scheme can successfully enable VSC-HVDC-connected WPPs to ride through balanced and unbalanced faults in host power systems, as well as faults in the WPP collector system, with a fast and robust response.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Siemens Wind Power A/S
Authors: Sharma, R. (Ekstern), Wu, Q. (Intern), Jensen, K. H. (Ekstern), Rasmussen, T. W. (Intern), Østergaard, J. (Intern)
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Fault Tolerant Position-mooring Control for Offshore Vessels
Fault-tolerance is crucial to maintain safety in offshore operations. The objective of this paper is to show how systematic analysis and design of fault-tolerance is conducted for a complex automation system, exemplified by thruster assisted Position-mooring. Using redundancy as required by classification societies' class notations for offshore position controlled vessels, the paper shows how violations of normal behaviour of main components can be detected and isolated. Using a functional service philosophy, diagnosis procedures are auto-generated based on provable correct graph analysis methods. Functional faults that are only detectable, are rendered isolable through an active isolation approach. Once functional faults are isolated, they are handled by fault accommodation techniques to meet overall control objectives specified by class requirements. The paper illustrates the generic methodology by a system to handle faults in mooring lines, sensors or thrusters. Simulations and model basin experiments are carried out to validate the concept for scenarios with single or multiple faults. The results demonstrate that enhanced availability and safety are obtainable with this design approach. While methods are introduced at a tutorial level, the paper is original by providing a total Position-mooring
system design that ensures resilience to any single fault and to selected multiple faults.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Norwegian University of Science and Technology
Authors: Blanke, M. (Intern), Nguyen, T. D. (Ekstern)
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Scopus rating (2017): CiteScore 2.7 SJR 1.284 SNIP 1.929
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46 SJR 1.258 SNIP 1.975
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.235 SNIP 1.908 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.188 SNIP 2.249 CiteScore 2.11
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.129 SNIP 2.719 CiteScore 2.2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.14 SNIP 2.407 CiteScore 1.71
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.952 SNIP 2.411 CiteScore 1.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.05 SNIP 2.106
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.058 SNIP 1.858
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.937 SNIP 1.57
Scopus rating (2007): SJR 0.901 SNIP 1.884
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.838 SNIP 1.641
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.511 SNIP 1.263
Scopus rating (2004): SJR 0.714 SNIP 1.273
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.662 SNIP 1.272
We suggest a novel approach for wide-field imaging of the neural network dynamics of brain slices that uses highly sensitivity magnetometry based on nitrogen-vacancy (NV) centers in diamond. In vitro recordings in brain slices is a proven method for the characterization of electrical neural activity and has strongly contributed to our understanding of the mechanisms that govern neural information processing. However, this traditional approach only acquires signals from a few positions, which severely limits its ability to characterize the dynamics of the underlying neural networks. We suggest to extend its scope using NV magnetometry-based imaging of the neural magnetic fields across the slice. Employing comprehensive computational simulations and theoretical analyses, we determine the spatiotemporal characteristics of the neural fields and the required key performance parameters of an NV magnetometry-based imaging setup. We investigate how the technical parameters determine the achievable spatial resolution for an optimal 2D reconstruction of neural currents from the measured field distributions. Finally, we compare the imaging of neural slice activity with that of a single planar pyramidal cell. Our results suggest that imaging of slice activity will be possible with the upcoming generation of NV magnetic field sensors, while single-shot imaging of planar cell activity remains challenging.
Fractal Characteristics Analysis of Blackouts in Interconnected Power Grid

The power failure models are a key to understand the mechanism of large scale blackouts. In this letter, the similarity of blackouts in interconnected power grids (IPGs) and their sub-grids is discovered by the fractal characteristics analysis to simplify the failure models of the IPG. The distribution characteristics of blackouts in various sub-grids are demonstrated based on the Kolmogorov-Smirnov (KS) test. The fractal dimensions (FDs) of the IPG and its sub-grids are then obtained by using the KS test and the maximum likelihood estimation (MLE). The blackouts data in China were used to demonstrate the similarity of distribution characteristics and FDs of the IPG and its sub-grids. The results are consistent with the development of the power grids (PGs).

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hunan University
Authors: Wang, F. (Ekstern), Li, L. (Ekstern), Li, C. (Ekstern), Wu, Q. (Intern), Cao, Y. (Ekstern), Zhou, B. (Ekstern), Fang, B. (Ekstern)
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Pages: 1085-1086
Publication date: 2018
Main Research Area: Technical/natural sciences

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Blackout, Complex network, Fractal dimensions, Interconnected power grid, Power failure models

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Fractional-Order Modeling and Sliding Mode Control of Energy-Saving and Emission-Reduction Dynamic Evolution System

This paper proposes the fractional-order modeling for sliding mode control of a complex four-dimensional energy-saving and emission-reduction system (ESERS). In the proposed methodology, the fractional calculus techniques are employed to accurately model the dynamics of the ESERS, and the fractional-order model of the energy-saving and emission-reduction system (FOESERS) is formulated. With the proposed FOESERS, all of the equilibrium points and the corresponding eigenvalues are obtained, and the instability region and the state trajectories of FOESERS are also given. The FOESERS can represent complex dynamic behaviours with chaotic and unstable states on the energy conservation, carbon emissions, economic growth, and renewable energy development, and have a great impact on the formulation of
government energy policies. Furthermore, based on the fractional Lyapunov stability and robust control theory, a sliding-mode controller is designed to control the FOESERS with model uncertainties and external disturbances to the equilibrium point in the finite time. Finally, simulation results confirm the effectiveness and robustness of the proposed scheme.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hunan University, Shenzhen University  
Authors: Huang, S. (Ekstern), Zhou, B. (Ekstern), Li, C. (Ekstern), Wu, Q. (Intern), Xia, S. (Ekstern), Wang, H. (Ekstern), Yang, H. (Ekstern)  
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Original language: English

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Electronic versions:  
1_s2.0_S0142061517328211_main.pdf  
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Source: PublicationPreSubmission  
Source-ID: 144207542  
Publication: Research - peer-review > Journal article – Annual report year: 2018

**Frequency modulation excursion and rate discrimination in normal-hearing and hearing-impaired listeners**

Most natural sounds contain frequency fluctuations over time such as changes in their fundamental frequency, non-periodic speech formant transitions, or periodic fluctuations like musical vibrato. These are sometimes characterized as frequency modulation (FM) with a given excursion (FMe) and rate (FMr) (Fig.1). Accurate processing of FM may play an important role in music and speech perception, especially in complex instrument or talker situations. While age and sensorineural hearing loss (SNHL) can affect FM detection thresholds [1,2] and SNHL can affect the range of FMe and FMr values producing a sung vowel percept (Fig.2) [3], less is known about how these factors affect FMe and FMr discrimination. Moreover, reference data for FM discrimination in normal-hearing (NH) listeners remains scarce [4-6]. As discrimination tasks are closer to what listeners may use in real-life situations, this study investigated the effects of age and SNHL on FMe and FMr difference limens (DLs) for reference values typical of frequency fluctuations observed in speech and music signals.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Hearing Systems, Copenhagen University Hospital, Eriksenhol Research Centre  
Authors: Schindwolf, I. (Ekstern), Vatti, M. (Ekstern), Santurette, S. (Intern)  
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Friction-resilient position control for machine tools—Adaptive and sliding-mode methods compared

Robust trajectory tracking and increasing demand for high-accuracy tool positioning have motivated research in advanced control design for machine tools. State-of-the-art industry solutions employ cascades of Proportional (P) and Proportional-Integral (PI) controllers for closed-loop servo control of position and velocity of the machine axes. Although these schemes provide the required positioning accuracy in nominal conditions, performance deteriorates with increased friction and wear of the machine. With conventional control, re-tuning is necessary during the lifetime if specified accuracy shall be maintained. This paper investigates whether nonlinear and adaptive controllers can cope with typical levels of friction increase without loss of performance. It evaluates the performance of a state-of-art industry solution with that obtainable with adaptive and sliding mode positioning controls. The main finding is that an adaptive backstepping control is resilient to unknown and increasing friction at realistic levels of wear, where the P-PI control fall short with respect to accuracy. A single-axis test rig with adjustable friction is used to assess the performance of different controllers.
Functional Modeling for Monitoring of Robotic System

With the expansion of robotic applications in the industrial domain, it is important that the robots can execute their tasks in a safe and reliable way. A monitoring system can be implemented to ensure the detection of abnormal situations of the robots and report the abnormality to their human supervisors or cooperators. In this work, we focus on developing a modeling framework for monitoring robotic system based on means-end analysis and the concept of action phases from action theory. A circular cascaded action phase structure is proposed for building the model of cyclical robotic events. This functional model provide a formal way of decompose robotic tasks and analyze each level of conditions for an action to be executed successfully. It can be used for monitoring robotic systems by checking the preconditions in the action phases and identifying the failure modes. The proposed method is demonstrated by using a simulated robotic manipulation system. The simulation results demonstrate the feasibility of the developed functional model in finding errors during the execution monitoring.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Technical University of Denmark
Authors: Wu, H. (Intern), Bateman, R. R. (Ekstern), Zhang, X. (Intern), Lind, M. (Intern)
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Scopus rating (2017): SNIP 0.599 SJR 0.273 CiteScore 1.06
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Grid Code Requirements for Wind Power Integration

This chapter reviews the grid code requirements for integration of wind power plants (WPPs). The grid codes reviewed are from the UK, Ireland, Germany, Denmark, Spain, Sweden, the USA, and Canada. Transmission system operators (TSOs) around the world have specified requirements for WPPs under steady-state and dynamic conditions in their grid codes. Steady-state operational requirements concern the power factor requirement, voltage operating range, frequency operating range and voltage quality. The steady-state operational requirements for WPPs are specified at the point of connection (POC). Low-voltage ride through (LVRT) is a WPP’s capability to stay connected under specified low-voltage conditions at the POC, normally caused by faults in the grid. The UK grid code specifies LVRT requirements for both onshore and offshore WPPs. In some grid codes, WPPs are also requested to supply a maximum reactive current during specified low-voltage conditions. The chapter describes the low-voltage conditions at the POC that are specified in various grid codes.

General information
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Authors: Wu, Q. (Intern)
Pages: 11-36
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Main Research Area: Technical/natural sciences
DOIs:
10.1002/9781119236382.ch2
Grid integration of DC fast-charging stations for EVs by using modular li-ion batteries

Widespread use of electric vehicles (EVs) requires investigating impacts of vehicles’ charging on power systems. This paper focuses on the design of a new DC fast charging station (DCFCS) for EVs combined with local battery energy storages (BESs). Due to the BESs the DCFCS is able to decouple the peak load demand caused by multiple EVs and decrease the installation costs as well as the connection fees. The charging system is equipped with a bidirectional AC/DC converter, two lithium-ion batteries and a DC/DC converter. The introduction of BES within the DCFCSs is investigated with regards to operational costs of the charging stations as well as the ability of a BES to mitigating negative impacts on the power grid during congestion hours. The proposed solution is shown to reduce not only the installation costs but also the charging time and it facilitates the integration of fast chargers in existing low voltage (LV) grids. A cost-benefit analysis (CBA) is performed to evaluate the financial feasibility of BES within the DCFCSs by considering the installation costs, grid connection costs and battery life cycle costs.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Gjelaj, M. (Intern), Hashemi, S. (Intern), Træholt, C. (Intern), Andersen, P. B. (Intern)
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Scopus rating (2017): CiteScore 3.31 SJR 0.907 SNIP 1.305
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.2 SJR 1.03 SNIP 1.457
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.01 SNIP 1.496 CiteScore 2.74
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.923 SNIP 1.61 CiteScore 2.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.088 SNIP 1.923 CiteScore 2.73
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.899 SNIP 1.782 CiteScore 2.58
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.766 SNIP 1.768 CiteScore 2.27
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.723 SNIP 1.444
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.747 SNIP 1.254
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.596 SNIP 1.114
Guest Editorial: Coordinated Control and Protection of Offshore Wind and Combined AC/DC Grid

Voltage source converter (VSC) based High Voltage Direct Current (HVDC) Technologies have attracted more and more attention for integration of offshore wind power due to its good controllability. Coordinated control strategies shall be developed to utilize ancillary services from combined alternating current (AC)/DC grids and wind power plants, maintain good voltages, and mitigate the potential resonance problem. Besides, the fault current situation in DC grids depends on the control strategy and the interaction between the DC and AC grids. It is important to investigate the fault current situation considering both factors and design protection schemes. This Special Issue on Coordinated Control and Protection of Offshore Wind and Combined AC/DC Grid contains 17 high quality papers that are relevant to this topic, including frequency control, voltage control, optimal operation, fault analysis and protection of wind power and AC/DC grids, and HVDC technologies.
Hardware-in-the-Loop Test for Automatic Voltage Regulator of Synchronous Condenser

Automatic voltage regulator (AVR) plays an important role in volt/var control of synchronous condenser (SC) in power systems. Test AVR performance in steady-state and dynamic conditions in real grid is expensive, low efficiency, and hard to achieve. To address this issue, we implement hardware-in-the-loop (HiL) test for the AVR of SC to test the steady-state and dynamic performances of AVR in different operating conditions. Startup procedure of the system and voltage set point changes are studied to evaluate the AVR hardware response. Overexcitation, underexcitation, and AVR set point loss are tested to compare the performance of SC with the AVR hardware and that of simulation. The comparative results demonstrate how AVR will work in a real system. The results show HiL test is an effective approach for testing devices before deployment and is able to parameterize the controller with lower cost, higher efficiency, and more flexibility.

Hardware-in-the-loop Tests on Distance Protection Considering VSC Fault-ride-through Control Strategies

General information
H∞ Current Damping Control of DFIG based Wind Farm for Sub-Synchronous Control Interaction Mitigation

This paper proposes an H∞ damping controller for the doubly-fed induction generator (DFIG) based wind farm (WF) to mitigate sub-synchronous control interactions (SSCI) with series capacitor compensated lines. A multi-input multi-output (MIMO) uncertain state-space model is developed to reflect the main SSCI characteristics considering the uncertainties of wind speed, series compensation (SC) levels and system parameters. The SSCI is analyzed using the eigenvalue analysis of the uncertain system model. In order to damp the SSCI between the WF and series capacitor compensated lines under uncertainties, an H∞ damping controller is designed for the rotor side converter (RSC). The weighting functions are designed to meet the mitigation requirements of sub-synchronous oscillation currents and output power. The robust stability (RS) and robust performance (RP) of the system are validated by the µ analysis. The performance of the H∞ damping controller is demonstrated by time domain simulations of a 90 MW wind farm model with different wind speed, and SC levels. The case study with 6 m/s wind speed and 70% SC level shows superior performance of the H∞ damping controller.
Hierarchical Control of Thermostatically Controller Loads for Primary Frequency Control

This paper proposes a hierarchical control of Thermostatically Controlled Loads (TCLs) to provide primary frequency control support. The control architecture is comprised of three levels. At the high level, an aggregator coordinates multiple distribution substations and dispatches the primary reserve references. At the middle level, distribution substations estimate the available power of TCLs based on the aggregated bin model, and dispatch control signals to individual TCLs. At the local level, a supplementary frequency control loop is implemented at the local controller, which makes TCLs respond to the frequency event autonomously. Case studies show that the proposed controller can efficiently respond to frequency events and fulfill the requirement specified by the system operator. The users’ comforts are not compromised and the short cycling of TCLs is largely reduced. Due to the autonomous control, the communication requirement is minimized.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University
Authors: Zhao, H. (Intern), Wu, Q. (Intern), Huang, S. (Intern), Zhang, H. (Ekstern), Xue, Y. (Ekstern)
Pages: 2986-2998
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Main Research Area: Technical/natural sciences

Publication information
High Frequency LLC Resonant Converter with Magnetic Shunt Integrated Planar Transformer

High Frequency LLC requires a smaller resonant inductance which is usually implemented by transformer leakage inductance. However, this small resonant inductance is difficult to deal with a wide input voltage range. This paper proposes a new method to implement a larger resonant inductance by using a magnetic shunt integrated into planar transformer. The switching frequency can be greatly narrowed by designing a smaller inductance ratio of magnetizing inductance to resonant inductance. Since this method can well deal with a wide input voltage range without adding extra inductor and increasing the size of the transformer, the power density can be improved. The precise leakage inductance calculation method for this transformer and detailed LLC converter design procedure are presented. A 280-380V and 48V-100W half bridge LLC resonant converter with 1 MHz resonant frequency is built to verify the design methodology.

General Information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Li, M. (Ekstern), Ouyang, Z. (Intern), Andersen, M. A. E. (Intern)
Pages: 2678-2685
Publication date: 2018

Host publication information
Title of host publication: Proceedings of IEEE Applied Power Electronics Conference and Exposition
High Frequency LLC Resonant Converter with Magnetic Shunt Integrated Planar Transformer

LLC resonant converter has been proved as an excellent candidate to achieve high efficiency and power density. To achieve smaller size of passive components, the resonant inductor in LLC converter is usually integrated into the transformer by utilizing its leakage inductance. However, leakage inductance of transformer is usually insufficient and thus the LLC converter has to be operated in a limited frequency range, otherwise the power efficiency will drop dramatically. Therefore, a larger resonant inductance in LLC converter is expected to operate in a wider input voltage range. This paper proposes a new method to create a larger resonant inductance by using a magnetic shunt integrated into planar windings. Accurate leakage inductance modelling, calculation and optimal design guideline for LLC transformer are presented. A 280-380V input and output 48V-100W half bridge LLC resonant converter with 1 MHz resonant frequency is built to verify the design methodology. A comparison is made between the converter with magnetic shunt integrated transformer and the other with traditional planar transformer without magnetic shunt. Experimental results show the proposed converter with magnetic shunt can greatly narrow switching frequency range and thus achieve high efficiency under a wider input range.
Highly Subwavelength, Superdirective Cylindrical Nanoantenna

A superdirective cylindrical nanoantenna is demonstrated with a multilayered cylindrical metamaterial-inspired structure. Targeting specific scattering coefficients for the dipole and higher-order modes, the ideal limit of needle radiation is demonstrated. A five-layer system is optimized to demonstrate its approach to the theoretical directivity bound. While the resulting structure is scalable to any frequency regime, its highly subwavelength overall size (\(\lambda/10\)) takes advantage of combinations of positive and negative permittivity materials in the optical regime.

General information

State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, University of Technology Sydney
Authors: Arslanagic, S. (Intern), Ziolkowski, R. W. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.33 SJR 4.196 SNIP 2.61
Web of Science (2016): Indexed yes
High-Q 3D Microfabricated Magnetic-core Toroidal Inductors for Power Supplies in Package

Integration of power inductors is a roadblock in realizing highly miniaturized power supply in package (PwrSiP) and power supply on chip (PwrSoC). Inductors in such power system are used for energy storage and filtering, but they dominate in size and loss. This paper presents a novel 3D through-silicon via (TSV) magnetic-core toroidal inductor for PwrSiP. The magnetic-powder-based core is embedded into TSV air-core inductor using a casting method. The unique air-core inductor design with a hollow core and suspended windings enable a complete core filling with microscale magnetic powders. TSV magnetic-core inductors are fabricated in a compact size of 2.4 x 2.4 x 0.28 mm with the core content varying from 63 to 88 weight percent of soft ferrite NiZn powders. Small-signal measurements show a three-fold higher inductance of 112 nH and a 30% higher quality factor of 14.3 at 12.5 MHz for TSV magnetic-core inductors compared to similar TSV air-core inductors. The results are verified by the modelled results. The total core loss is characterized by large-signal measurements. A suitable inductor is implemented in a zero-voltage-switching 12-MHz buck converter. The converter achieves a peak efficiency of 72% and the output power of 2.4 W converting 12 to 5 VDC.
Developing bidirectional dc-dc converters has become a critical research topic and gains more and more attention in recent years due to the extensive applications of smart grids with energy storages, hybrid and electrical vehicles and dc microgrids. In this paper, a Partial Parallel Dual Active Bridge (P2DAB) converter, i.e. low-voltage (LV) side parallel and high-voltage (HV) side series, is proposed to achieve high voltage gain and low current stress over switching devices and transformer windings. Given the unmodified P2DAB power stage, by regulating the phase-shift angle between the paralleled active bridges, the power equations and voltage gain are then modified, and therefore the operation range can be extended effectively. The operating principles of the proposed converter and its power characteristics under various operation modes are studied, and the design constraints are discussed. Finally, a laboratory prototype is constructed and tested. Both simulation and experimental results have verified the proposed topology’s operation and design.
Human In-vivo Brain MR Current Density Imaging (MRCDI) based on Steady-state Free Precession Free Induction Decay (SSFP-FID)

MRCDI is a novel technique for non-invasive measurement of weak currents in the human head, which is important in several neuroscience applications. Here, we present reliable in-vivo MRCDI measurements in the human brain based on SSFP-FID, yielding an unprecedented accuracy. We demonstrate the destructive influences of stray magnetic fields caused by the current passing through feeding cables, and propose a correction method. Also, we show inter-individual differences in MRCDI measurements for two different current profiles, and compare the measurements with simulations based on individualized head models. The simulations of the current-induced magnetic fields show good agreement with in-vivo brain measurements.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Copenhagen University Hospital, University of Tubingen
Authors: Göksu, C. (Intern), Hanson, L. G. (Intern), Siebner, H. (Ekstern), Ehses, P. (Ekstern), Scheffler, K. (Ekstern), Thielscher, A. (Intern)
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Identifying Plausible Harmful N-k Contingencies: A Practical Approach based on Dynamic Simulations

This paper presents a practical search algorithm using detailed dynamic simulations to identify plausible harmful N − k contingency sequences. Starting from an initial list of contingencies, progressively more severe contingency sequences are investigated. For that purpose, components, which violated conservative protection limits during a N − k contingency simulation are identified and considered as candidate k + 1-th contingencies, since these could be tripped due to a hidden failure. This approach takes into account cascading events, such as over- or under-speed generator tripping, which are considered to be part of the system response. The implementation of the proposed algorithm into a parallel computing environment and its performance are demonstrated on the IEEE Nordic test system.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of Liege
Authors: Weckesser, J. T. G. (Intern), Van Cutsem, T. (Ekstern)
Number of pages: 8
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Main Research Area: Technical/natural sciences
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N-k contingencies, Cascading events, Protection hidden failures, Time-domain simulation
Source: PublicationPreSubmission
Source-ID: 145079942
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Impact of SNR, masker type and noise reduction processing on sentence recognition performance and listening effort as indicated by the pupil dilation response

Recent studies have shown that activating the noise reduction scheme in hearing aids results in a smaller peak pupil dilation (PPD), indicating reduced listening effort, at 50% and 95% correct sentence recognition with a 4-talker masker. The objective of this study was to measure the effect of the noise reduction scheme (on or off) on PPD and sentence recognition across a wide range of signal-to-noise ratios (SNRs) from +16 dB to -12 dB and two masker types (4-talker and stationary noise). Relatively low PPDs were observed at very low (-12 dB) and very high (+18 dB to +8 dB) SNRs presumably due to 'giving up' and 'easy listening', respectively. The maximum PPD was observed with SNRs at approximately 50% correct sentence recognition. Sentence recognition with both masker types was significantly improved by the noise reduction scheme, which corresponds to the shift in performance from SNR function at approximately 5 dB.
toward a lower SNR. This intelligibility effect was accompanied by a corresponding effect on the PPD, shifting the peak by approximately 4 dB toward a lower SNR. In addition, with the 4-talker masker, when the noise reduction scheme was active, the PPD was smaller overall than that when the scheme was inactive. We conclude that with the 4-talker masker, noise reduction scheme processing provides a listening effort benefit in addition to any effect associated with improved intelligibility. Thus, the effect of the noise reduction scheme on listening effort incorporates more than can be explained by intelligibility alone, emphasizing the potential importance of measuring listening effort in addition to traditional speech reception measures.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Hearing Systems, VU University Medical Centre, University of Nottingham, Linköping University
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.12 SJR 1.533 SNIP 1.334
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.886 SNIP 1.462 CiteScore 3.28
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.718 SNIP 1.353 CiteScore 3.11
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.52 SNIP 1.471 CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.658 SNIP 1.191 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.343 SNIP 1.218 CiteScore 2.73
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.522 SNIP 1.13
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.335 SNIP 1.086
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.531 SNIP 0.987
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.174 SNIP 1.058
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.988 SNIP 0.918
Scopus rating (2005): SJR 1.036 SNIP 0.967
Web of Science (2005): Indexed yes
Impact of VSC Control Strategies and Incorporation of Synchronous Condensers on Distance Protection under Unbalanced Faults
The short circuit response of a voltage source converter (VSC) under grid unbalanced faults mainly depends on the design of its control system. Due to the limited semiconductor overload capability, the short circuit current contributed by a VSC should be restricted within the limit for each phase. This might bring up challenges to the protection system of a converter-dominated power system. This paper derives a generic converter peak current limitation method for three different VSC control strategies. The impact of the control strategies and the combined impact of a VSC with a synchronous condenser on distance protection are evaluated using a commercial relay through hardware-in-the-loop (HIL) tests. Based on the test results, we propose to avoid using constant reactive power control strategy. It poses an adverse impact on the reliability and speed of distance protection regardless of the presence of SC at the point of common coupling (PCC), while constant active power and balanced current control strategies favor the performances of distance protection.
This paper proposes an approach to assist a pricemaker merchant energy storage facility in making its optimal operation decisions. The facility operates in a pool-based electricity market, where the ramping capability of other resources is limited. Also, wind power resources exist in the system. The merchant facility seeks to maximize its profit through strategic inter-temporal arbitrage decisions, when taking advantage of those ramp limitations. The market operator, on the other hand, aims at maximizing the social welfare under wind power generation uncertainty. Thus, a stochastic bi-level optimization model is proposed, taking into account the interactions between the storage facility and the market operator, and the existing market opportunities for the storage facility. The proposed bilevel model is then transformed into a Mathematical Program with Equilibrium Constraints (MPEC) that can be recast as a Mixed-integer Linear Programming (MILP) problem. Different case studies are presented and discussed using a six-bus illustrative example and the IEEE one-area reliability test system to evaluate the performance of the proposed approach.
Increased variability of watershed areas in patients with high-grade carotid stenosis

Purpose: Watershed areas (WSAs) of the brain are most susceptible to acute hypoperfusion due to their peripheral location between vascular territories. Additionally, chronic WSA-related vascular processes underlie cognitive decline especially in patients with cerebral hemodynamic compromise. Despite of high relevance for both clinical diagnostics and research, individual in vivo WSA definition is fairly limited to date. Thus, this study proposes a standardized segmentation approach to delineate individual WSAs by use of time-to-peak (TTP) maps and investigates spatial variability of individual WSAs. Methods: We defined individual watershed masks based on relative TTP increases in 30 healthy elderly persons and 28 patients with unilateral, high-grade carotid stenosis, being at risk for watershed-related hemodynamic impairment. Determined WSA location was confirmed by an arterial transit time atlas and individual super-selective arterial spin labeling. We compared spatial variability of WSA probability maps between groups and assessed TTP differences between hemispheres in individual and group-average watershed locations. Results: Patients showed significantly higher spatial variability of WSAs than healthy controls. Perfusion on the side of the stenosis was delayed within individual watershed masks as compared to a watershed template derived from controls, being independent from the grade of the stenosis and collateralization status of the circle of Willis. Conclusion: Results demonstrate feasibility of individual WSA delineation by TTP maps in healthy elderly and carotid stenosis patients. Data indicate necessity of individual segmentation approaches especially in patients with hemodynamic compromise to detect critical regions of impaired hemodynamics.

General information
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Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Technical University of Munich, Philips Research, Technische Universität München
Increasing the field-of-view of row–column-addressed ultrasound transducers: implementation of a diverging compound lens

The purpose of this work is to investigate compound lenses for row-column-addressed (RCA) ultrasound transducers for increasing the field-of-view (FOV) to a curvilinear volume region, while retaining a flat sole to avoid trapping air between the transducer sole and the patient, which would otherwise lead to unwanted reflections. The primary motivation behind this research is to develop a RCA ultrasound transducer for abdominal or cardiac imaging, where a curvilinear volume region is a necessity. RCA transducers provide 3-D ultrasound imaging with fewer channels than fully-addressed 2-D arrays (2N instead of \(N^2\)), but they have inherently limited FOV. By increasing the RCA FOV, these transducers can be used for the same applications as fully-addressed transducers while retaining the same price range as conventional 2-D imaging due to the lower channel count. Analytical and finite element method (FEM) models were employed to evaluate design options. Composite materials were developed by loading polymers with inorganic powders to satisfy the corresponding speed of sound and specific acoustical impedance requirements. A Bi\(_2\)O\(_3\) powder with a density of 8.9 g/cm\(^3\) was used to decrease the speed of sound of a room temperature vulcanizing (RTV) silicone, RTV615, from 1.03 mm/μs to 0.792 mm/μs. Using micro-balloons in RTV615 and a urethane, Hapflex 541, their speeds of sound were increased from 1.03 mm/μs to 1.50 mm/μs and from 1.52 mm/μs to 1.93 mm/μs, respectively. A diverging add-on lens was fabricated of a Bi\(_2\)O\(_3\) loaded RTV615 and an unloaded Hapflex 541. The lens was tested using a RCA probe, and a FOV of 32.2° was measured from water tank tests, while the FEM model yielded 33.4°. A wire phantom with 0.15 mm diameter wires was imaged at 3 MHz down to a depth of 14 cm using a synthetic aperture imaging sequence with single element transmissions. The beamformed image showed that wires outside the array footprint were visible, demonstrating the increased FOV.

General information
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Organisations: Center for Fast Ultrasound Imaging, Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Department of Electrical Engineering, Biomedical Engineering, Sound Technology, Inc.
Authors: Engholm, M. (Intern), Beers, C. (Ekstern), Bouzari, H. (Intern), Jensen, J. A. (Intern), Thomsen, E. V. (Intern)
Pages: 97–105
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.714 SJR 0.973 CiteScore 2.72
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.51 SJR 0.834 SNIP 1.728
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.708 SNIP 1.655 CiteScore 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.848 SNIP 2.156 CiteScore 2.41
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.67 SNIP 1.727 CiteScore 2.12
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.675 SNIP 1.886 CiteScore 2.09
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.707 SNIP 1.72 CiteScore 2.2
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Infill Optimization for Additive Manufacturing - Approaching Bone-like Porous Structures

Porous structures such as trabecular bone are widely seen in nature. These structures exhibit superior mechanical properties whilst being lightweight. In this paper, we present a method to generate bone-like porous structures as lightweight infill for additive manufacturing. Our method builds upon and extends voxel-wise topology optimization. In particular, for the purpose of generating sparse yet stable structures distributed in the interior of a given shape, we propose upper bounds on the localized material volume in the proximity of each voxel in the design domain. We then aggregate the local per-voxel constraints by their p-norm into an equivalent global constraint, in order to facilitate an efficient optimization process. Implemented on a high-resolution topology optimization framework, our results demonstrate mechanically optimized, detailed porous structures which mimic those found in nature. We further show variants of the optimized structures subject to different design specifications, and analyze the optimality and robustness of the obtained structures.
Influence of V2G Frequency Services and Driving on Electric Vehicles Battery Degradation in the Nordic Countries

Researchers worldwide are investigating whether electric vehicles (EV) Vehicle-to-Grid (V2G) services can be profitable for both customer and involved stakeholders. However, marginal consideration has been given so far to the possible wear of the EV battery while providing energy intense services. This paper intends to clearly distinguish and quantify the impact on the battery lifetime because of normal driving and frequency based service. A representative 40 kWh EV with battery characteristics modelled as Lithium Nickel Manganese Cobalt Oxide batteries is taken as reference, being subject to realistic driving patterns in the Danish island of Bornholm and providing V2G service with 10 kW fast chargers when grid connected. It is shown that if the service energy requirements are relatively low, short term power flows have limited effect on the battery degradation and despite very long provision periods the degradation is not much higher than from normal driving usage.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources

For hyperpolarized 13C MRI acquisitions aimed at metabolic rate constant estimation, the Bloch-Siegert shift enables encoding of the transmit field (B1+-field) amplitude within a single hyperpolarized substrate injection. This ability is needed since most clinical hyperpolarized MRI studies use inhomogeneous transmit coils, and because kinetic modeling based on incorrect flip angles can lead to incorrect rate constant estimations. This study demonstrates the feasibility of integrated B1+ mapping for large volume thermal and hyperpolarized phantoms in a clinical setup using a clamshell transmit coil and a 16-channel receive array, and a 3D stack-of-spirals sequence. Phase-sensitive coil-combination was achieved using ESPRIT.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, University of California at San Francisco
Authors: Hansen, R. B. (Intern), Shin, P. J. (Ekstern), Gordon, J. W. (Ekstern), van Criekinge, M. (Ekstern), Carvajal, L. (Ekstern), Hanson, L. G. (Intern), Ardenkjær-Larsen, J. H. (Intern), Vigneron, D. B. (Ekstern)
Number of pages: 3
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Integrated Off-Line Power Converter

The miniaturization trend of industrial and consumer electronics continuously drives the demand of reductions in size, weight, and cost of power supplies. The examples of such applications considered in this research are light-emitting diode (LED) drivers for intelligent lighting systems and internet of things (IoT). These power supplies convert the mains power of 220-240 Vrms AC in Europe to low DC voltages around 13 V with an output power of 5-20 W. This research focuses on the DC-DC power conversion, with rectified AC mains as input. The size reduction is the direct requirement, and it can only be obtained by simultaneously improving efficiency to maintain thermal limits at maximum losses. However, fundamental trade-off relationships exist between the power density and the efficiency. To achieve both high efficiency and high power density, systematic development is imperative for components, topologies, and architectures. The research started from integrating active components on a single chip, i.e. integrated high voltage (≥100 V) power MOSFETs in a Silicon-on-Insulator (SOI) process. The extreme performances (such as maximum switching speeds and minimum attainable on-resistances) of these devices are jointly determined by the device, layout, package, and PCB parasitic properties. The research highly contributes to the development towards Power Supply on Chip (PwrSoC) regardless of topologies and switching technologies. First, parasitic capacitances of power semiconductors are a part of the key design parameters of power supplies, for both hardswitched and soft-switched converters. A modelling method is proposed to systematically analyse the nonlinear parasitic capacitances of the power MOSFETs in different states, whereas datasheets typically specify capacitances only in transistor off-states. Second, the nonlinear figure-of-merits (FOMs), which might be used for device-to-device comparisons, are systematically analysed and optimized up to 18.3 times for a given device with quasi-zero voltage switching conditions. Third, four layout structures are proposed and their parasitic capacitive coupling effects are analytically compared, which shows that parasitic capacitances of on-chip interconnections could dominate over intrinsic capacitances of power devices. In addition, the parasitic effects of package and PCB are qualitatively analysed. For topologies and architectures, a two-stage power converter architecture is proposed, where the input stage is a high-voltage switched-capacitor converter and the output stage is a low-voltage inductor-based converter. For the output stage, a buck converter using the integrated power MOSFETs is implemented.
with measured efficiencies around 93%. For resonant converters, integrated power stages with parasitic bipolar effects, using piezo elements as resonant tanks, and discrete prototypes of class-DE series-parallel LCLC converters are investigated. The input stage is implemented as 380 V input switched-capacitor converters, using both Gallium Nitride (GaN) and Silicon Carbide (SiC) devices to properly address switching losses at high-voltage low-power levels. For power stages, a 10 W prototype reaches a peak efficiency of 98.6% and a power density of 7.5 W/cm³. For converters including driver and its supply, a 21.3 W prototype achieves a full-load efficiency of 97.6% and a power density of 2.7 W/cm³. For switching schemes, a concept of Asynchronous-Switched-Capacitor (ASC) is proposed for a 380 V, 4:1 switched-capacitor converter, and a peak efficiency of 95.4% is achieved with reduced output voltage ripples. All these prototypes demonstrate the switched-capacitor feasibility at higher-voltage (> 200 V) lower-power (< 30 W) levels than previously published ones.

Integrated Off-Line Power Converter

The main conclusions are that this research contributes to the analysis and design of the integrated high voltage power MOSFETs for on-chip integrated power converters, and contributes to the design and implementation of the switched-capacitor based two-stage architecture for discrete off-line power converters. It is concluded that efficient integrated off-line power conversion is currently in its infancy, and this research work fosters the framework and paves the way for future development in this area.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Fan, L. (Intern)
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Electronic versions:
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Publication: Research › Ph.D. thesis – Annual report year: 2018

Interaction of nanofillers in injection-molded graphene/carbon nanotube reinforced PA66 hybrid nanocomposites

Interaction of multi-walled carbon nanotubes and graphene nanoplatelets within injection-molded thermoplastic-based nanocomposites is investigated. The research shows how the nanofillers’ combination ratio and content influence the properties in the semicrystalline thermoplastic-based composites. Three main groups of polyamide-based composite specimens containing either or both of the nanofillers are prepared. Results show that the single inclusion of the nanomaterials improves the mechanical and thermal properties significantly. However, the combined incorporation of both the nanofillers in the polymeric matrix does not lead to the linear combination of the observed behaviors. While the mechanical properties and the degrees of crystallinity improve, the thermal conductivities decrease in the hybrid composites for similar nanofiller contents. Rheological and crystallization investigations also showed the dominant influence of the nanotubes in the structure of the hybrid composites. The underlying mechanisms of modulation in the properties were also investigated in detail.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Solid Mechanics, Technical University of Denmark
Authors: Doagou-Rad, S. (Intern), Islam, A. (Intern), Jensen, J. S. (Intern), Alnasser, A. (Ekstern)
Number of pages: 11
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Main Research Area: Technical/natural sciences

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Journal: Journal of Polymer Engineering
ISSN (Print): 0334-6447
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Scopus rating (2017): CiteScore 0.77
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.64
Interactions Between Indirect DC-Voltage Estimation and Circulating Current Controllers of MMC-Based HVDC Transmission Systems

Estimation-based indirect dc-voltage control in MMCs interacts with circulating current control methods. This paper proposes an estimation-based indirect dc-voltage control method for MMC-HVDC systems and analyzes its performance compared to alternative estimations. The interactions between estimation-based indirect dc-voltage control and circulating current control methods, active/reactive power regulation are also investigated. The proposed method delivers similar performance to measurement-based direct dc-voltage control, regardless of the circulating current control method. Steady-state and transient performance is demonstrated using a benchmark MMC-HVDC transmission system, implemented in a real-time digital simulator. The results verify the theoretical evaluations and illustrate the operation and performance of the proposed indirect dc-voltage control method.
Investigation on acceptable reverberation time at various frequency bands in halls that present amplified music
Subjective ratings from 25 professional musicians and sound engineers were obtained to assess two Danish rock venues of similar size and similar low frequency reverberation times, but different high frequency reverberation times. The musicians judged one hall significantly better than the other, confirming a hypothesis that rock venues can have a longer reverberation time at mid to high frequencies at least in the empty condition. A fairly long reverberation time in the 63 Hz octave band is found to be acceptable, so the 125 Hz octave band is probably the single most important band to control for amplified music.

**General information**
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Organisations: Department of Electrical Engineering, Acoustic Technology, Flex Acoustics, COWI AS
Authors: Adelman-Larsen, N. W. (Ekstern), Jeong, C. (Intern), Støfringsdal, B. (Ekstern)
Pages: 104–107
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**Publication information**
Journal: Applied Acoustics
Kinetic Analysis of Hexose Conversion to Methyl Lactate by Sn Beta: Effects of Substrate Masking and of Water

Simple sugars bear promise as substrates for the formation of fuels and chemicals using heterogeneous catalysts in alcoholic solvents. Sn-Beta is a particularly well suited catalyst for the cleavage, isomerization and dehydration of sugars into more valuable chemicals. In order to understand these processes and save resources and time by optimising them, kinetic and mechanistic analyses are helpful. Herein, we study substrate entry into the Sn-Beta catalysed methyl lactate process using abundant hexose substrates. NMR spectroscopy is applied to show that the formation of methyl lactate occurs in two kinetic regimes for fructose, glucose and sucrose. The majority of methyl lactate is not formed from the substrate directly, but from methyl fructosides in a slow regime. At 160 °C, more than 40% of substrate carbon are masked (i.e. reversibly protected in situ) as methyl fructosides within few minutes when using hydrothermally synthesised Sn-Beta, while more than 60% methyl fructosides can be produced within few minutes using post synthetically synthesised Sn-Beta. A significant fraction of substrate thus is masked by rapid methyl fructoside formation prior to subsequent slow release of fructose. This release is the rate limiting step in the Sn-Beta catalysed methyl lactate process, but can be accelerated by the addition of small amounts of water at the expense of maximum methyl lactate yield.
Liquid-State Polarization of 30% through Photo-Induced Non-Persistent Radicals on $^{13}$C Pyruvic Acid

Liquid-State $^{13}$C Polarization of 30% through Photoinduced Nonpersistent Radicals

Hyperpolarization via dissolution dynamic nuclear polarization (dDNP) is crucial to significantly increasing the magnetic resonance imaging (MRI) sensitivity, opening up in vivo real-time MRI using $^{13}$C-labeled substrates. The range of applications, however, is limited by the relatively fast decay of the nuclear spin polarization together with the constraint of having to polarize the spins near the MRI magnet. As recently demonstrated, the employment of UV-induced nonpersistent radicals represents an elegant solution to tackling these drawbacks. Nevertheless, since its introduction, the spread of the technique has been prevented by the relatively low achievable polarization, slow buildup time, and time-consuming sample preparation.

In the present work, thanks to a thorough investigation of the radical generation step, we provide a robust protocol to enhance the efficiency and performance of the UV-radical technique. Under optimal conditions, it was possible to produce up to 60 mM radical in less than 5 min and reach maximum DNP enhancement with a buildup time constant of approximately 25 min at 6.7 T and 1 K, resulting in 30% $^{13}$C liquid-state polarization.

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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2018

Journal: Journal of Physical Chemistry C
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BFI (2018): BFI-level 1
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Scopus rating (2017): CiteScore 4.58 SJR 2.135 SNIP 1.147
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.48 SJR 1.964 SNIP 1.195
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.886 SNIP 1.26 CiteScore 4.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.032 SNIP 1.447 CiteScore 5.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.143 SNIP 1.445 CiteScore 5.14
ISI indexed (2013): ISI indexed yes
Loss Analysis of GaN Based Partial Parallel Isolated Bidirectional Full Bridge Boost Converter

A theoretical loss analysis is presented for GaN switches, for which conduction and switching losses are considered, and for planar transformers, where winding and core losses are considered. The analysis is then used to make a comparison of the losses in the partial parallel isolated full bridge boost converter and the isolated full bridge boost converter.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Jørgensen, K. L. (Intern), Mira Albert, M. D. C. (Intern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 4
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Conference: 3rd International Conference on Intelligent Green Building and Smart Grid, Yilan, Taiwan, Province of China, 22/04/2018 - 22/04/2018
dc-dc converter, Bidirectional, Full bridge boost, Partial parallel
Electronic versions:
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Source: PublicationPreSubmission
Marine Diesel Engine Control to meet Emission Requirements and Maintain Maneuverability

International shipping has been reported to account for 13% of global NOx emissions and 2.1% of global green house gas emissions. Recent restrictions of NOx emissions from marine vessels have led to the development of exhaust gas recirculation (EGR) for large two-stroke diesel engines. Meanwhile, the same engines have been downsized and derated to optimize fuel efficiency. The smaller engines reduce the possible vessel acceleration, and to counteract this, the engine controller must be improved to fully utilize the physical potential of the engine. A fuel index limiter based on air/fuel ratio was recently developed [1], but as it does not account for EGR, accelerations lead to excessive exhaust smoke formation which could damage the engine when recirculated. This paper presents two methods for extending a fuel index limiter function to EGR engines. The methods are validated through simulations with a mean-value engine model and on a vessel operating at sea. Validation tests compare combinations of the two index limiter methods, using either traditional PI control for the EGR loop or the recently developed fast adaptive feedforward EGR control [2]. The experiments show that the extended limiters reduce exhaust smoke formation during acceleration to a minimum, and that the suggested limiter, combined with adaptive feedforward EGR control, is able to maintain full engine acceleration capability. Sea tests with engine speed steps from 35 to 50 RPM, made peak exhaust opacity increase by only 5 percentage points when using the proposed limiter, whereas it increased 70 percentage points without the limiter.
Miniaturization of power supplies is required for future intelligent electronic systems e.g. internet of things devices. Inductors play an essential role, and they are by far the most bulky and expensive components in power supplies. This paper presents a miniaturized microelectromechanical systems (MEMS) inductor and its performance in a very high frequency (VHF) power converter. The MEMS inductor is a silicon-embedded air-core toroidal inductor, and it is constructed with through-silicon vias, suspended copper windings, silicon fixtures, and a silicon support die. The air-core inductors outperform the silicon-core inductors with higher quality factor at higher frequency. This is verified by small-signal measurements. A 20-turn air-core inductor achieved an inductance of 44.6 nH and a quality factor of 13.3 at 33 MHz, while a silicon-core inductor with the same geometry has a quality factor of 9 at 20 MHz. A DC-DC class-E boost converter is designed and implemented using the fabricated MEMS air-core inductor and a high-performance 65 V gallium nitride field effect transistor. The VHF converter achieved a peak efficiency of 78 % at the input voltage of 6.5 VDC. The MEMS inductor can carry 1 A RMS AC current at 33 MHz and delivers 10.5 W to the output.
Microstrip linear phase low pass filter based on defected ground structures for partial response modulation

We report a high performance linear phase low pass filter (LPF) designed for partial response (PR) modulations. For the implementation, we adopted microstrip technology and a variant of the standard stepped-impedance technique. Defected ground structures (DGS) are used for increasing the characteristic impedance of transmission lines. Experimental results prove that the proposed filter can successfully modulate a non-return-to-zero (NRZ) signal into a five levels PR one.

General information
State: Published
Organisations: Metro-Access and Short Range Systems, Department of Electrical Engineering, Electromagnetic Systems, Mellanox Technologies
Authors: Cimoli, B. (Intern), Johansen, T. K. (Intern), Olmos, J. J. V. (Ekstern)
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Scopus rating (2017): CiteScore 0.99 SJR 0.273 SNIP 0.599
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.87 SJR 0.278 SNIP 0.561
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.318 SNIP 0.506 CiteScore 0.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.347 SNIP 0.578 CiteScore 0.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.34 SNIP 0.63 CiteScore 0.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.333 SNIP 0.585 CiteScore 0.83
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Microwave Technology for Brain Imaging and Monitoring: Physical Foundations, Potential and Limitations

This chapter provides an introduction to the physical principles underlying the adoption of microwave technology as a biomedical imaging modality for diagnosis and follow-up of neurological diseases and injuries (e.g., stroke, haematoma). In particular, a theoretical analysis, supported by numerical simulations and experiments, will be given to describe the physical constraints that arise in this kind of application and the relevant limitations. In addition, we discuss the main aspects to be faced when implementing microwave imaging technology in a clinical scenario, by exploiting a design procedure to determine the number of antennas needed to capture, in a non-redundant way, the largest part of the available data.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Ecole Polytechnique Federale de Lausanne (EPFL), Polytechnic University of Turin, National Research Council of Italy
Authors: Scapaticci, R. (Ekstern), Bjelogrlic, M. (Ekstern), Tobon Vasquez, J. (Ekstern), Vipiana, F. (Ekstern), Mattes, M. (Intern), Crocco, L. (Ekstern)
Pages: 7-35
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Series: Emerging Electromagnetic Technologies for Brain Diseases Diagnostics, Monitoring and Therapy
Main Research Area: Technical/natural sciences
Mixed H2/H∞ Pitch Control of Wind Turbine with a Markovian Jump Model

This paper proposes a Markovian jump model and the corresponding H2 /H∞ control strategy for the wind turbine driven by the stochastic switching wind speed, which can be used to regulate the generator speed in order to harvest the rated power while reducing the fatigue loads on the mechanical side of wind turbine. Through sampling the low-frequency wind speed data into separate intervals, the stochastic characteristic of the steady wind speed can be represented as a Markov process, while the high-frequency wind speed in the each interval is regarded as the disturbance input. Then, the traditional operating points of wind turbine can be divided into separate subregions correspondingly, where the model parameters and the control mode can be fixed in each mode. Then, the mixed H2 /H∞ control problem is discussed for such a class of Markovian jump wind turbine working above the rated wind speed to guarantee both the disturbance rejection and the mechanical loads objectives, which can reduce the power volatility and the generator torque fluctuation of the whole transmission mechanism efficiently. Simulation results for a 2 MW wind turbine show the effectiveness of the proposed method.
Modeling and Modern Control of Wind Power

This book covers the modeling of wind power and application of modern control methods to the wind power control—specifically the models of type 3 and type 4 wind turbines. The modeling aspects will help readers to streamline the wind turbine and wind power plant modeling, and reduce the burden of power system simulations to investigate the impact of wind power on power systems. The use of modern control methods will help technology development, especially from the perspective of manufactures.

Modeling of diffraction radiation processes on periodic metal-dielectric structures in millimeter wavelength range

A general approach to experimental modeling of Cherenkov and diffraction radiation in vacuum electron devices employing periodic metal-dielectric structures is presented. The potential benefits and drawbacks of this approach to the design of microwave devices are discussed. The approach is based on resemblance of electromagnetic properties between the modulated electron beam and the surface wave in a dielectric waveguide. A dedicated millimeter-wave experimental setup is developed and constructed.
Modeling of ciprofloxacin killing enhanced by hyperbaric oxygen treatment in Pseudomonas aeruginosa PAO1 biofilms

Outline

In chronic lung infections by Pseudomonas aeruginosa (PA) the bacteria thrive in biofilm structures protected from the immune system of the host and from antibiotic treatment. Increasing evidence suggests that the susceptibility of the bacteria to antibiotic treatment can be significantly enhanced by hyperbaric oxygen treatment. The aim of this study is to...
simulate the effect of ciprofloxacin treatment in a PAO1 biofilm model with aggregates in agarose when combined with hyperbaric oxygen treatment. This is achieved in a reaction-diffusion model that describes the combined effect of ciprofloxacin diffusion, oxygen diffusion and depletion, bacterial growth and killing, and adaptation of the bacteria to ciprofloxacin. In the model, the oxygen diffusion and depletion use a set of parameters derived from experimental results presented in this work. The part of the model describing ciprofloxacin killing uses parameter values from the literature in combination with our estimates (Jacobs, et al., 2016; Grillon, et al., 2016). Micro-respirometry experiments were conducted to determine the oxygen consumption in the P. aeruginosa strain PAO1. The parameters were validated against existing data from an HBOT experiment by Kolpen et al. (2017). The complete oxygen model comprises a reaction-diffusion equation describing the oxygen consumption by using a Michaelis-Menten reaction term. The oxygen model performed well in predicting oxygen concentrations in both time and depth into the biofilm. At 2.8 bar pure oxygen pressure, HBOT increases the penetration depth of oxygen into the biofilm almost by a factor of 4 in agreement with the scaling that follows from the stationary balance between the consumption term and diffusion term.

Conclusion
In the full reaction-diffusion model we see that hyperbaric oxygen treatment significantly increases the killing by ciprofloxacin in a PAO1 biofilm in alignment with the experimental results from Kolpen et al. (Kolpen, et al., 2017; Kolpen, et al. 2016). The enhanced killing, in turn, lowers the oxygen consumption in the outer layers of the biofilm, and leads to even deeper penetration of oxygen into the biofilm.
This brief proposes a new convex model predictive control (MPC) strategy for dynamic optimal power flow between battery energy storage (ES) systems distributed in an ac microgrid. The proposed control strategy uses a new problem formulation, based on a linear $d$–$q$ reference frame voltage-current model and linearized power flow approximations. This allows the optimal power flows to be solved as a convex optimization problem, for which fast and robust solvers exist. The proposed method does not assume that real and reactive power flows are decoupled, allowing line losses, voltage constraints, and converter current constraints to be addressed. In addition, nonlinear variations in the charge and discharge efficiencies of lithium ion batteries are analyzed and included in the control strategy. Real-time digital simulations were carried out for an islanded microgrid based on the IEEE 13 bus prototypical feeder, with distributed battery ES systems and intermittent photovoltaic generation. It is shown that the proposed control strategy approaches the performance of a strategy based on nonconvex optimization, while reducing the required computation time by a factor of 1000, making it suitable for a real-time MPC implementation.
Model Predictive Voltage Control of Wind Power Plants

This chapter proposes an autonomous wind farm voltage controller (WFVC) based on model predictive control (MPC). It also introduces the analytical expressions for the voltage sensitivity to tap positions of a transformer. The chapter then describes the discrete models for the wind turbine generators (WTGs) and static var compensators (SVCs)/static var generators (SVGs). Next, it describes the implementation of the on-load tap changing (OLTC) in the MPC. Furthermore, the chapter examines the cost function as well as the constraints of the MPC-based WFVC for both control modes. In order to test the efficacy of the proposed WFVC, two case scenarios were designed: the wind farm is under normal operating conditions and the internal wind power fluctuation is considered; and besides internal power fluctuation, the impact of the external grid on the wind farm is considered.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy
Authors: Zhao, H. (Intern), Wu, Q. (Intern)
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Publication date: 2018

Host publication information
Molecular imaging of tumor photoimmunotherapy: Evidence of photosensitized tumor necrosis and hemodynamic changes

Near-infrared photoimmunotherapy (NIR PIT) employs the photoabsorbing dye IR700 conjugated to antibodies specific for cell surface epidermal growth factor receptor (EGFR). NIR PIT has shown highly selective cytotoxicity in vitro and in vivo. Cell necrosis is thought to be the main mode of cytotoxicity based mainly on in vitro studies. To better understand the acute effects of NIR PIT, molecular imaging studies were performed to assess its cellular and vascular effects. In addition to in vitro studies for cytotoxicity of NIR PIT, the in vivo tumoricidal effects and hemodynamic changes induced by NIR PIT were evaluated by C-13 MRI using hyperpolarized [1,4-C-13(2)] fumarate, R-2* mapping from T-2*-weighted MRI, and photoacoustic imaging. In vitro studies confirmed that NIR PIT resulted in rapid cell death via membrane damage, with evidence for rapid cell expansion followed by membrane rupture. Following NIR PIT, metabolic MRI using hyperpolarized fumarate showed the production of malate in EGFR-expressing A431 tumor xenografts, providing direct evidence for photosensitized tumor necrosis induced by NIR PIT. R2* mapping studies showed temporal changes in oxygenation, with an accompanying increase of deoxyhemoglobin at the start of light exposure followed by a sustained decrease after cessation of light exposure. This result suggests a rapid decrease of blood flow in EGFR-expressing A431 tumor xenografts, which is supported by the results of the photoacoustic imaging experiments. Our findings suggest NIR PIT mediates necrosis and hemodynamic changes in tumors by photosensitized oxidation pathways and that these imaging modalities, once translated, may be useful in monitoring clinical treatment response.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, National Cancer Institute, National Institute of Neurological Disease and Stroke
Authors: Kishimoto, S. (Ekstern), Oshima, N. (Ekstern), Yamamoto, K. (Ekstern), Munasinghe, J. (Ekstern), Ardenkjær-Larsen, J. H. (Intern), Mitchell, J. B. (Ekstern), Choyke, P. L. (Ekstern), Krishna, M. C. (Ekstern)
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Main Research Area: Technical/natural sciences

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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.518 SNIP 1.623 CiteScore 5.89
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.469 SNIP 1.653 CiteScore 5.86
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.239 SNIP 1.69 CiteScore 5.81
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.116 SNIP 1.66 CiteScore 5.51
ISI indexed (2012): ISI indexed yes
Multi-agent modeling and analysis of EV users' travel willingness based on an integrated causal/statistical/behavioral model

An electric vehicle (EV) centred ecosystem has not yet been formed, the existing limited statistic data are far from enough for the analysis of EV users' travel and charge behaviors, which however tends to be affected by many certain and uncertain factors. An experimental economics (EE) based simulation method can be used to analyze the behaviors of key participants in a system. However, it is restricted by the system size, experimental site and the number of qualified human participants. Therefore, this method is hard to be adopted for the behavioral analysis of a large number of human participants. In this paper, a new method combining a questionnaire statistics and the EE-based simulation is proposed. The causal relationship is considered in the design of the questionnaires and data extraction, then a multi-agent modeling integration method is introduced in the EE-based simulation, which enables the integration of causal/statistical/behavioral models into the multi-agent framework to reflect the EV users' travel willingness statistically. The generated multi-agents are used to replace human participants in the EE-based simulation in order to evaluate EV users' travel demands in different scenarios, and compare the differences of simulated or measured travel behaviors between potential EV users and internal combustion engine (ICE) vehicle users.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, State Grid Electric Power System Research Institute, Nanjing University of Information Science and Technology, Queen's University Belfast, Zhejiang University
Authors: Wu, J. (Ekstern), Xue, Y. (Ekstern), Xie, D. (Ekstern), Li, K. (Ekstern), Wen, F. (Ekstern), Yang, G. (Intern), Wu, Q. (Intern)
Number of pages: 9
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Modern Power Systems and Clean Energy
ISSN (Print): 2196-5625
Multichannel Hyperpolarized 13C MRI in a Patient with Liver Metastases using Multi-slice EPI and an Alternating Projection Method for Denoising

Hyperpolarized 13C-pyruvate for monitoring metabolism of liver metastases in vivo is being investigated for clinical trials of new therapeutics. This study applied advances in multichannel receive arrays and sequence design for human 13C liver imaging and investigated a new denoising method. The method is based on an alternating projection method to enforce structuredness and low-rankness, and is applied with automatic threshold estimation. In vivo data demonstrate improved quality of kinetic modeling after denoising. However, simulations revealed certain unresolved pitfalls.

Multi-dimensional microstructural imaging offers novel in vivo insights into brain pathology: an application to multiple sclerosis

Magnetic resonance imaging is today the most versatile imaging method for characterization of multiple sclerosis (MS) in vivo, but clinical examinations lack sensitivity to capture changes in the tissue microstructure. Using a multi-dimensional microstructural imaging approach, we demonstrate how it is possible to obtain more specific and broader microstructural insights about the underlying pathology of MS. For this we use a comprehensive battery of conventional and novel diffusion weighted imaging and quantitative MRI sequences each capable of explaining different and complementary microstructural properties. This allows us to explore the underlying pathology of MS, which is normally only accessible with histology.
Multi-Flow Transmitter with Full Format and Rate Flexibility for Next Generation Networks

We extend our proof-of-concept demonstration of a novel multi-flow transmitter for next generation optical metro networks. The multi-flow concept is based on the combination of spectrum and polarization sliceability, and its implementation on the combination of a polymer photonic integration platform with high-speed IQ modulators. In this work, we replace the static scheme of our previous demonstration for the definition of the optical flows and the generation of the driving signals, and we unveil the true potential of the transmitter in terms of programmability and network flexibility. Using a software defined optics (SDO) platform for the configuration of the digital and optical parts of the transmitter, and the configuration of the optical switch inside the node, we demonstrate operation with flexible selection of the number and type of the optical flows, and flexible selection of the modulation format, symbol rate, emission wavelength and destination of each flow. We focus on 16 specific cases accommodating 1 or 2 optical flows with modulation format up to 64-quadrature amplitude modulation (64-QAM), and symbol rate up to 25 Gbaud. Through transmission experiments over 100 km of standard single-mode fiber, we validate the possibility of the transmitter to interchange its configuration within this range of operation cases with bit-error rate performance below the forward error correction limit. Future plans for transmitter miniaturization and extension of our SDO platform in order to interface with the software defined networking (SDN) hierarchy of true networks are also outlined.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Electromagnetic Systems, National Technical University of Athens, Nokia Bell Labs, Fraunhofer Gesellschaft, III-V Lab, Cordon Electronics Italia, Fraunhofer-Gesellschaft
Number of pages: 9
Publication date: 2018
Main Research Area: Technical/natural sciences

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Volume: PP
Issue number: 99
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.42 SJR 1.166 SNIP 1.791
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.87 SJR 1.23 SNIP 1.819
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.598 SNIP 1.901 CiteScore 4.15
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.737 SNIP 2.411 CiteScore 4.23
Web of Science (2014): Indexed yes
This paper presents a methodology to improve the operation of the power system and to deal with technical issues caused by electric vehicles (EVs) fast charging load. Fast charging stations (FCSs) are indispensable for widespread use of EVs since they can fully charge EVs in a short period of time. The integration of battery energy storage (BES) within the FCSs is considered a smart option to avoid the power congestion during the peak hours as well as the grid reinforcement costs due to FCSs. In addition, the BES can be used as multifunctional equipment, which is able to provide services such as...
This paper proposes a method to determine an optimal size of BES considering a stochastic modelling approach of the EVs load demand based on the users’ behaviour and their probabilistic driving patterns. Finally, a case study is carried out using a real DC fast-charging infrastructure in Copenhagen.

**General information**
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Sao Paulo State University
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Number of pages: 6
Publication date: 2018

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Publisher: Institution of Engineering and Technology
Main Research Area: Technical/natural sciences
Conference: 7th International Conference on Renewable Power Generation, Copenhagen, Denmark, 26/09/2018 - 26/09/2018
Electric vehicle, Battery energy storage, Fast charging station, Frequency regulation, Peak shaving

**Electronic versions:**
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

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**Multilevel tracking power supply for switch-mode audio power amplifiers**

Switch-mode technology is the common choice for high efficiency audio power amplifiers. The dynamic nature of real audio reduces efficiency as less continuous output power can be achieved. Based on methods used for RF amplifiers this paper proposes to employ envelope tracking techniques to the power supply in order to improve efficiency. A 100 W prototype system was designed. Measured results show that systems employing envelope tracking can improve system efficiency from 2% to 12%, i.e. a factor of 6. The temperature rise is strongly reduced, especially for the switching power MOSFETs where it is halved from 100 °C to 50 °C.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electronics, Universidad Politecnica de Madrid
Authors: Iversen, N. E. (Intern), Lazarevic, V. (Ekstern), Vasic, M. (Ekstern), Knott, A. (Intern), Andersen, M. A. E. (Intern), Cobos, J. A. (Ekstern)
Number of pages: 6
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**Network Topology Independent Multi-Agent Dynamic Optimal Power Flow for Microgrids with Distributed Energy Storage Systems**

This paper proposes a multi-agent dynamic optimal power flow (DOPF) strategy for microgrids with distributed energy storage systems. The proposed control strategy uses a convex formulation of the ac DOPF problem developed from a d-q reference frame voltage-current model and linear power flow approximations. The convex DOPF problem is divided between autonomous agents and solved based on local information and neighbour-to-neighbour communication over a sparse communication network, using a distributed primal subgradient algorithm. Each agent is only required to solve convex quadratic sub-problems, for which robust and efficient solvers exist, making the control strategy suitable for receding horizon model predictive control. Also, the agent sub-problems require limited power network information and include only a subset of the centralised optimisation problem decision variables and constraints, providing scalability and data privacy. Unlike existing distributed optimal power flow methods, such as alternating direction method of multipliers, under the proposed control strategy the information required by each agent is independent of the communication network.
New Hybrid Control for Wide Input Full-bridge LLC Resonant DC/DC Converter

In order to achieve low switching frequency range and high efficiency for a wide-input LLC resonant converter, a new hybrid control combining pulse-frequency modulation (PFM) and phase-shift pulse-width modulation (PS-PWM) is proposed. In the new control, the LLC converter has two operation modes, i.e. PFM and PFM+PS-PWM. The new control scheme and operation principle is analyzed deeply, and then efficiency optimization can be carried out by the proposed design procedure for the resonant tank of LLC converter. Finally, a prototype is developed with input voltage range from 22V to 45V, and rated power of 250W and output voltage of 380V. The experiment shows that the peak efficiency of LLC topology, providing increased flexibility and robustness. The performance of the proposed control strategy was verified for an ac microgrid with distributed lead-acid batteries and intermittent photovoltaic generation, using an RTDS Technologies real-time digital simulator.
converter reaches to 96.2%, and verifies the proposed control scheme, design.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electronics, Center for Electric Power and Energy, Fuzhou University
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LLC resonant DC/DC converter, Phase-shift PWM, PFM, New energy power generations
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10.1109/IGBSG.2018.8393556

Noise and room acoustic conditions in a tertiary referral hospital in Seoul, Korea

Noise levels and room acoustic parameters at a tertiary referral hospital, Seoul National University Hospital in Korea, are investigated. Through a questionnaire, acoustically problematic rooms are identified. Noise levels in emergency rooms (ERs) and intensive care units (ICUs) are measured over about three days. Acoustically critical and problematic rooms in the otolaryngology department are measured: examination rooms, operating rooms, nurse stations, patient rooms, and audiometric rooms. The equivalent A-weighted noise level, LAeq, ranges from 54 to 56 dBA in two ERs. In an ICU, the noise level for the first night was 66 dBA, which came down to 56 dBA for the next day. The reason for the higher noise level for the first night in the ICU was frequent alarm sound and treatment noise related to a critical patient. The noise level in the measured ERs is about 10 dB lower than those measured in other ERs in the US, which range from 65 to 73 dBA. The noise levels during three different ear surgeries vary from 57 to 62 dBA, depending on the use of surgical drills and suctioning. The noise levels in a patient room is found to be 47 dBA, while the nurse stations have a high noise level up to 64 dBA, even noisier than the ERs. The reverberation time, T20, in an operation room, examination room, and single patient room are found to be satisfactory below 0.6 s.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Korea Institute of Machinery and Materials, Korea Research Institute of Standards and Science, Seoul National University Hospital
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Number of pages: 6
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Source: PublicationPreSubmission
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Noise measurements during focus-based classroom activities as an indication of student's learning with ambient and focused artificial light distribution

Students’ learning is of utmost importance in classrooms. The environmental conditions in classrooms have been found to impact students’ ability to learn. This study investigated how artificial light distribution impacts students’ learning during focus-based learning activities, e.g., mathematics, reading, and paper-based activities, by measuring the noise level in classrooms. The measurements are carefully designed so that the similar focus-based activities are planned with
two different light distributions, one being an ambient artificial light distribution and the other being a focused artificial light distribution. In each light condition, the noise levels from pupils doing similar focus-based activities are compared. Four classrooms covering from elementary school year 1 to 6 (aged from 6 to 11) are measured, ending up with 20 comparable pairs in terms of the activity and the pupil's number with help of video footage analysis. It is found that the noise level with the focused lighting is reduced in 14 out of 20 cases. The average reduction of the noise level with the focused light distribution is found to be 1.7 dB.
and the simulation model showed -5.4kPa±52 Pa and -2.9 kPa, respectively. An in-vivo acquisition of 10 s was made at
the carotid bifurcation. This produced eight cardiac cycles from where pressure gradients of -227Pa±15 Pa were found.
Lastly, the aortic valve measurement showed a peak pressure drop of -2.1 kPa over one cardiac cycle. In conclusion,
pressure gradients from convective flow changes are detectable using 2-D vector velocity ultrasound.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging,
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K. L. (Ekstern), Nielsen, M. B. (Ekstern), Bech, B. (Forskerdatabase), Lönn, L. (Ekstern), Traberg, M. S. (Intern), Jensen,
J. A. (Intern)
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Journal: IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 2.94 SJR 1.183 SNIP 1.447
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.73 SJR 0.986 SNIP 1.402
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.814 SNIP 1.494 CiteScore 2.43
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.088 SNIP 1.627 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.872 SNIP 1.496 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.802 SNIP 1.479 CiteScore 1.87
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.733 SNIP 1.325 CiteScore 1.95
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.928 SNIP 1.562
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.296 SNIP 1.775
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.324 SNIP 1.567
Web of Science (2008): Indexed yes
Objective measures for detecting the auditory brainstem response: comparisons of specificity, sensitivity and detection time

Objective: To evaluate and compare the specificity, sensitivity and detection time of various time-domain and multi-band frequency domain methods when detecting the auditory brainstem response (ABR). Design: Simulations and subject recorded data were used to assess and compare the performance of the Hotelling's T-2 test (applied in either time or frequency domain), two versions of the modified q-sample uniform scores test and both the Fsp and Fmp, which were evaluated using both conventional F-distributions with assumed degrees of freedom and a bootstrap approach. Study sample: Data consisted of click-evoked ABRs and recordings of EEG background activity from 12 to 17 normal hearing adults, respectively. Results: An overall advantage in sensitivity and detection time was demonstrated for the Hotelling's T-2 test. The false-positive rates (FPRs) of the Fsp and Fmp were also closer to the nominal alpha-level when evaluating statistical significance using the bootstrap approach, as opposed to using conventional F-distributions. The FPRs of the remaining methods were slightly higher than expected. Conclusions: In this work, Hotelling's T-2 outperformed the alternative methods for automatically detecting ABRs. Its promise as a sensitive and efficient detection method should now be tested in a larger clinical study.
Observability and Decision Support for Supervision of Distributed Power System Control

Analyses of past disturbances and blackouts have shown that lack of situation awareness of control room operators led to wrong or suboptimal decisions. Two main issues are associated with lack of situation awareness. On the one hand, operators do not get the information needed to fully understand the current state of the grid. On the other hand, the information is not correctly interpreted. Along with the enhancement of existing tools, complementary monitoring methods must be developed for increased observability and situation awareness. To facilitate the decision process, tools that provide specific operational information, relevant to the current grid condition, need to be developed. This dissertation covers three areas where specific challenges for improved observability and decision support in future control rooms are addressed: Classical large power system stability issues, innovative data-driven techniques for voltage estimation at the distribution level, and aggregation functions for geographically dispersed time-dependent distributed energy resources are investigated. In particular, this dissertation proposes a decision support tool for transient stability preventive control, a neural-network-based approach for real-time voltage estimation in active distribution grids, and a modeling approach to harness the
flexibility of an aggregation of electric vehicles. For improved monitoring and maintaining power system stability, a decision support tool for transient stability preventive control, based on time-domain simulations, is proposed. The approach employs a critical bus screening and a fast critical contingency screening prior to the assessment to reduce the computational burden. In addition, a fast-converging technique to determine the required dispatch for re-establishing a predefined stability margin is presented. The approach delivers a near optimal solution in terms of cost minimization due to its sequential nature and shows to be robust when applied to larger power systems. The general problem of low distribution grid observability is addressed by proposing a data-driven approach for real-time voltage estimation in active distribution grids utilizing existing real-time and non-real-time measurements. The framework to establish such a neural real-time voltage estimator is described. Then, the capabilities and limitations of the approach under practical considerations are analyzed by means of field data. This includes a methodology to select the most relevant input variables and find a tradeoff solution between achievable performance and number of inputs and a sensitivity analysis of the performance and number of neurons. Moreover, the quantity of historical data which is needed to train an adequately functioning model is analyzed. In order to maintain the accuracy of the trained model, the impact of the retraining interval on the model performance is determined. Additionally, the sensitivity of the model to distributed generation is investigated. The growth of electric vehicles results in additional demand for charging which will require large investments in power distribution, transmission, and generation. However, this demand is often also flexible in time and can be actively managed to reduce the required investments and to enhance power system operation. Harnessing this flexibility requires forecasting and controlling electric vehicle charging at thousands of stations. A model to aggregate and forecast the flexible demand from tens to thousands of electric vehicle supply equipments is proposed. From an operational perspective, the aggregated EVs are represented as an equivalent time-variant storage model whose parameters can be easily aggregated and forecasted using autoregressive models. The forecastability of the uncontrolled demand and the storage parameters is evaluated using an extensive dataset from 1341 non-residential electric vehicle supply equipments located in Northern California. Two possible applications of the model are presented: peak reduction compared to uncontrolled charging, and an energy arbitrage scenario. Overall, it is shown that a combination of classical and innovative approaches can contribute to improved situation awareness of control room operators. In addition, complementary decision support tools can further aid the control room operator in determining appropriate operational actions. However, observability and decision support tools must be integrated to allow optimal operational decisions that satisfy all constraints.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Pertl, M. (Intern)
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Projects:
Observability and Decision Support for Supervision of Distributed Power System Control
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Source-ID: 144485337
Publication: Research › Ph.D. thesis – Annual report year: 2018

Offering Strategy of a Flexibility Aggregator in a Balancing Market Using Asymmetric Block Offers
In order to enable large-scale penetration of renewables with variable generation, new sources of flexibility have to be exploited in the power systems. Allowing asymmetric block offers (including response and rebound blocks) in balancing markets can facilitate the participation of flexibility aggregators and unlock load-shifting flexibility from, e.g., thermostatic loads. In this paper, we formulate an optimal offering strategy for a risk-averse flexibility aggregator participating in such a market. Using a price-taker approach, load flexibility characteristics and balancing market price forecast scenarios are used to find optimal load-shifting offers under uncertainty. The problem is formulated as a stochastic mixed-integer linear program and can be solved with reasonable computational time. This work is taking place in the framework of the real-life demonstration project EcoGrid 2.0, which includes the operation of a balancing market on the island of Bornholm, Denmark. In this context, aggregators will participate in the market by applying the offering strategy optimization tool presented in this paper.
On the importance of precise electrode placement for targeted transcranial electric stimulation

Transcranial electric stimulation (TES) is an increasingly popular method for non-invasive modulation of brain activity and a potential treatment for neuropsychiatric disorders. However, there are concerns about the reliability of its application because of variability in TES-induced intracranial electric fields across individuals. While realistic computational models offer can help to alleviate these concerns, their direct empirical validation is sparse, and their practical implications are not always clear. In this study, we combine direct intracranial measurements of electric fields generated by TES in surgical epilepsy patients with computational modeling. First, we directly validate the computational models and identify key parameters needed for accurate model predictions. Second, we derive practical guidelines for a reliable application of TES in terms of the precision of electrode placement needed to achieve a desired electric field distribution. Based on our results, we recommend electrode placement accuracy to be <1 cm for a reliable application of TES across sessions.
On the joint distribution of excursion duration and amplitude of a narrow-band Gaussian process

The probability density of crest amplitude and of duration of exceeding a given level are used in many theoretical and practical problems in engineering. The joint density is essential for design of constructions that are subjected to waves and wind. The presently available joint distributions of amplitude and period are limited to excursion through a mean-level or to describe the asymptotic behavior of high level excursions. This paper extends the knowledge by presenting a theoretical derivation of probability of wave exceedance amplitude and duration, for a narrow-band Gaussian process. The suggested density function has the following properties: (1) it only depends on the three lowest spectral moments m0, m1, m2 and desired level of exceedance, H. It does not require any condition on the autocorrelation function; (2) by increasing H, correlation between excursion periods and amplitudes increases; (3) for a spectrum describing a physical phenomenon such as a sea state spectrum, the accuracy of the proposed approximation, for a given spectral width parameter ν, increases for higher level H. The paper shows that the marginal distribution of amplitude is compatible with the Rayleigh distribution, as expected, and that the marginal distribution of excursion duration works both for asymptotic and non-asymptotic cases. The suggested model is found to be a good replacement for the empirical distributions that are widely used. Results from simulations of narrow-band Gaussian processes, real sea states at three European sites—in the Atlantic ocean and in North sea—are found to agree well with the established distribution.
Optimal Allocation of Smart Substations in a Distribution System Considering Interruption Costs of Customers

One of the major functions of a smart substation (SS) is to restore power supply to interrupted customers as quickly as possible after an outage. The high cost of a smart substation limits its widespread utilization. In this paper, a smart substation allocation model (SSAM) to determine the optimal number and allocation of smart substations in a given distribution system is presented, with the upgrade costs of substations and the interruption costs of customers taken into account. Besides, the reliability criterion is also properly considered in the model. By linearization strategies, the SSAM is simplified into a mixed integer linear programming problem which could be solved efficiently with commercial solvers. Finally, the performance of the proposed methodology is demonstrated by the standard RBTS-BUS 4 test system and a medium voltage power distribution system in Denmark.
Optimal control of a high-frequency class-D amplifier

Control loops have been used with switch-mode audio amplifiers to improve the sound quality of the amplifier. Because these amplifiers use a high-frequency modulation, precautions in the controller design must be taken. Further, the quality factor of the output filter can have a great impact on the controller's capabilities to suppress noise and track the audio signal. In this paper design methods for modern control are presented. The control method proves to easily overcome the challenge of designing a good performing controller when the output filter has a high quality factor. The results show that the controller is able to produce a clear improvement in the Total Harmonic Distortion with up to a 30 times improvement compared to open-loop with a clear reduction in the noise. This places the audio quality on pair with current solutions.
Optimal design and operating strategies for a biomass-fueled combined heat and power system with energy storage

An economic linear programming model with a sliding time window was developed to assess designing and scheduling a biomass-fueled combined heat and power system consisting of biomass gasifier, internal combustion engine, heat recovery set, heat-only boiler, producer gas storage and thermal energy storage. A case study was examined for a
conceptual utility grid-connected BCHP application in Davis, California under different scenarios. The results show that a 100kW biomass gasifier and engine combination with energy storage was the most cost effective design based on the assumed energy load profile, utility tariff structure and technical and financial performance of the system components. Engine partial load performance was taken into consideration. Sensitivity analyses demonstrate how the optimal BCHP configuration changes with varying demands and utility tariff rates.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, University of California at Davis
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.6 SJR 1.99 SNIP 1.923
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.974 SNIP 1.823
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.22 SNIP 2.037 CiteScore 5.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.575 SNIP 2.602 CiteScore 5.7
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.458 SNIP 2.556 CiteScore 5.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.935 SNIP 2.214 CiteScore 4.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.566 SNIP 2.01 CiteScore 4
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.712 SNIP 2.46
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.663 SNIP 2.357
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.103 SNIP 1.438
Scopus rating (2007): SJR 0.902 SNIP 1.434
Web of Science (2007): Indexed yes
Optimal Scheduling of Biogas-Solar-Wind Renewable Portfolio for Multi-Carrier Energy Supplies

This paper proposes a multi-source multi-product framework for coupled multi-carrier energy supplies with a biogas-solar-wind hybrid renewable system. In this framework, the biogas-solar-wind complementarities are fully exploited based on digesting thermodynamic effects for the synergetic interactions of electricity, gas and heating energy flows, and a coupling matrix is formulated for the modeling of production, conversion, storage, and consumption of different energy carriers. The multi-energy complementarity of biogas-solar-wind renewable portfolio can be utilized to facilitate the mitigation of renewable intermittency and the efficient utilization of batteries, and a multi-carrier generation scheduling scheme is further presented to dynamically optimize dispatch factors in the coupling matrix for energy-efficient conversion and storage, while different energy demands of end-users are satisfied. The proposed methodology has been fully tested and benchmarked on a stand-alone Microgrid over a 24-hour scheduling horizon. Comparative results demonstrate that the proposed scheme can lower the battery charging/discharging actions as well as the degradation cost, and also confirm its capability to accommodate high penetration of variable renewables.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hunan University, University of Saskatchewan, Hong Kong Polytechnic University
Authors: Zhou, B. (Ekstern), Xu, D. (Ekstern), Li, C. (Ekstern), Chung, C. Y. (Ekstern), Cao, Y. (Ekstern), Chan, K. W. (Ekstern), Wu, Q. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Optimisation of Combine Harvesters using Model-based Control

The world population is expected to grow by over one third between 2009 and 2050 according to the Food and Agriculture Organization of the United Nations. The arable areas are expected to decrease in the developed countries requiring an increase in yield on the available land meanwhile it gets increasingly harder to find qualified operators for combine harvesters.

The performance of the combine harvester is affected by a number of uncontrollable biological variables comprising both temporal and spatial field variations. The threshing, separation and cleaning processes can be optimised by adjusting a number of actuators, however this is not straightforward as the material flows are tightly coupled and the optimisation parameters are even conflicting. Integration of a closed-loop control system is highly challenging as most state of the art process sensors only offer a relative reading of the actual material flows in the combine.

The aim of the project is to design a closed-loop control system than can optimise the performance of the threshing, separation and cleaning processes in a combine harvester. Model development will be required to analyse, optimise and obtain transparency to the system states. The methods acknowledge that a high degree of model accuracy is not achievable as well as the complexity of observer and controller design is kept at a minimum.

Material flow models are generated for the threshing, separation and cleaning systems using acquired material samples from laboratory test stands and field test experiments. Material samples and sensor data are used to generate a virtual
combine, which is utilised for initial testing of all controllers, greatly reducing the scarce field test time required for test and verification.

The material flow analysis revealed that the rotor speed had a dominating effect on both separation grain losses as well as grain damage compared to the concave clearance, hence sole control of the rotor speed in the threshing and separation system is chosen.

A Luenberger observer was designed to estimate grain damage from a grain quality sensor, which has a long settling time compared to impact loss sensors. This facilitates a fast response to changes in the separation grain loss in varying conditions.

A closed-loop rotor speed controller was designed to balance rotor separation loss and grain damage using the grain damage observer. The controller was verified by means of simulation as well as during field test experiments.

The material flow analysis for the cleaning system showed degradation of cleaning performance is dominated by the MOG load and inclination angles as well as the effect from the fan speed and sieve actuators to material flows were tightly coupled, similar to the results from previous literature.

It was shown that the fluidised phase characterising low grain losses could be identified using the tailings grain and MOG throughputs.

The upper sieve primarily affected cleaning losses and tailings MOG throughput, and the lower sieve the cleanliness of the clean grain throughput and tailings grain throughput, hence these should be controlled using a distributed control scheme for optimisation, where each individual controller primarily will consider two balance parameters.

An estimate of the tailings MOG throughput and tailings grain composition was obtained with reasonable good accuracy using sensor fusion of the tailings grain sensor and the non-linear tailings volume sensor.

An on-line estimate of the tailings grain composition set-point characterising the fluidised phase was obtained, which facilitates a novel closed-loop fan speed control design. The fan speed controller was validated using a virtual combine, the cleaning system laboratory environment and during full scale field test. Implementation and verification of upper and lower sieve controllers is not addressed.

The average harvest grain loss in the industrialised countries is 4% corresponding to the total cereal consumption of Germany. Hence reducing the grain loss by a fraction results in millions of tonnes of food as well as it can be the key to maintain a profitable business for the farmer, which is characterised by high revenues and small profit margins.

The contributions of this project enables integration of a control system for rotor speed, fan speed and sieve openings on the AGCO IDEAL series of combine harvesters. The developed controllers are planned to be included in the automation system and will be commercially available in 2019.

The dissertation is a summary of Ph.D. project and the methods developed during the project period.
The results are disseminated in four conference articles, two submitted journal articles and one patent application.

General information
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Organisations: Department of Electrical Engineering, Automation and Control
Authors: Hermann, D. (Intern)
Number of pages: 229
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Electronic versions:
thesis_180625.pdf

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Projects:
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Optimization under uncertainty of a biomass-integrated renewable energy microgrid with energy storage
Deterministic constrained optimization and stochastic optimization approaches were used to evaluate uncertainties in biomass-integrated microgrids supplying both electricity and heat. An economic linear programming model with a sliding time window was developed to assess design and scheduling of biomass combined heat and power (BCHP) based microgrid systems. Other available technologies considered within the microgrid were small-scale wind turbines, photovoltaic modules (PV), producer gas storage, battery storage, thermal energy storage and heat-only boilers. As an illustrative example, a case study was examined for a conceptual utility grid-connected microgrid application in Davis, California. The results show that for the assumptions used, a BCHP/PV with battery storage combination is the most cost effective design based on the assumed energy load profile, local climate data, utility tariff structure, and technical and financial performance of the various components of the microgrid. Monte Carlo simulation was used to evaluate uncertainties in weather and economic assumptions, generating a probability density function for the cost of energy.

General information
Orthogonal Genetic Algorithm Based Power System Restoration Path Optimization

Optimizing the power system restoration path is a key issue for the system restoration after a blackout. Because the optimization is a complex nonlinear programming problem, artificial intelligent algorithms are widely employed to solve this problem due to its modeling flexibility and strong optimization capability. However, because the dimension of restoration path optimization is very high especially for large scale systems, artificial intelligent algorithms in current works are easy to be trapped in the local optima. In order to improve the optimal solution from the artificial intelligence algorithms, an orthogonal genetic algorithm is employed in this paper to optimize the restoration path, which can search the solution space in a statistically sound manner. Firstly, the experimental design method was employed to generate orthogonal array as the initial population which was scattered uniformly over the feasible solution space. Then, the orthogonal crossover operator based on the orthogonal experimental design was employed to generate a small but representative feasible solution as the potential offspring. Finally, the proposed method is validated using the IEEE 118-bus test system and part of the Jiangsu power grid in China.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Nanjing University of Science and Technology
Authors: Xie, Y. (Ekstern), Kunlong, S. (Ekstern), Wu, Q. (Intern)
Number of pages: 16
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- Scopus rating (2017): CiteScore 1.63
- Scopus rating (2016): CiteScore 1.16
- Scopus rating (2015): CiteScore 1.14
- Scopus rating (2014): CiteScore 0.47
- Scopus rating (2013): CiteScore 0.1
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Original language: English
Orthogonal experimental design, Orthogonal genetic algorithm, Path optimization, Power system restoration
Source: PublicationPreSubmission
Source-ID: 147705531
Parameter optimization of forward sound propagation models using Bayesian inference for sound field control purposes

Sound field control in outdoor concerts requires accurate estimates of the transfer functions between sources and receivers. Feed forward approaches are based on direct measurements of the transfer functions in a dense grid of points. This makes them intractable for large scale situations, showing the need of propagation models in order to characterize the sound field in such large areas. Uncertainty in the parameters introduced in the propagation models, such as meteorological, acoustical and geometrical ones, lead to inaccurate estimates of the transfer functions and therefore to a poor performance of the sound field control strategy. In this paper we present first results of the method introduced by Heuchel et al. [1] to increase the accuracy of the predictions. The parameters of the propagation model are optimized through auxiliary measurements and Bayesian inference.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Caviedes Nozal, D. (Intern), Brunskog, J. (Intern)
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Participation of an Energy Hub in Electricity and Heat Distribution Markets: An MPEC Approach

Integration of electricity and heat distribution networks offers extra flexibility to system operation and improves energy efficiency. The energy hub (EH) plays an important role in energy production, conversion and storage in such coupled infrastructures. This paper provides a new outlook and thorough mathematical tool for studying the integrated energy system from a deregulated market perspective. A mathematic program with equilibrium constraints (MPEC) model is proposed to study the strategic behaviors of a profit-driven energy hub in the electricity market and heating market under the background of energy system integration. In the upper level, the EH submits bids of prices and quantities to a distribution power market and a heating market; in the lower level, the two markets are cleared and energy contracts between the EH and two energy markets are determined. Network constraints of physical systems are explicitly represented by an optimal power flow problem and an optimal thermal flow problem. The proposed MPEC formulation is approximated by a mixed-integer linear program via performing integer disjunctions on the complementarity and slackness conditions and binary expansion technique on the bilinear production terms. Case studies demonstrate the effectiveness of the proposed model and method.

**General information**
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Tsinghua University, Harvard John A. Paulson School of Engineering and Applied Sciences
Authors: Li, R. (Ekstern), Wu, Q. (Intern), Wei, W. (Ekstern), Mei, S. (Ekstern), Hu, Q. (Ekstern)
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Scopus rating (2017): CiteScore 9.02 SJR 2.854 SNIP 2.995
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BFI (2016): BFI-level 1
PCB Embedded Inductor for High-Frequency ZVS SEPIC Converter

The volume and temperature rise of passive components, especially inductors, limit the momentum toward high power density in high-frequency power converters. To address the limitations, PCB integration of passive components should be considered with the benefit of low profile, excellent thermal characteristic and cost reduction. This paper investigates an embedded structure of inductors to further increase the power density of a low power DC-DC converter. A pair of coupling inductors have been embedded into the PCB. The detailed embedded process has been described and the characteristics of embedded inductor and design consideration are discussed. A 2MHz SEPIC converter working in ZVS turn-on with embedded inductors is built to verify the effectiveness of the embedded structure.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Dou, Y. (Ekstern), Ouyang, Z. (Intern), Thummala, P. (Intern), Andersen, M. A. E. (Intern)
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Source-ID: 145954743
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Peer review i et obligatorisk bachelorkursus for civilingeniørstuderende i medikoteknik
Et nyudviklet peer review-system, der integrerer studenterdata, administration og grafiske procesoversigter, blev afprøvet i et obligatorisk bachelorkursus. Overensstemmelse mellem de studerende og hjælpeærlernes kvantitative bedømmelser blev undersøgt for en relativt udfordrende opgave med 15 delspørgsmål. 49 studerende afleverede besvarelser. Efterfølgende blev hver besvarelses bedømt af tre medstuderende, svarende til at 735 delbesvarelser blev bedømt. Ud af disse var der enighed mellem studenterhjælperne og hjælpelærerne i 480 tilfælde (65 %). I under 3,5 % af tilfældene
var der total uenighed. Der var tendens til, at jo mere rigtigt en besvarelse blev bedømt, eller jo mere konkret svaret var, des mere enighed. En interviewundersøgelse hos de studerende viste stor opbakning til fremgangsmåden og viste også, at de studerende fandt det meget nyttigt at se andre studerendes besvarelser såvel som rettevejledningen. Afslutningsvis gives en række anbefalinger til processen og systemet.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Office for Study Programmes and Student Affairs
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Pages: 134-151
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BFI (2013): BFI-level 1
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BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
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Publication: Communication › Journal article – Annual report year: 2018

**Periphony-Lattice Mixed-Order Ambisonic Scheme for Spherical Microphone Arrays**
Most methods for sound field reconstruction and spherical beamforming with spherical microphone arrays are mathematically based on the spherical harmonics expansion. In many cases, this expansion is truncated at a certain order as in higher order ambisonics (HOA). This truncation leads to performance that is independent of the incident direction of the sound waves. On the other hand, mixed-order ambisonic (MOA) schemes that select an appropriate subset of spherical harmonics can improve the performance for horizontal directions at the expense of other directions. This paper proposes an MOA scheme called Periphony-Lattice to improve sound field reconstruction performance for horizontally incident sound waves. The proposed scheme is compared with the previously introduced MOA and HOA schemes in terms of theoretical truncation error and performance in sound field reconstruction and spherical beamforming. Computer simulations and measurements are conducted with a spherical array of 52 microphones with a nonuniform layout. The results show that the proposed MOA scheme has better performance in sound field reconstruction and spherical beamforming for horizontal sound waves than the other schemes for a given number of microphones. This scheme can be applied to other spherical array layouts if the number of microphones is greater than that of the required spherical harmonics coefficients, and may improve the horizontal performance.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Korea Research Institute of Standards and Science
Authors: Chang, J. (Ekstern), Marschall, M. (Intern)
Pages: 924-936
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**
Journal: IEEE/ACM Transactions on Audio, Speech, and Language Processing
Volume: 26
Power Plateau and Anti-Power Phenomenon of Dual Active Bridge Converter with Phase-Shift Modulation

In this paper, an improved power flow model for dual active bridge (DAB) converters with phase-shift modulation is introduced. Based on the analysis and the accordingly derived equations, a power plateau phenomenon, in which the phase shift loses its power-regulating capability, is investigated. Moreover, it is found that this power plateau phenomenon leads to an inverted power flow characteristic in some specific regions compared to the models reported in previous literature. The characteristics of the power plateau and its occurring conditions are derived and analyzed in depth. The calculations, simulations and analyses have been verified by experiments.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Fuzhou University
Authors: Yudi, X. (Ekstern), Zhang, Z. (Intern), Xingkui, M. (Ekstern), Tomas Manez, K. (Intern), Andersen, M. A. E. (Intern)
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Pages: 1871-1875
Publication date: 2018
Precision temperature sensing in the presence of magnetic field noise and vice-versa using nitrogen-vacancy centers in diamond

We demonstrate a technique for precision sensing of temperature or the magnetic field by simultaneously driving two hyperfine transitions involving distinct electronic states of the nitrogen-vacancy center in diamond. Frequency modulation of both driving fields is used with either the same or opposite phase, resulting in the immunity to fluctuations in either the magnetic field or the temperature, respectively. In this way, a sensitivity of 1.4 nT Hz$^{-1/2}$ or 430 μK Hz$^{-1/2}$ is demonstrated. The presented technique only requires a single frequency demodulator and enables the use of phase-sensitive camera imaging sensors. A simple extension of the method utilizing two demodulators allows for simultaneous, independent, and high-bandwidth monitoring of both the magnetic field and temperature.
Predicting consonant recognition and confusions using a microscopic speech perception model

The perception of consonants has been investigated in various studies and shown to critically depend on fine details in the stimuli. The present study proposes a microscopic speech perception model that combines an auditory processing front end with a correlation-based template-matching back end to predict consonant recognition and confusions. The model represents an extension of the auditory signal processing model by Dau et al. [(1997). J. Acoust. Soc. Am. 102, 2892–2905] towards predicting microscopic speech perception data. Model predictions were computed for the extensive consonant perception data set provided by Zaar and Dau [(2015). J. Acoust. Soc. Am. 138, 1253–1267], obtained with consonant-vowels (CVs) in white noise. The predictions were in good agreement with the perceptual data both in terms of consonant recognition and confusions. The model was further evaluated with respect to perceptual artifacts induced by (i) different hearing-aid signal processing strategies and (ii) simulated cochlear-implant processing, based on data from DiNino et al. [(2016). J. Acoust. Soc. Am., 140, 4404–4418]. The model successfully predicted the strong consonant confusions measured in these conditions. Overall, the results suggest that the proposed model may provide a valuable framework for assessing acoustic transmission channels and hearing-instrument signal processing.
Predicting Speech Intelligibility based on Fluctuations in Simulated Auditory Nerve Responses

Various speech intelligibility (SI) models have been proposed to predict the ability of normal-hearing (NH) listeners to understand speech in adverse listening conditions. However, most current SI models are based on a strongly simplified linear simulation of the highly non-linear auditory periphery, which limits their ability to predict effects of hearing impairment on SI. At the same time, the models’ decision stages typically interact strongly with the type of auditory front-end processing applied.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, University of Rochester
Authors: Zaar, J. (Intern), Scheidiger, C. (Intern), Carney, L. H. (Ekstern), Dau, T. (Intern)
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Price-Taker Offering Strategy in Electricity Pay-as-Bid Markets

The recent increase in the deployment of renewable energy sources may affect the offering strategy of conventional producers, mainly in the balancing market. The topics of optimal offering strategy and self-scheduling of thermal units have been extensively addressed in the literature. The feasible operating region of such units can be modeled using a mixed-integer linear programming approach, and the trading problem as a linear programming problem. However, the existing models mostly assume a uniform pricing scheme in all market stages, while several European balancing markets (e.g., in Germany and Italy) are settled under a pay-as-bid pricing scheme. The existing tools for solving the trading problem in pay-as-bid electricity markets rely on non-linear optimization models, which, combined with the unit commitment constraints, result in a mixed-integer non-linear programming problem. In contrast, we provide a linear formulation for that trading problem. Then, we extend the proposed approach by formulating a two-stage stochastic problem for optimal offering in a two-settlement electricity market with a pay-as-bid pricing scheme at the balancing stage. The resulting model is mixed-integer and linear. The proposed model is tested on a realistic case study against a sequential offering approach, showing the capability of increasing profits in expectation.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Università degli Studi di Padova
Authors: Mazzi, N. (Ekstern), Kazempour, J. (Intern), Pinson, P. (Intern)
Pages: 2175 - 2183
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Main Research Area: Technical/natural sciences
Probe development of CMUT and PZT row-column-addressed 2-D arrays

This paper presents the characterization of two prototyped fully integrated 62 + 62 row-column-addressed (RCA) 2-D transducer array probes, which are based on capacitive micromachined ultrasonic transducer (CMUT) and on piezoelectric transducer (PZT) technology, respectively. Both transducers have integrated apodization to reduce ghost echoes and were designed with similar acoustical features i.e. 3 MHz center frequency, λ/2-pitch and 24.8 mm² × 24.8 mm² active footprint. The transducer arrays were assembled in a 3-D printed probe handle with electromagnetic shield and integrated electronics for driving the 128-channel coaxial cable to the scanner. The electronics were designed to allow all elements, both rows and columns, to be used interchangeably as either transmitters or receivers. The transducer characterization i.e. bandwidth, phase delay, surface pressure, sensitivity, insertion loss, and acoustical crosstalk, were based on several single element measurements, including pressure and pulse-echo, and were evaluated quantitatively and comparatively. The weighted center frequency was 3.0 MHz for both probes and the measured -6 dB fractional bandwidth was 109 ± 4% and 80 ± 3% for the CMUT and the PZT probe, respectively. The surface pressures of the CMUT and PZT were 0.55 ± 0.06 MPa and 1.68 ± 0.09 MPa, respectively, and the receive sensitivities of the rows (receiving elements) were 12.9 ± 0.7 μV/Pa and 13.7 ± 2.1 μV/Pa.

General information

State: Published
Organisations: Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Sound Technology, Inc., BK Ultrasound
Authors: Engholm, M. (Intern), Bouzari, H. (Intern), Christiansen, T. L. (Intern), Beers, C. (Ekstern), Bagge, J. P. (Ekstern), Moesner, L. N. (Ekstern), Diederichsen, S. E. (Intern), Stuart, M. B. (Intern), Jensen, J. A. (Intern), Thomsen, E. V. (Intern)
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Scopus rating (2016): CiteScore 2.79 SJR 0.787 SNIP 1.627
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.826 SNIP 1.553 CiteScore 2.73
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.866 SNIP 1.771 CiteScore 2.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.819 SNIP 1.762 CiteScore 2.53
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.91 SNIP 2.113 CiteScore 2.34
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.909 SNIP 2.103 CiteScore 2.5
To probe the cardiac metabolism of carbohydrates and short chain fatty acids simultaneously in vivo following the injection of a hyperpolarized 13 C-labeled substrate mixture prepared using photo-induced nonpersistent radicals. Droplets of mixed [1-13 C]pyruvic and [1-13 C]butyric acids were frozen into glassy beads in liquid nitrogen. Ethanol addition was investigated as a means to increase the polarization level. The beads were irradiated with ultraviolet light and the radical concentration was measured by ESR spectroscopy. Following dynamic nuclear polarization in a 7T polarizer, the beads were dissolved, and the radical-free hyperpolarized solution was rapidly transferred into an injection pump located inside a 9.4T scanner. The hyperpolarized solution was injected in healthy rats to measure cardiac metabolism in vivo. Ultraviolet irradiation created nonpersistent radicals in a mixture containing 13 C-labeled pyruvic and butyric acids, and enabled the hyperpolarization of both substrates by dynamic nuclear polarization. Ethanol addition increased the radical concentration from 16 to 26 mM. Liquid-state 13 C polarization was 3% inside the pump at the time of injection, and increased to 5% by addition of ethanol to the substrate mixture prior to ultraviolet irradiation. In the rat heart, the in vivo 13 C signals from lactate, alanine, bicarbonate, and acetylcarnitine were detected following the metabolism of the injected substrate mixture. Copolarization of two different 13 C-labeled substrates and the detection of their myocardial metabolism in vivo was achieved without using persistent radicals. The absence of radicals in the solution containing the hyperpolarized 13 C-substrates may simplify the translation to clinical use, as no radical filtration is required prior to injection.
Pupil light reflex evoked by light-emitting diode and computer screen: Methodology and association with need for recovery in daily life

Objectives
Pupil light reflex (PLR) has been widely used as a method for evaluating parasympathetic activity. The first aim of the present study is to develop a PLR measurement using a computer screen set-up and compare its results with the PLR generated by a more conventional setup using light-emitting diode (LED). The parasympathetic nervous system, which is known to control the 'rest and digest' response of the human body, is considered to be associated with daily life fatigue. However, only few studies have attempted to test the relationship between self-reported daily fatigue and physiological measurement of the parasympathetic nervous system. Therefore, the second aim of this study was to investigate the relationship between daily-life fatigue, assessed using the Need for Recovery scale, and parasympathetic activity, as indicated by the PLR parameters.

Design
A pilot study was conducted first to develop a PLR measurement set-up using a computer screen. PLRs evoked by light stimuli with different characteristics were recorded to confirm the influence of light intensity, flash duration, and color on the PLRs evoked by the system. In the subsequent experimental study, we recorded the PLR of 25 adult participants to light flashes generated by the screen set-up as well as by a conventional LED set-up. PLR parameters relating to parasympathetic and sympathetic activity were calculated from the pupil responses. We tested the split-half reliability across two consecutive blocks of trials, and the relationships between the parameters of PLRs evoked by the two set-ups. Participants rated their need for recovery prior to the PLR recordings.

Results
PLR parameters acquired in the screen and LED set-ups showed good reliability for amplitude related parameters. The PLRs evoked by both set-ups were consistent, but showed systematic differences in absolute values of all parameters. Additionally, higher need for recovery was associated with faster and larger constriction of the PLR.

Conclusions
This study assessed the PLR generated by a computer screen and the PLR generated by a LED. The good reliability within set-ups and the consistency between the PLRs evoked by the set-ups indicate that both systems provides a valid way to evoke the PLR. A higher need for recovery was associated with faster and larger constricting PLRs, suggesting increased levels of parasympathetic nervous system activity in people experiencing higher levels of need for recovery on a daily basis.
Quantifying undesired parallel components in Thévenin-equivalent acoustic source parameters

The calibration of an ear probe to determine its Thévenin-equivalent acoustic source parameters facilitates the measurement of ear-canal impedance and reflectance. Existing calibration error metrics, used to evaluate the quality of a calibration, are unable to reveal undesired parallel components in the source parameters. Such parallel components can result from, e.g., a leak in the ear tip or improperly accounting for evanescent modes, and introduce errors into subsequent measurements of impedance and reflectance. This paper proposes a set of additional error metrics that are capable of detecting such parallel components by examining the causality of the source admittance in the frequency domain and estimating the source pressure in the time domain. The proposed and existing error metrics are applied to four different calibrations using two existing calibration methods, representing typical use cases and introducing deliberate parallel components. The results demonstrate the capability of the proposed error metrics in identifying various undesired components in the source parameters that might otherwise go undetected.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Boys Town National Research Hospital
Authors: Nørgaard, K. R. (Intern), Neely, S. T. (Ekstern), Rasetshwane, D. M. (Ekstern)
Pages: 1491–1503
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Journal: Journal of the Acoustical Society of America
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
Reactive power planning for regional power grids based on active and reactive power adjustments of DGs

To deal with extreme overvoltage scenarios with small probabilities in regional power grids, the traditional reactive power planning model requires a huge VAR compensator investment. Obviously, such a decision that makes a large investment to cope with a small probability event is not economic. Therefore, based on the scenario analysis of power outputs of distributed generations and load consumption, a novel reactive power planning model considering the active and reactive power adjustments of distributed generations is proposed to derive the optimal allocation of VAR compensators and ensure bus voltages within an acceptable range under extreme overvoltage scenarios. The objective of the proposed reactive power planning model is to minimize the VAR compensator investment cost and active power adjustment cost of distributed generations. Moreover, since the proposed reactive power planning model is formulated as a mixed-integer nonlinear programming problem, a primal-dual interior point method-based particle swarm optimization algorithm is developed to effectively solve the proposed model. Simulation results were conducted with the modified IEEE 30-bus system to verify the effectiveness of the proposed reactive power planning model.
Real-time 2-D Phased Array Vector Flow Imaging

Echocardiography examination of the blood flow is currently either restricted to 1-D techniques in real-time or experimental off-line 2-D methods. This paper presents an implementation of transverse oscillation for real-time 2-D vector flow imaging (VFI) on a commercial BK Ultrasound scanner. A large field-of-view (FOV) sequence for studying flow dynamics at 11 frames per second (fps) and a sequence for studying peak systolic velocities (PSV) with a narrow FOV at 36 fps were validated. The VFI sequences were validated in a flow-rig with continuous laminar parabolic flow and in a pulsating flow pump system before being tested in vivo, where measurements were obtained on two healthy volunteers. Mean PSV from 11 cycles was 155 cm s−1 with a precision of ± 9.0% for the pulsating flow pump. In vivo, PSV estimated in the ascending aorta was 135 cm s−1 ± 16.9% for 8 cardiac cycles. Furthermore, in vivo flow dynamics of the left ventricle and in the ascending aorta were visualized. In conclusion, angle independent 2-D VFI on a phased array has been implemented in real-time, and it is capable of providing quantitative and qualitative flow evaluations of both complex and fully transverse flow.

General information
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Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, BK Ultrasound, Copenhagen University Hospital
Authors: Holbek, S. (Intern), Hansen, K. L. (Ekstern), Fogh, N. (Forskerdatabase), Moshavegh, R. (Intern), Olesen, J. B. (Intern), Bachmann Nielsen, M. (Ekstern), Jensen, J. A. (Intern)
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.94 SJR 1.183 SNIP 1.447
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.73 SJR 0.986 SNIP 1.402
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.814 SNIP 1.494 CiteScore 2.43
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.088 SNIP 1.627 CiteScore 2.18
Web of Science (2014): Indexed yes
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Recommendations on future development of decision support systems

Deliverable 8.3 reports on the consolidation of experiences from visualisation, decision support prototypes experiments and recommendations on future developments of decision support systems

General information

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management, Instituto de Engenharia de Sistemas e Computadores do Porto, University of Strathclyde, Ricerca Sistema Energetico SpA, Ricerca sul Sistema Energetico, Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile, ENEA Portici Research Center

Reconstructing Dynamic Promoter Activity Profiles from Reporter Gene Data

Accurate characterization of promoter activity is important when designing expression systems for systems biology and metabolic engineering applications. Promoters that respond to changes in the environment enable the dynamic control of gene expression without the necessity of inducer compounds, for example. However, the dynamic nature of these processes poses challenges for estimating promoter activity. Most experimental approaches utilize reporter gene expression to estimate promoter activity. Typically the reporter gene encodes a fluorescent protein that is used to infer a constant promoter activity despite the fact that the observed output may be dynamic and is a number of steps away from the transcription process. In fact, some promoters that are often thought of as constitutive can show changes in activity when growth conditions change. For these reasons, we have developed a system of ordinary differential equations for estimating dynamic promoter activity for promoters that change their activity in response to the environment that is robust to noise and changes in growth rate. Our approach, inference of dynamic promoter activity (PromAct), improves on existing methods by more accurately inferring known promoter activity profiles. This method is also capable of estimating the correct scale of promoter activity and can be applied to quantitative data sets to estimate quantitative rates.
Reconstruction of the sound field in a room using compressive sensing

Capturing the impulse or frequency response functions within extended regions of a room requires an unfeasible number of measurements. In this study, a method to reconstruct the response at arbitrary points based on compressive sensing (CS) is examined. The sound field is expanded into plane waves and their amplitudes are estimated via CS, obtaining a spatially sparse representation of the sound field. The validity of the CS assumptions are discussed, namely, the assumption of the wave field spatial sparsity (which depends strongly on the properties of the specific room), and the coherence of the sensing matrix due to different spatial sampling schemes. An experimental study is presented in order to analyze the accuracy of the reconstruction. Measurements with a scanning robotic arm make it possible to circumvent uncertainty due to positioning and transducer mismatch, and examine the accuracy of the reconstruction over extended regions of space. The results indicate that near perfect reconstructions are possible at low frequencies, even from a limited set of measurements. In addition, the study shows that it is possible to reconstruct damped room responses with reasonable accuracy well into the mid-frequency range.
Redefining Requirements of Ancillary Services for Technology Agnostic Sources

New sources for ancillary services are needed, yet the requirements for service provision in most countries are explicitly formulated for traditional generators. This leads to waste of the potential for new technologies to deliver ancillary services. In order to harness this potential, we propose to parameterize the requirements of ancillary services so that reserves can be built by combining the advantageous properties of different technologies. The proposal is exemplified through a laboratory test where it shown that the system needs can be covered through cheaper and smaller reserves.

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Monitoring, Control, and Protection ancillary services, Requirements, Demand response
Electronic versions: paper0334.pdf
Reliability Worth Analysis of Distribution Systems Using Cascade Correlation Neural Networks

Reliability worth analysis is of great importance in the area of distribution network planning and operation. The reliability worth's precision can be affected greatly by the customer interruption cost model used. The choice of the cost models can change system and load point reliability indices. In this study, a cascade correlation neural network is adopted to further develop two cost models comprising a probabilistic distribution model and an average or aggregate model. A contingency-based analytical technique is adopted to conduct the reliability worth analysis. Furthermore, the possible effects of adding distributed generation units into the network are evaluated. The proposed approach has been tested on a radial distribution test network evaluating the reliability worth. The results show that the probabilistic distribution model provides a more realistic model for the reliability analysis.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Nanyang Technological University, University of New South Wales, Shiraz University of Technology, University of Sharjah
Authors: Heidari, A. (Ekstern), Agelidis, V. (Intern), Pou, J. (Ekstern), Aghaei, J. (Ekstern), Ghias, A. M. Y. M. (Ekstern)
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.58 SJR 2.742 SNIP 2.662
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.475 SNIP 3.485 CiteScore 5.31
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.523 SNIP 4.243 CiteScore 6.33
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.941 SNIP 3.387 CiteScore 5.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.586 SNIP 3.205 CiteScore 5.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.708 SNIP 2.759
Report on the evaluation and validation of the ELECTRA WoC control concept

This report summarizes the evaluation and validation of the ELECTRA Web-of-Cells concept which has been implemented for the proof of concept in selected validation environments provided by the project partners. The performed experiments have been realized in simulations and in laboratory environments and showed the feasibility of the Web-of-Cells concept and integrated functions for balancing and voltage control. Future work is necessary to further refine the concept and functions and to focus the controller implementations on higher technology readiness levels.

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Resolving Ultrasound Contrast Microbubbles using Minimum Variance Beamforming

Minimum Variance (MV) beamforming is known to improve the lateral resolution of ultrasound images and enhance the separation of isolated point scatterers. This paper aims to evaluate the adaptive beamformer's performance with flowing microbubbles (MBs), which are relevant to super-resolution ultrasound imaging. Simulations using point scatterer data from single emissions were complemented by an experimental investigation performed using a capillary tube phantom and the Synthetic Aperture Real-time Ultrasound System (SARUS). The MV performance was assessed by the minimum distance that allows the display of two scatterers positioned side-by-side, the lateral Full-Width-Half-Maximum (FWHM), and the Peak-Side-lobe-Level (PSL). In the tube, scatterer responses separated by down to 196 μm (or 1.05λ) were distinguished by the MV method, while the standard Delay-and-Sum (DAS) beamformers were unable to achieve such separation. Up to 9-fold FWHM decrease was also measured in favour of the MV beamformer, for individual echoes from MBs. The lateral distance between two scatterers impacted on their FWHM value, and additional differences in the scatterers' axial or out-of-plane position also impacted on their size and appearance. The simulation and experimental results were in agreement in terms of lateral resolution. The point scatterer study showed that the proposed MV imaging scheme provided clear resolution benefits compared to DAS. Current super-resolution methods mainly depend on DAS beamformers. Instead, the use of the MV method may provide a larger number of detected, and potentially better localized, MB scatterers.
Resonant Full-Bridge Synchronous Rectifier Utilizing 15 V GaN Transistors for Wireless Power Transfer Applications Following AirFuel Standard Operating at 6.78 MHz

Connectivity in smart devices is increasingly realized by wireless connections. The remaining reason for using connectors at all is for charging the internal battery, for which wireless power transfer is an alternative. Two industry standards, AirFuel and Qi, exist to support compatibility between devices. This work is focusing on the AirFuel standard, as it is operating at a higher frequency (6.78 MHz), than the Qi standard, and therefore allows smaller passive components, including the coupling coils. Whereas gallium-nitride (GaN) devices are being widely used on the transmitter (Tx) side, this work uses low voltage GaN transistors on the receiver (Rx) side to allow synchronous rectification and soft switching, thereby achieving high efficiency. After analyzing adequate Class-DE rectifier topologies, a ClassDE full-bridge 5 W rectifier using 15 V GaN transistors are designed and implemented. The experimental results show an efficiency above 80 % over a wide operating range and a peak efficiency of 89 %, at an arbitrary alignment of Tx and Rx coils with 3 cm distance between them.

General information
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Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Jensen, C. H. K. (Ekstern), Spliid, F. M. (Intern), Hertel, J. C. (Intern), Nour, Y. (Intern), Zsurzsan, T. (Intern), Knott, A. (Intern)
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Respiratory variability of peak velocities in the common femoral vein estimated with vector flow imaging and Doppler ultrasound

Respiratory variability of peak velocities (RVPV) in the common femoral vein measured with ultrasound can reveal venous outflow obstruction. Pulse wave (PW) Doppler is the gold standard for venous velocity estimation of the lower extremities. PW Doppler measurements are angle dependent, whereas vector flow imaging (VFI) can yield angle-independent measures. The hypothesis of the present study was that VFI can provide RVPV estimations without the angle dependency of PW Doppler for an improved venous disease assessment. Sixty-seven patients with symptomatic chronic venous disease were included in the study. On average, VFI measured a lower RVPV than PW Doppler (VFI: 14.11 cm/s; PW: 17.32 cm/s, p=0.002) with a non-significant improved precision compared with PW Doppler (VFI: 21.09%; PW: 26.49%, p=0.08). In a flow phantom, VFI had improved accuracy (p < 0.01) and equal precision compared with PW Doppler. The study indicated that VFI can characterize the hemodynamic fluctuations in the common femoral vein.

General information
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Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Authors: Bechsgaard, T. (Ekstern), Hansen, K. L. (Ekstern), Brandt, A. H. (Ekstern), Moshavegh, R. (Ekstern), Forman, J. L. (Ekstern), Føgh, P. (Ekstern), Klitfod, L. (Ekstern), Bækgaard, N. (Ekstern), Lönn, L. (Ekstern), Nielsen, M. B. (Ekstern), Jensen, J. A. (Intern)
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.5 SJR 0.932 SNIP 1.031
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.7 SJR 0.915 SNIP 1.111
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.929 SNIP 1.174 CiteScore 2.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.054 SNIP 1.407 CiteScore 2.65
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.916 SNIP 1.241 CiteScore 2.71
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.957 SNIP 1.458 CiteScore 2.66
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.952 SNIP 1.437 CiteScore 2.68
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.306 SNIP 1.572
Response Accuracy and Tracking Errors with Decentralized Control of Commercial V2G Chargers

There is a growing interest in using the flexibility of electric vehicles (EVs) to provide power system services, such as fast frequency regulation. Decentralized control is advocated due to its reliability and much lower communication requirements. A commonly used linear droop characteristic results in low average efficiencies, whereas controllers with 3 modes (idle, fully charging, fully discharging) result in large reserve errors when the aggregation size is small. To address these issues, we propose a stochastic, decentralized controller with tunable response granularity which minimizes switching actions. The EV fleet operator can optimize the chargers’ performance according to the fleet size, the service error requirements, the average switching rate and the average efficiency. We use real efficiency characteristics from EVs and chargers providing fast frequency regulation and we show that the proposed controller can significantly reduce reserve errors and increase efficiency for a given fleet size, while at the same time minimizing the switching actions.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources
Authors: Ziras, C. (Intern), Zecchino, A. (Intern), Marinelli, M. (Intern)
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Decentralized control, Electric vehicles, Primary frequency control, Stochastic control, V2G chargers
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2018
In the last two decades, emerging use of renewable and distributed energy sources in electricity grid has created new challenges for the utility regarding the power quality, voltage stabilization and efficient energy utilization. Power electronic converters are extensively utilized to interface the emerging energy systems (without and with energy storage) and smart buildings with the transmission and distribution systems. Flexible ac transmission systems (FACTSs) and voltage-source converters, with smart dynamic controllers, are emerging as a stabilization and power filtering equipment to improve the power quality. Also, distributed FACTSs play an important role in improving the power factor, energy utilization, enhancing the power quality, and ensuring efficient energy utilization and energy management in smart grids with renewable energy sources. This paper presents a literature survey of FACTS technology tools and applications for power quality and efficient renewable energy system utilization.

**General information**

**State:** Published  
**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Vrije Universiteit Brussel, University of New South Wales, Energy Systems, Incorporated, Universita di Salerno  
**Authors:** Gandoman, F. H. (Ekstern), Ahmadi, A. (Ekstern), Sharaf, A. M. (Ekstern), Siano, P. (Ekstern), Pou, J. (Ekstern), Hredzak, B. (Ekstern), Agelidis, V. G. (Intern)  
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- Web of Science (2018): Indexed yes  
- BFI (2017): BFI-level 2  
- Scopus rating (2017): CiteScore 10.54 SJR 3.036 SNIP 3.594  
- Web of Science (2017): Indexed yes  
- BFI (2016): BFI-level 2  
- Scopus rating (2016): CiteScore 9.52 SJR 2.998 SNIP 3.501  
- Web of Science (2016): Indexed yes  
- BFI (2015): BFI-level 2  
- Scopus rating (2015): SJR 2.921 SNIP 3.368 CiteScore 8.35  
- Web of Science (2015): Indexed yes  
- BFI (2014): BFI-level 2  
- Scopus rating (2014): SJR 3.03 SNIP 3.72 CiteScore 7.79  
- Web of Science (2014): Indexed yes  
- BFI (2013): BFI-level 1  
- Scopus rating (2013): SJR 2.98 SNIP 3.893 CiteScore 7.88  
- ISI indexed (2013): ISI indexed yes  
- Web of Science (2013): Indexed yes  
- BFI (2012): BFI-level 1  
- Scopus rating (2012): SJR 2.734 SNIP 3.861 CiteScore 7.24  
- ISI indexed (2012): ISI indexed yes  
- Web of Science (2012): Indexed yes  
- BFI (2011): BFI-level 1  
- Scopus rating (2011): SJR 2.717 SNIP 3.911 CiteScore 7.39  
- ISI indexed (2011): ISI indexed yes  
- Web of Science (2011): Indexed yes  
- BFI (2010): BFI-level 1  
- Scopus rating (2010): SJR 2.338 SNIP 3.092  
- Web of Science (2010): Indexed yes  
- BFI (2009): BFI-level 1  
- Scopus rating (2009): SJR 2.457 SNIP 3.608
Review of Resonant Gate Driver in Power Conversion

Resonant gate driver is a vital trend of research topic along with the development of high electron mobility transistor (HEMT). Compared with conventional gate driver, resonant gate driver achieves much lower power dissipation during switching transient and widely viewed as one essential technique for high frequency power conversion. This paper provides a state-of-art review and thorough comparison of different resonant gate driver topologies. Case study of two representative topologies is carried out. Application of resonant gate driver in Gallium Nitride (GaN) HEMT is discussed.

Robust Allocation of Reserve Policies for a Multiple-Cell Based Power System

This paper applies a robust optimization technique for coordinating reserve allocations in multiple-cell based power systems. The linear decision rules (LDR)-based policies were implemented to achieve the reserve robustness, and consist of a nominal power schedule with a series of linear modifications. The LDR method can effectively adapt the participation factors of reserve providers to respond to system imbalance signals. The policies considered the covariance of historic system imbalance signals to reduce the overall reserve cost. When applying this method to the cell-based power system for a certain horizon, the influence of different time resolutions on policy-making is also investigated, which presents guidance for its practical application. The main results illustrate that: (a) the LDR-based method shows better performance, by producing smaller reserve costs compared to the costs given by a reference method; and (b) the cost index decreases with increased time intervals, however, longer intervals might result in insufficient reserves, due to low time resolution. On the other hand, shorter time intervals require heavy computational time. Thus, it is important to choose a proper time interval in real time operation to make a trade off.
Robust Backlash Estimation for Industrial Drive-Train Systems—Theory and Validation

Backlash compensation is used in modern machinetool controls to ensure high-accuracy positioning. When wear of a machine causes deadzone width to increase, high-accuracy control may be maintained if the deadzone is accurately estimated. Deadzone estimation is also an important parameter to indicate the level of wear in a machine transmission, and tracking its development is essential for condition-based maintenance. This paper addresses the backlash estimation problem using sliding-mode and adaptive estimation principles and shows that prognosis of the development of wear is
possible in both theory and practice. This paper provides the proof of asymptotic convergence of the suggested estimator, and it shows how position offset between motor and load is efficiently utilized in the design of a very efficient estimator. The algorithm is experimentally tested on a drive-train system with the state-of-the-art Siemens equipment. The experiments validate the theory and show that expected performance and robustness to parameter uncertainties are both achieved.

**General information**

State: Accepted/In press
Organisations: Department of Electrical Engineering, Automation and Control, Department of Applied Mathematics and Computer Science, Siemens
Authors: Papageorgiou, D. (Intern), Blanke, M. (Intern), Niemann, H. H. (Intern), Richter, J. H. (Ekstern)
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.89 SJR 1.832 SNIP 2.728
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.655 SNIP 2.643
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.966 SNIP 2.798 CiteScore 4.72
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.786 SNIP 3.006 CiteScore 4.34
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.707 SNIP 3.41 CiteScore 4.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 3.011 CiteScore 3.7
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.585 SNIP 2.909 CiteScore 3.26
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.098 SNIP 2.391
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.587 SNIP 2.789
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.43 SNIP 2.736
Scopus rating (2007): SJR 1.082 SNIP 2.205
Scopus rating (2006): SJR 1.021 SNIP 2.306
Scopus rating (2005): SJR 0.968 SNIP 2.593
Scopus rating (2004): SJR 1.173 SNIP 2.183
Scopus rating (2003): SJR 1.537 SNIP 2.355
Scopus rating (2002): SJR 2.342 SNIP 2.886
Scopus rating (2001): SJR 2.073 SNIP 2.262
Robust speech dereverberation with a neural network-based post-filter that exploits multi-conditional training of binaural cues

This study presents an algorithm for binaural speech dereverberation based on the supervised learning of short-term binaural cues. The proposed system combined a delay-and-sum beamformer (DSB) with a neural network-based post-filter that attenuated reverberant components in individual time-frequency (T-F) units. A multi-conditional training (MCT) procedure was used to simulate the uncertainties of short-term binaural cues in response to room reverberation by mixing the direct part of head related impulse responses (HRIRs) with diffuse noise. Despite being trained with only anechoic HRIRs, the proposed dereverberation algorithm was tested in a variety of reverberant environments and achieved considerable improvements relative to a coherence-based approach in terms of three objective metrics reflecting speech quality and speech intelligibility. Moreover, a systematic evaluation showed that the proposed system generalized very well to a wide range of acoustic conditions, including various measured binaural room impulse responses (BRIRs) reflecting different reverberation times, azimuth positions spanning the entire frontal hemifield, various source-receiver distances as well as different artificial heads.
Room Acoustic Simulations using High-Order Spectral Element Methods

A wave-based numerical scheme for simulating room acoustics, based on the spectral element method, is presented. This method possesses qualities, such as high-order accuracy and geometrical flexibility, which make it very suitable for accurate and cost-effective room acoustic simulations of complex geometries of any size and shape. Various numerical experiments are carried out in order to analyze the accuracy and efficiency of the scheme. The results demonstrate how using high-order elements is essential for capturing wave dispersion and thereby allowing for the usage of coarser spatial discretizations, which can reduce computation time significantly. Furthermore, the method’s ability to accurately represent curved boundaries, by means of curvilinear mesh elements, is demonstrated. The investigation is relevant for understanding how to improve the accuracy of room acoustics simulations in real geometries and serves as a stepping stone towards developing a relatively fast and flexible wave-based room acoustic simulator.

Shape morphing and topology optimization of fluid channels by explicit boundary tracking

An integrated shape morphing and topology optimization approach based on the Deformable Simplicial Complex (DSC) methodology is developed to address Stokes and Navier-Stokes flow problems. The optimized geometry is interpreted by a set of piecewise linear curves embedded in a well-formed triangular mesh, resulting in a physically well-defined interface between fluid and impermeable regions. The shape evolution is realized by deforming the curves while maintaining a high-quality mesh through adaption of the mesh near the structural boundary, rather than performing a global remeshing. Topological changes are allowed through hole merging or splitting of islands. The finite element discretization used,
provides smooth and stable optimized boundaries for simple energy dissipation objectives. However, for more advanced problems boundary oscillations are observed due to conflicts between objective function and minimum length-scale imposed by the meshing algorithm. A surface regularization scheme is introduced to circumvent this issue, which is specifically tailored for the DSC approach. In contrast to other filter-based regularization techniques, the scheme does not introduce additional control variables and at the same time it is based on rigorous sensitivity analysis. Several numerical examples are presented to demonstrate the applicability of the approach.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology, Shanghai Jiao Tong University, Taiyuan University of Technology
Authors: Zhou, M. (Ekstern), Lian, H. (Ekstern), Sigmund, O. (Intern), Aage, N. (Intern)
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.371 SNIP 1.47 CiteScore 2.26
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.101 SNIP 1.332 CiteScore 1.69
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.999 SNIP 1.3 CiteScore 1.85
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.748 SNIP 1.396 CiteScore 1.66
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.936 SNIP 1.236 CiteScore 1.58
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.475 SNIP 1.249 CiteScore 1.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.144 SNIP 1.201
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.112 SNIP 1.069
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.999 SNIP 1.223
Scopus rating (2007): SJR 0.861 SNIP 1.118
Scopus rating (2006): SJR 1.18 SNIP 1.27
Scopus rating (2005): SJR 1.056 SNIP 1.156
Scopus rating (2004): SJR 0.816 SNIP 1.015
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.041 SNIP 1.104
Signal to noise comparison of metabolic imaging methods on a clinical 3T MRI

MRI with hyperpolarized tracers has enabled new diagnostic applications, e.g. metabolic imaging in cancer research. However, the acquisition of the transient, hyperpolarized signal with spatial and frequency resolution requires dedicated imaging methods. Here, we compare three promising candidates for 2D MR spectroscopic imaging (MRSI): (i) multi-echo balanced steady-state free precession (me-bSSFP), (ii) echo planar spectroscopic imaging (EPSI) sequence and (iii) phase-encoded, pulse-acquisition chemical-shift imaging (CSI)

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, University of Freiburg, University of Copenhagen, University of Kiel
Authors: Müller, C. A. (Ekstern), Hansen, R. B. (Intern), Skinner, J. G. (Ekstern), Eldirdiri, A. (Ekstern), Leupold, J. (Ekstern), Hennig, J. (Ekstern), Ardenkjær-Larsen, J. H. (Intern), Hansen, A. (Ekstern), Hövener, J. -. B. (Ekstern)
Number of pages: 4
Publication date: 2018
Event: Abstract from 13th European Molecular Imaging Meeting, San Sebastián, Spain.
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2017_11_EMIM_ABSTRACT_CM_FINAL.pdf
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Simulations based evaluation of the ELECTRA WoC solutions for voltage and balance control - Stand-alone Use Case simulation results

Within IRP ELECTRA six control schemes were developed to control power system voltage and balancing (frequency) in the Web-of-Cells architecture. This document summarizes and presents simulations proving that the Web-of-Cells can be controlled in a stable way by each of these six control schemes in stand-alone mode.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources, University of Strathclyde, Nederlandse Organisatie voor Toegepast Natuurwenschappelijk Onderzoek, VTT, VTT - Technical Research Centre of Finland, Tecnalia, Parque Científico y Tecnológico de Bizkaia, Centre for Renewable Energy Sources, Instytut Energetyki
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Main Research Area: Technical/natural sciences
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ELECTRA_D6_4_Simulation_based_evaluation_of_the_Electra_WoC_solutions_for_voltage_and_balance.pdf
Source: PublicationPreSubmission
Single-Phase Boost Inverter-Based Electric Vehicle Charger With Integrated Vehicle to Grid Reactive Power Compensation

Vehicle to grid (V2G) reactive power compensation using electric vehicle (EV) onboard chargers helps to ensure grid power quality by achieving unity power factor operation. However, the use of EVs for V2G reactive power compensation increases the second-order harmonic ripple current component at the DC-side of the charger. For single-phase, single-stage EV chargers, the ripple current component has to be supplied by the EV battery, unless a ripple compensation method is employed. Additionally, continuous usage of EV chargers for reactive power compensation, when the EV battery is not charging from the grid, exposes the EV battery to these undesirable ripple current components for a longer period and discharges the battery due to power conversion losses. This paper presents a way to provide V2G reactive power compensation through a boost inverter-based single stage EV charger and a DC-side capacitor without adversely affecting the EV battery. The operation of the boost inverter-based EV charger with second-order harmonic and switching frequency ripple current reduction, the dynamic behavior of the system, the transition between different operating modes, the DC-side capacitor voltage control above a minimum allowed voltage, and the DC-side capacitor sizing are extensively analyzed. The performance of the proposed system is verified using an experimental prototype, and presented results demonstrate the ability of the system to provide V2G reactive power compensation both with and without the EV battery.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, University of New South Wales
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 9.08 SJR 2.215 SNIP 3.106
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.267 SNIP 3.808 CiteScore 9.2
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.115 SNIP 4.252 CiteScore 8.78
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.189 SNIP 4.324 CiteScore 8.41
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.918 SNIP 3.859 CiteScore 6.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Voltage rise (VR) due to reverse power flow is an important obstacle for high integration of Photovoltaic (PV) into residential networks. This paper introduces and elaborates a novel methodology of an index-based single-point-reactive power-control (SPRPC) methodology to mitigate voltage rise by absorbing adequate reactive power from one selected point. The proposed index utilizes short circuit analysis to select the best point to apply this Volt/Var control method. SPRPC is supported technically and financially by distribution network operator that makes it cost effective, simple and efficient to eliminate VR in the affected network. With SPRPC none of the previous PV inverters need to upgrade and can retain their unity power factor to not to conflict with current grid codes. Comprehensive 24-h simulation studies are done on a modified IEEE 69-bus Network emulating a traditional residential power system with high r/x ratio. Efficacy, effectiveness and cost study of SPRPC is compared to droop control to evaluate its advantages.
Skull segmentation from MR scans using a higher-order shape model based on convolutional restricted Boltzmann machines

Transcranial brain stimulation (TBS) techniques such as transcranial magnetic stimulation (TMS), transcranial direct current stimulation (tDCS) and others have seen a strong increase as tools in therapy and research within the last 20 years. In order to precisely target the stimulation, it is important to accurately model the individual head anatomy of a subject. Of particular importance is accurate reconstruction of the skull, as it has the strongest impact on the current pathways due to its low conductivity. Thus providing automated tools, which can reliably reconstruct the anatomy of the human head from magnetic resonance (MR) scans would be highly valuable for the application of transcranial stimulation methods. These head models can also be used to inform source localization methods such as EEG and MEG. Automated segmentation of the skull from MR images is, however, challenging as the skull emits very little signal in MR. In order to avoid topological defects, such as holes in the segmentations, a strong model of the skull shape is needed. In this paper we propose a new shape model for skull segmentation based on the so-called convolutional restricted Boltzmann machines (cRBMs). Compared to traditionally used lower-order shape models, such as pair-wise Markov random fields (MRFs), the cRBMs model local shapes in larger spatial neighborhoods while still allowing for efficient inference. We compare the skull segmentation accuracy of our approach to two previously published methods and show significant improvement.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Cognitive Systems, Hvidovre Hospital
Authors: Puonti, O. (Intern), Van Leemput, K. (Intern), Nielsen, J. D. (Intern), Bauer, C. (Ekstern), Siebner, H. R. (Ekstern), Madsen, K. H. (Intern), Thielscher, A. (Intern)
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Conference: SPIE Medical Imaging 2018, Houston, United States, 10/02/2018 - 10/02/2018
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DOIs: 10.1117/12.2293073
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Source-ID: 2434431257
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Slice-wise motion tracking during simultaneous EEG-fMRI
Slice-wise motion tracking during combined electroencephalography (EEG) and echo planar imaging (EPI) is developed. Using gradient-induced noise on the EEG for tracking, no interleaved navigator modules or additional hardware is needed. The motion parameters are determined after a calibration and training scan. The method is explored in a phantom and in vivo.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Department of Applied Mathematics and Computer Science, Cognitive Systems, Center for Hyperpolarization in Magnetic Resonance, Philips - Copenhagen, Copenhagen University Hospital, Chinese Academy of Sciences
Authors: Laustsen, M. (Intern), Andersen, M. (Ekstern), Lehmann, P. M. (Ekstern), Xue, R. (Ekstern), Madsen, K. H. (Intern), Hanson, L. G. (Intern)
Number of pages: 2
Publication date: 2018
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Electronic versions: ISMRM18_4082_MalteSlcwiseMotion.pdf
Source: PublicationPreSubmission
Source-ID: 149080698
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2018
Smart grid communication infrastructure comparison for distributed control of distributed energy resources using internet of things devices

Communication between distributed energy resources and aggregators is necessary to improve the efficiency of power use and solve stability issues. For the communication, the probability of delivery for measurements and control commands, determines the possible power system services. The probability of delivery is determined by the processing units, data connection, middleware, and serialization. The comparison is made based on multiple experimental setups to test the performance of different middleware and serialization with different processing units and data connections in a Smart Grid context. The hardware includes Beagle Bones, Raspberry Pi's, and Dell laptops processing units, and the data connection bandwidths include 1, 10, 100 and 1000 Mbit/s. The results show that there are better alternatives to XMPP and Web Services middleware and XML serialization as advocated for by the prevalent communication standards. The paper gives guidance in choosing the best software and hardware for communication depending on the use case.

General information
State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), Poulsen, B. (Intern), You, S. (Intern)
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Smart grids innovation challenge

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Dynamical Systems, Ricerca Sistema Energetico SpA
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Chapter: 5
Main Research Area: Technical/natural sciences
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Solar PV plant for supplying ancillary services in distribution systems
The paper reports the latest practice in the field for solar PV integration in distribution grids in Denmark, where the communication capability of solar inverters is exploited for integrating the monitoring and control functions of solar inverters into the SCADA system of the grid operator. The project demonstrates that, by implementing the enabled communication protocols of solar PV inverters in the remote terminal unit (RTU), the operator can receive measurements
from the PV inverter on a variety of quantities, as well as remotely regulate the active and reactive power production for procurement of grid services. The practice demonstrates the feasibility of using solar PV plants for grid support in critical situations, where the experience is repeatable for other distribution grid operators to integrate distributed generation resources into the grid management functions. The work is carried out in cooperation with the grid operator of Bornholm, which is one of the islands in Denmark having the highest penetration of renewable energy.

**General information**
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Bornholms Energi og Forsyning, Kenergy, Danfoss A/S
Authors: Yang, G. (Intern), Zimmermann, J. K. (Intern), Ipsen, H. H. (Ekstern), Hansen, T. V. (Ekstern), Frederiksen, K. H. B. (Ekstern), Helth, T. (Ekstern), Kjaer, S. B. (Ekstern)
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Electronic versions:
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Source: PublicationPreSubmission
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Sparsity Prevention Pivoting Method for Linear Programming**
When the simplex algorithm is used to calculate a linear programming problem, if the matrix is a sparse matrix, it will be possible to lead to many zero-length calculation steps, and even iterative cycle will appear. To deal with the problem, a new pivoting method is proposed in this paper. The principle of this method is avoided choosing the row which the value of the element in the b vector is zero as the row of the pivot element to make the matrix in linear programming density and ensure that most subsequent steps will improve the value of the objective function. One step following this principle is inserted to reselect the pivot element in the existing linear programming algorithm. Both the conditions for inserting this step and the maximum number of allowed insertion steps are determined. In the case study, taking several numbers of linear programming problems as examples, the results indicate that this method can effectively improve the efficiency of linear programming for the sparse matrix.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hunan University
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Pages: 19560 - 19567
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Scopus rating (2017): CiteScore 4.49
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.13
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 4.32
Stable isotope-resolved analysis with quantitative dissolution dynamic nuclear polarization

Metabolite profiles and their isotopomer distributions can be studied non-invasively in complex mixtures with NMR. The advent of dissolution Dynamic Nuclear Polarization (dDNP) and isotope enrichment add sensitivity and resolution to such met-abolic studies. Metabolic pathways and networks can be mapped and quantified if protocols that control and exploit the ex situ signal enhancement are created. We present a sample preparation method, including cell incubation, extraction and signal enhancement, to facilitate reproducible and quantitative dDNP (qdDNP) NMR-based isotope tracer analysis. We further illustrate how qdDNP was applied to gain systematic and novel metabolic phenotypic insights into aggressive cancer cells.
Status of Wind Power Technologies

With the development of wind turbine technology, wind power will become more controllable and grid-friendly. It is desirable to make wind farms operate as conventional power plants. Wind turbine generators (WTGs) were mainly used in rural and remote areas for wind power generation. WTG-based wind energy conversion systems (WECS) can be divided into the four main types (type 1-4). Due to the inherent variability and uncertainty of the wind, the integration of wind power into the grid has brought challenges in several different areas, including power quality, system reliability, stability, and planning. The impact of each is largely dependent on the level of wind power penetration in the grid. In many countries, relatively high levels of wind power penetration have been achieved. This chapter shows the estimated wind power penetration in leading wind markets.

Stochastic Economic Dispatch with Wind using Versatile Probability Distribution and L-BFGS-B Based Dual Decomposition

This paper focuses on economic dispatch (ED) in power systems with intermittent wind power, which is a very critical issue in future power systems. A stochastic ED problem is formed based on the recently proposed versatile probability distribution (VPD) of wind power. The problem is then analyzed and proved to be strictly convex. Although such convex optimization is tractable in many cases, it may take a long time to solve due to its large scale. This paper proposes a dual decomposition method to decompose the large problem. Then two methods are employed to solve the decomposed problem, namely, the subgradient method and a faster method, limited-memory BFGS with box constraints (L-BFGS-B, a quasi-Newton method). Case studies were conducted to verify the efficiency of the dual decomposition and L-BFGS-B method for solving the stochastic ED problem.
Stratified spherical model for microwave imaging of the brain: Analysis and experimental validation of transmitted power

This work presents the analysis of power transmission of a radiating field inside the human head for microwave imaging applications. For this purpose, a spherical layered model composed of dispersive biological tissues is investigated in the range of (0.5–4) GHz and is confronted to experimental verification.

General information
State: Published
Authors: Bjelogrlic, M. (Ekstern), Volery, M. (Ekstern), Fuchs, B. (Ekstern), Thiran, J. (Ekstern), Mosig, J. R. (Ekstern), Mattes, M. (Intern)
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Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.99 SJR 0.273 SNIP 0.599
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.87 SJR 0.278 SNIP 0.561
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.318 SNIP 0.506 CiteScore 0.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.347 SNIP 0.578 CiteScore 0.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.34 SNIP 0.63 CiteScore 0.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.333 SNIP 0.585 CiteScore 0.83
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.37 SNIP 0.612 CiteScore 0.83
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.386 SNIP 0.541
Study of control strategies of power electronics during faults in microgrids

This chapter has firstly summarized the instantaneous power theory and its extension for the purpose of controlling voltage source inverters under unbalanced faults. Regarding the converters operating in grid-connected mode to feed a certain amount of active and reactive power to the microgrid, two groups of control strategies, namely flexible oscillating power control and flexible positive- and negative-sequence power control are reviewed together with the design of inner current controllers and converter current limitation methods. For the autonomous operation of the microgrid, the control of a voltage source inverter operating under an islanded mode to provide voltage amplitude and frequency references is briefly reviewed. To improve the short-circuit performance of such an inverter under unbalanced fault, the negative-sequence current control loop is implemented. This chapter is finally supported by the application of different control strategies in a typical microgrid setting followed by discussions on microgrid protection.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Siemens A/S
Authors: Jia, J. (Intern), Yang, G. (Intern), Nielsen, A. H. (Intern), Rønne-Hansen, P. (Ekstern)
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Suitability of Commercial V2G CHAdeMO Chargers for Grid Services
Aggregation and control of electric vehicles (EVs) via vehicle-to-grid (V2G) technologies is seen as a valid option for providing ancillary power system services. This work presents results from V2G-ready equipment tests. The technical capabilities of an EV connected to a commercial V2G charger are investigated when controlled either locally or remotely. The charger is characterized in terms of efficiency characteristics, activation time, response granularity, ramping up/down time, accuracy and precision. Results show the performance for different operating conditions, highlighting the importance of a good calibration and knowledge of the employed hardware when providing standard-compliant grid regulation services via V2G technology.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Zecchino, A. (Intern), Thingvad, A. (Intern), Andersen, P. B. (Intern), Marinelli, M. (Intern)
Number of pages: 7
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Switching Transient Analysis and Characterization of GaN HEMT
High electron mobility transistor (HEMT) has the advantage of fast switching capability, low power loss and small package design. Gallium Nitride (GaN) HEMT is widely researched in recent years. Accurate characterization and detailed switching analysis are critical for the practical application in power converters. In this paper, a 650V GaN HEMT is tested based on the double pulse tester. Based on the experimental results, the switching transient analysis is given and the phenomenon of Miller plateau shifting is explained. Switching time and switching loss characterization are given as the reference value for converter design.

General information
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Organisations: Department of Electrical Engineering, Electronics
Authors: Sun, B. (Intern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
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Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 3rd International Conference on Intelligent Green Building and Smart Grid, Yilan, Taiwan, Province of China, 22/04/2018 - 22/04/2018
Double pulse test, GaN HEMT, Miller plateau, Switching characterization
Source: PublicationPreSubmission
Source-ID: 147291110
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Synchronization of Solar Stand-alone Devices and Autonomous Energy Management through Solar Time Measurements
This work presents a method for synchronization of a solar device to real solar time for event triggering and energy management. Specifications require the devices to be off-grid and self-adjusting. Measurements of daylight duration were performed using one test device over the course of several months in Denmark. Analysis of viability over the accuracy of solar time determination and potential for self-adjusting energy management was carried out. Measurement results allowed for the development of an algorithm with good potential for performing the required tasks. Influence of variations in weather and different shadowing conditions were tested in two prototype devices. Results show a good potential for daily synchronization between devices and estimation of solar time within less than 5 minutes error.
Synchronous Condenser Allocation for Improving System Short Circuit Ratio

With converter-based renewable energy sources increasingly integrated into power systems and conventional power plants gradually phased out, future power systems will experience reduced short circuit strength. The deployment of synchronous condensers can serve as a potential solution. This paper presents an optimal synchronous condenser allocation method for improving system short circuit ratio at converter point of common coupling using a modified short circuit analysis approach. The total cost of installing new synchronous condensers is minimized while the system short circuit ratios are maintained above a certain level. The presented method is implemented on the simplified western Danish power system for a future scenario.

Systematic Analysis of the Effects of Moulding Conditions on the Properties of Shape Memory Polymers

Shape memory polymers (SMP) demonstrate a unique ability to recover to their original shape upon application of the external stimulus after being deformed and fixed into a temporary shape. The SMP part can be produced by injection moulding process but limited work has been done to understand the effects of moulding conditions on the shape memory effect. The aim of this research is to investigate the influence of selected moulding parameters on the shape memory effect (SME). Three moulding process parameters - injection speed, packing pressure and mould temperature were differentiated in order to produce the test parts. The samples were subjected to thermomechanical experiments and their shape before and after the experiments were analysed along with the overall quality of the parts. The results from these analyses are presented in the paper.
Talega SynCon - Power Grid Support for Renewable-based Systems

Toward the renewable energy era where the electricity is based 100% on renewable energy sources, the power systems are experiencing operational challenges due to lack of short-circuit power and inertia support. This may cause a cascade failure or even a collapse of the whole system. In addressing this issue, synchronous condenser as a reborn technology which not only supports voltage regulation but also supplies inertial response and short-circuit power for the systems. This paper validates the synchronous condenser benefit at Talega substation in southern California which is equipped with a modern and advanced control technology for synchronous condensers. Based on the measurement data from phasor measurement unit (PMU), it can be concluded that synchronous condenser is a critical key for the system frequency stability improvement and short-circuit power support of renewable-based systems.

Task dialog by native-Danish talkers in Danish and English in both quiet and noise

The zip files contain recorded conversations between 19 pairs of normal-hearing native-Danish talkers taking part in an experiment in the lab of the Hearing Systems Group at The Technical University of Denmark during October-November 2016.
Task-Modulated Cortical Representations of Natural Sound Source Categories

In everyday sound environments, we recognize sound sources and events by attending to relevant aspects of an acoustic input. Evidence about the cortical mechanisms involved in extracting relevant category information from natural sounds is, however, limited to speech. Here, we used functional MRI to measure cortical response patterns while human listeners categorized real-world sounds created by objects of different solid materials (glass, metal, wood) manipulated by different sound-producing actions (striking, rattling, dropping). In different sessions, subjects had to identify either material or action categories in the same sound stimuli. The sound-producing action and the material of the sound source could be decoded from multivoxel activity patterns in auditory cortex, including Heschl’s gyrus and planum temporale. Importantly, decoding success depended on task relevance and category discriminability. Action categories were more accurately decoded in auditory cortex when subjects identified action information. Conversely, the material of the same sound sources was decoded with higher accuracy in the inferior frontal cortex during material identification. Representational similarity analyses indicated that both early and higher-order auditory cortex selectively enhanced spectrotemporal features relevant to the target category. Together, the results indicate a cortical selection mechanism that favors task-relevant information in the processing of nonvocal sound categories.
This paper provides a technical assessment of electric heat boosters (EHBs) in low-energy districts. The analysis is based on a hypothetical district with 23 terraced single-family houses supplied by both a low-temperature district heating (LTDH) network and a low-voltage network (LVN). Two case studies are provided to show the active role of EHBs in a smart energy system (SES). The first case compares annual heat and power flow analyses for LTDH at five supply temperature levels, focusing on their impacts. The results show that district heating network (DHN) losses can be reduced by 35% if the supply temperature is reduced from 70°C to 50°C, but the LVN peak power will have to be increased by up to 2% using heat boosting. The second case further aggregates EHBs to provide a fuel shift (FS) service for the DHN. The results show that the LVN peak power was increased by up to 4.3%, the basic power production and peak boiler usage for DHN could be reduced by as much as 15% and 48%, respectively. In summary, lower supply temperatures and intelligent components can improve system efficiency and turn the DHN into an integrated part of a SES.
Technical evaluation of hearing-aid fitting parameters for different auditory profiles

Hearing-aid users have reported an increased satisfaction since digital technology and advanced signal processing became available in hearing aids. However, many users still experience difficulties in noisy environments and in complex listening scenarios. Although numerous parameters can be adjusted to provide an individualized hearing solution, hearing-aid fitting currently consists of: 1) the gain prescription and adjustment based on the pure-tone audiogram, 2) the activation of advanced features on-demand, such as beamforming and noise reduction. In a previous study [1], a novel approach for auditory profiling was suggested, where the hearing deficits were characterized according to two types of distortion. This allowed the classification of listeners into four auditory profiles according to a high/low degree of hearing distortions along the two dimensions. The aim of the present study was to evaluate different hearing-aid compensation strategies that may fit the needs of different auditory profiles via technical measures. A hearing-aid simulator, consisting of
beamforming, noise reduction, and dynamic range compression, was used to test which parameter spaces and outcome measures may be of interest for a “profile-based hearing-aid fitting”. The simulator consists of two dummy behind-the-ear hearing aids and off-line sound processing performed on a personal computer. Technical measures, such as signal-to-noise ratio (SNR) improvement, envelope degradation, and a metric of spectral distortions, were used to evaluate the effects of different signal processing strategies on the signal at the output of the simulator. Several parameter settings were evaluated using speech in the presence of various interferers at different SNRs. Here, the results of this technical evaluation are presented and discussed, with a view towards identifying the effective compensation strategies for different auditory profiles.

General information
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Test of PV inverters under unbalanced operations
In the modern renewable energy system, recent years have seen a rise in the share of power being generated through photovoltaic (PV) plants. In the Danish power system, PV plants are mostly integrated in the medium and low voltage networks which are usually operating under unbalanced conditions. Furthermore, the increasing number of power electronic based equipment affects the grid during faults through their contribution to the fault current. So far studies of PV plants in unbalanced conditions are based on computational simulations, which have limitations in representing reality. Therefore, this study investigated the performance of a threephase PV inverter under unbalanced operation and fault conditions. The inverter is tested in stable power system operation and during grid support situations through frequency response and reactive power control. All experiments are carried out using an experimental laboratory platform in PowerLabDK. The key outcomes from this study includes the correlation between positive sequence component of voltage and reactive power, active power and current under unbalanced operation, the frequency response dependence on positive sequence voltage, and the fault current contribution from PV inverter during different fault conditions.

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The benefit of combining a deep neural network architecture with ideal ratio mask estimation in computational speech segregation to improve speech intelligibility
Computational speech segregation attempts to automatically separate speech from noise. This is challenging in conditions with interfering talkers and low signal-to-noise ratios. Recent approaches have adopted deep neural networks and successfully demonstrated speech intelligibility improvements. A selection of components may be responsible for the success with these state-of-the-art approaches: the system architecture, a time frame concatenation technique and the learning objective. The aim of this study was to explore the roles and the relative contributions of these components by measuring speech intelligibility in normal-hearing listeners. A substantial improvement of 25.4 percentage points in speech intelligibility scores was found going from a subband-based architecture, in which a Gaussian Mixture Model-based classifier predicts the distributions of speech and noise for each frequency channel, to a state-of-the-art deep neural network-based architecture. Another improvement of 13.9 percentage points was obtained by changing the learning objective from the ideal binary mask, in which individual time-frequency units are labeled as either speech- or noise-dominated, to the ideal ratio mask, where the units are assigned a continuous value between zero and one. Therefore, both components play significant roles and by combining them, speech intelligibility improvements were obtained in a six-talker condition at a low signal-to-noise ratio.

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The difficulties of simulating the acoustics of an empty rectangular room with an absorbing ceiling

In this study, simulations of a scale model of an unfurnished rectangular room with an absorbing ceiling using an energy-based geometrical acoustic model and a phased geometrical acoustic model are compared to measurements. This room can represent a typical classroom or office. This comparison concluded that the phased model can capture more details of the sound field, particularly at low frequencies. For accurate predictions, precise surface descriptions are needed for the phased GA method, which are not always available. The main drawback of the phased model is a longer calculation time.
The impact of exploiting spectro-temporal context in computational speech segregation

Computational speech segregation aims to automatically segregate speech from interfering noise, often by employing ideal binary mask estimation. Several studies have tried to exploit contextual information in speech to improve mask estimation accuracy by using two frequently-used strategies that (1) incorporate delta features and (2) employ support vector machine (SVM) based integration. In this study, two experiments were conducted. In Experiment I, the impact of exploiting spectro-temporal context using these strategies was investigated in stationary and six-talker noise. In Experiment II, the delta features were explored in detail and tested in a setup that considered novel noise segments of the six-talker noise. Computing delta features led to higher intelligibility than employing SVM based integration and intelligibility increased with the amount of spectral information exploited via the delta features. The system did not, however, generalize well to novel segments of this noise type. Measured intelligibility was subsequently compared to extended short-term objective intelligibility, hit–false alarm rate, and the amount of mask clustering. None of these objective measures alone could account for measured intelligibility. The findings may have implications for the design of speech segregation systems, and for the selection of a cost function that correlates with intelligibility.
The mechanisms underlying multiple lobes in SOAE suppression tuning curves in a transmission line model of the cochlea

Spontaneous otoacoustic emissions (SOAE) can be suppressed by presenting an acoustical stimulus. For stimuli with frequencies close to the SOAE frequency, the SOAE either show a beating pattern or are heavily suppressed while the spectral energy of the stimulus increases. This effect indicates that the self-sustained oscillations in the cochlea underlying SOAE are entrained by the oscillation evoked by the stimulus. The level required to entrain SOAE needs to be higher for a larger spectral distance between SOAE and stimulus compared to a smaller spectral distance, leading to a V-shaped tuning curve. When these tuning curves are measured over a broad frequency range spanning several octaves, additional lobes of suppression can be found with a spectral distance of about half an octave. It has been proposed that SOAEs are generated by a standing wave pattern in the cochlea that arises by interference of multiple reflections between the best place and the oval window [1]. It has further been hypothesized that the additional side lobes in the SOAE suppression tuning curves are the result of interaction of the stimulus with the nodes and antinodes of the standing wave pattern underlying the SOAE [4]. In the present study, a nonlinear and active transmission line model of the cochlea is used to investigate this hypothesis. The model is able to produce SOAEs with plausible characteristics and further shows the suggested standing wave pattern. This approach hence makes it possible to disentangle contributions of entrainment and compression of the forward-traveling wave to the SOAE suppression tuning curves.
The role of temporal cues on voluntary stream segregation in cochlear implant users

The role of temporal cues in sequential stream segregation was investigated in cochlear implant (CI) listeners using a delay detection task composed of a sequence of bursts of pulses (B) on a single electrode interleaved with a second sequence (A) presented on the same electrode with a different pulse rate. In half of the trials, a delay was added to the last burst of the otherwise regular B sequence and the listeners were asked to detect this delay. As a jitter was added to the period between consecutive A bursts, time judgments between the A and B sequences provided an unreliable cue to perform the task. Thus, the segregation of the A and B sequences should improve performance. The pulse rate difference and the duration of the sequences were varied between trials. The performance in the detection task improved by increasing both the pulse rate differences and the sequence duration. This suggests that CI listeners can use pulse rate differences to segregate sequential sounds and that a segregated percept builds up over time. In addition, the contribution of place versus temporal cues for voluntary stream segregation was assessed by combining the results from this study with those from our previous study, where the same paradigm was used to determine the role of place cues on stream segregation. Pitch height differences between the A and the B sounds accounted for the results from both studies, suggesting that stream segregation is related to the salience of the perceptual difference between the sounds.
Toward a more comprehensive understanding of the impact of masker type and signal-to-noise ratio on the pupillary response while performing a speech-in-noise test

Difficulties arising in everyday speech communication often result from the acoustical environment, which may contain interfering background noise or competing speakers. Thus, listening and understanding speech in noise can be exhausting. Two experiments are presented in the current study that further explored the impact of masker type and Signal-to-Noise Ratio (SNR) on listening effort by means of pupillometry. In both studies, pupillary responses of participants were measured while performing the Danish Hearing in Noise Test (HINT; Nielsen and Dau, 2011). The first experiment aimed to replicate and extend earlier observed effects of noise type and semantic interference on listening effort (Koelewijn et al., 2012a). The impact of three different masker types, i.e. a fluctuating noise, a 1-talker masker and a 4-talker masker on listening effort was examined at a fixed speech intelligibility. In a second experiment, effects of SNR on listening effort were examined while presenting the HINT sentences across a broad range of fixed SNRs corresponding to intelligibility scores ranging from 100 % to 0 % correct performance. A peak pupil dilation (PPD) was calculated and a Growth Curve Analysis (GCA) was performed to examine listening effort involved in speech recognition as a function of SNR. The results of two experiments showed that the pupil dilation response is highly affected by both masker type and SNR when performing the HINT. The PPD was highest, suggesting the highest level of effort, for speech recognition in the presence of the 1-talker masker in comparison to the 4-talker babble and the fluctuating noise masker. However, the disrupting effect of one competing talker disappeared for intelligibility levels around 50 %. Furthermore, it was demonstrated that the pupillary response strongly varied as a function of SNRs. Listening effort was highest for intermediate SNRs with performance accuracies ranging between 30 % -70 % correct. GCA revealed time-dependent effects of the SNR on the pupillary response that were not reflected in the PPD.
Towards Predicting Room Acoustical Effects on Sound-Field ASSR from Stimulus Modulation Power

One of the most important goals in early intervention of hearing loss is to ensure the child's access to speech. This can enable hearing impaired infants to develop language skills to a level comparable to normal-hearing infants. Hearing-aid fitting validation is important to ensure an appropriate amplification. However, this becomes challenging in pre-lingual infants because they do not respond to behavioral tests. For this reason, there is a growing interest in using objective electrophysiological measures for hearing-aid validation. Here, an approach based on the auditory steady-state response (ASSR) is considered. Instead of using insert earphones to deliver the stimuli, as is customary, the auditory signals are reproduced from a loudspeaker placed in front of the subject, so as to include the hearing aid in the transmission path. Loudspeaker presentation of the stimulus can lower its effective modulation depth due to reverberation and background noise in the measurement room. This could be critical for the quality of the measurement as ASSR magnitude is dependent on the amount of modulation in the stimulus. Previous studies have shown a reduction in the response magnitude as the modulation depth decreases, indicating a slope of about $s = 0.8$ between response magnitude and...
modulation depth both in dB (Boettcher et al., 2001; Rønne, 2012; Bharadwaj et al., 2015). However, the relation between observed sound-field ASSR magnitude and changes to stimulus modulation brought about by the acoustical properties of the measurement room has not been considered. The present work explores the relation between the stimulus modulation power and the ASSR amplitude in a simulated sound-field ASSR data set with varying reverberation time. Three rooms were simulated using the Green's function approach, and the impulse responses were convolved with narrowband (NB) CE-Chirps centered at the octave-bands of 0.5, 1.0, 2.0 and 4.0 kHz. Fifteen normal-hearing adults were presented with the auralized stimuli, as well as an unmodified 'dry' version using insert earphones. The modulation power analysis is done based on the physiological input/output curves previously mentioned. This study discusses to what extend this modulation-growth function can be used as a prediction model to determine the changes in the ASSR amplitude based on the stimulus modulation in the room.

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Transactive Energy: an Effective Mechanism for Balancing Electric Energy System
Large-scales of distributed energy resources (DERs) including renewable generations such as wind and photovoltaic generation, electric vehicles will bring operational challenges to power system operation. On the transmission system level, the transmission system operator needs new balancing methods and balancing resources. On the distribution system level, the connected DERs may cause grid congestion problems. To accommodate more DERs in the system, especially at local level, the output of DERs should be coordinated to mitigate the problems. The coordination method needs to take the interests of various actors into account, thus, this paper reviews a promising coordination mechanism: transactive energy. In this paper, we will first introduce basic concepts and characteristics of transactive energy. Then, a review of existing research and demonstration projects in this area will be presented. In the end, we will describe the key technologies for transactive energy mechanism.

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Two-Stage Load Shedding for Secondary Control in Hierarchical Operation of Islanded Microgrids
A two-stage load shedding scheme is presented to cope with the severe power deficit caused by microgrid islanding. Coordinated with the fast response of inverter-based distributed energy resources (DERs), load shedding at each stage and the resulting power flow redistribution are estimated. The first stage of load shedding will cease rapid frequency decline in which the measured frequency deviation is employed to guide the load shedding level and process. Once a new steady-state is reached, the second stage is activated, which performs load shedding according to the priorities of loads. The effectiveness of the proposed scheme is verified through time-domain simulation in PSCAD/EMTDC based on a
Two-Stage Optimal Scheduling of Electric Vehicle Charging based on Transactive Control

In this paper, a two-stage optimal charging scheme based on transactive control is proposed for the aggregator to manage day-ahead electricity procurement and real-time EV charging management in order to minimize its total operating cost. The day-ahead electricity procurement considers both the day-ahead energy cost and expected real-time operation cost. In the real-time charging management, the cost of employing the charging flexibility from the EV owners is explicitly modelled. The aggregator uses a transactive market to manage the real-time charging demand to provide the regulating power. A model predictive control (MPC) based method is proposed for the aggregator to clear the transactive market. The realtime charging decisions of the EVs are determined by the clearing of the proposed transactive market according to the realtime requests and preferences of the EV owners. As such, the aggregators decisions in the real-time EV charging management and regulating power markets can be optimized. At the same time, the charging requirements and response preferences of the EV owners are respected. Case studies using real world driving data from the Danish National Travel Surveys were conducted to verify the proposed framework.
Ultra-low power transmitter for encoding non-MR signals in Magnetic Resonance (MR) recordings

Advancing Magnetic Resonance Imaging (MRI) technology requires integration of the MRI scanners with sensors and systems for monitoring various non-MRI signals. In this paper, we present design and integration of a low power AM radio transmitter into a 3T MRI scanner, which can be used for efficient collection of data from non-MRI sensors. The transmitter consumes only 1.3mW while transmitting 2.7µW at 120MHz with high frequency stability. The presented design is useful in low power applications requiring high frequency stability and is intended for wireless transmission of non-MR signal recordings during MRI scanning.
Ultrasound Open Platforms for Next-Generation Imaging Technique Development

Open platform (OP) ultrasound systems are aimed primarily at the research community. They have been at the forefront of the development of synthetic aperture, plane wave, shear wave elastography and vector flow imaging. Such platforms are driven by a need for broad flexibility of parameters that are normally pre-set or fixed within clinical scanners. OP ultrasound scanners are defined to have three key features including customization of the transmit waveform, access to the pre-beamformed receive data and the ability to implement realtime imaging. In this paper, a formative discussion is given on the development of OPs from both the research community and the commercial sector. Both software and hardware based architectures are considered, and their specifications are compared in terms of resources and programmability. Software based platforms capable of real-time beamforming generally make use of scalable graphics processing unit (GPU) architectures, whereas a common feature of hardware based platforms is the use of fieldprogrammable gate array (FPGA) and digital signal processor (DSP) devices to provide additional on-board processing capacity. OPs with extended number of channels (>256) are also discussed in relation to their role in supporting 3-D imaging technique development. With the increasing maturity of OP ultrasound scanners, the pace of advancement in ultrasound imaging algorithms is poised to be accelerated.

General information

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Ultra-Wideband Coplanar Waveguide to Asymmetric Coplanar Stripline Transition from DC to 165 GHz

This paper presents an ultra-wideband coplanar waveguide (CPW)-to-asymmetric coplanar stripline (ACPS) transition based on aluminum nitride (AlN) substrate. The concepts of designing CPW, ACPS, and CPW-to-ACPS transition are explained. In order to suppress parasitic modes, vias going through AlN substrate are added along the ground traces. The signal trace is tapered out and chamfered to reduce the reflection caused by the termination of ground trace. The CPW-to-ACPS transition is designed, fabricated, and measured in a backto-back configuration. The fabricated CPW-to-ACPS transition can provide a bandwidth of 165 GHz with an associated insertion loss of 3 dB.

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Validation of a Robust Neural Real-Time Voltage Estimator for Active Distribution Grids on Field Data

The installation of measurements in distribution grids enables the development of data driven methods for the power system. However, these methods have to be validated in order to understand the limitations and capabilities for their use. This paper presents a systematic validation of a neural network approach for voltage estimation in active distribution grids by means of measured data from two feeders of a real low voltage distribution grid. The approach enables a real-time voltage estimation at locations in the distribution grid, where otherwise only non-real-time measurements are available. The method shows robust behavior in all analyzed aspects, which is vital for real world applications. A methodology to select the most relevant input variables and find the best achievable performance for a particular number of inputs is presented. Moreover, the paper shows that the performance is not sensitive to the number of neurons in the hidden layer of the neural network as long as the model is not underdetermined. The paper examines the quantity of historical data needed to establish an adequately functioning model. To accommodate grid evolution and seasonal effects, the impact of different retraining intervals is investigated. Furthermore, the performance of the model during periods of high PV generation is evaluated. The validation shows that accurate voltage estimation models for distribution grids with high share of dispersed generation can be established with approximately one month of historical data. The model has to be retrained every 10 to 20 days to retain estimation mean squared errors below 0.35 V². It was also found that the performance does not decline during times of high PV generation.
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Scopus rating (2002): SJR 0.464 SNIP 0.709  
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Scopus rating (2000): SJR 0.227 SNIP 0.559  
Scopus rating (1999): SJR 0.225 SNIP 0.435  
Original language: English  
Active Distribution Grids, Data Driven Methods, Distributed Generation, Neural Networks, Real-Time Voltage Estimation, Renewable Energy Sources  
DOIs:  
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Source: PublicationPreSubmission  
Source-ID: 134654432
Value of flexible resources, virtual bidding, and self-scheduling in two-settlement electricity markets with wind generation - Part II: ISO Models and Application

In Part II of this paper, we present formulations for three two-settlement market models: baseline cost-minimization (Stoch-Opt); and two sequential market models in which an independent system operator (ISO) runs real-time (RT) balancing markets after making day-ahead (DA) generating unit commitment decisions based upon deterministic wind forecasts, while virtual bidders arbitrage the two markets (Seq and SeqSS). The latter two models differ in terms of whether some slow-start generators can self-schedule in the DA market while anticipating probabilities of RT prices. Models in Seq and Seq-SS build on components of the two-settlement equilibrium model (Stoch-MP) defined in Part I of this paper [1]. We then provide numerical results for all four models. A simple single-node case illustrates the economic impacts of flexibility, virtual bidding, and self-schedules, and is followed by a larger case study based on the 24-node IEEE reliability test system. Their results confirm that flexible resources, including fast-start generators and demand response, can reduce expected costs in a sequential two-settlement market. In addition, virtual bidders can also improve the functioning of sequential markets. In some circumstances, virtual bidders (together with self-scheduling by slow-start generators) enable deterministic ISO DA markets to obtain the least (expected) cost unit commitments.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Johns Hopkins University
Authors: Kazempour, J. (Intern), Hobbs, B. F. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.475 SNIP 3.485 CiteScore 5.31
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.523 SNIP 4.243 CiteScore 6.33
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.941 SNIP 3.387 CiteScore 5.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.586 SNIP 3.205 CiteScore 5.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2

Part one of this two-part paper presents new models for evaluating flexible resources in two-settlement electricity markets (day-ahead and real-time) with uncertain net loads (demand minus wind). Physical resources include wind together with fast- and slow-start demand response and thermal generators. We also model financial participants (virtual bidders). Wind is stochastic, represented by a set of scenarios. The two-settlement system is modeled as a two-stage process in which the first stage involves unit commitment and tentative scheduling, while the second stage adjusts flexible resources to resolve imbalances. The value of various flexible resources is evaluated through four two-settlement models: i) an equilibrium model in which each player independently schedules its generation or purchases to maximize expected profit; ii) a benchmark (expected system cost minimization); iii) a sequential equilibrium model in which the independent system operator (ISO) first optimizes against a deterministic wind power forecast; and iv) an extended sequential equilibrium model with self-scheduling by profit-maximizing slow-start generators. A tight convexified unit commitment allows for demonstration of certain equivalencies of the four models. We show how virtual bidding enhances market performance, since, together with self-scheduling by slow-start generators, it can help deterministic day-ahead market to choose the most efficient unit commitment.
Vector Flow Imaging Compared with Pulse Wave Doppler for Estimation of Peak Velocity in the Portal Vein

The study described here investigated whether angle-independent vector flow imaging (VFI) technique estimates peak velocities in the portal vein comparably to pulsed wave Doppler (PWD). Furthermore, intra- and inter-observer agreement was assessed in a substudy. VFI and PWD peak velocities were estimated from intercostal and subcostal views for 32 healthy volunteers, and precision analyses were conducted. Blinded to estimates, three physicians rescanned 10 volunteers for intra- and inter-observer agreement analyses. The precision of VFI and PWD was 18% and 28% from an intercostal view and 23% and 77% from a subcostal view, respectively. Bias between VFI and PWD was 0.57 cm/s ($p = 0.38$) with an intercostal view and 9.89 cm/s ($p$...
Vector velocity ultrasound—a new ultrasound technique

- Vector flow techniques, with their many advantages over conventional Doppler techniques, are powerful alternatives for blood flow evaluation.
- Vector flow imaging can visualise complex flow; refine the classic flow parameters; and introduce new flow parameters and insonation windows.
- These factors will reduce operator dependency, improve the logistical work flow for users and the diagnostic accuracy for patients.

General information

State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Copenhagen University Hospital
Authors: Lönn, L. (Ekstern), Jensen, J. A. (Intern), Olesen, J. B. (Intern), Nielsen, M. B. (Ekstern), Hansen, K. L. (Ekstern)
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Editor: Greenhalgh, M. R.
Main Research Area: Technical/natural sciences
Conference: Charing Cross Symposium, London, United Kingdom, 15/04/2018 - 15/04/2018
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Source-ID: 147146195
Publication: Research - peer-review Book chapter – Annual report year: 2018

Visualizing big energy data

Visualization is a crucial component of data analysis. It is always a good idea to plot the data before fitting models, making predictions, or drawing conclusions. As sensors of the electric grid are collecting large volumes of data from various sources, power industry professionals are facing the challenge of visualizing such data in a timely fashion. In this article, we demonstrate several data-visualization solutions for big energy data through three case studies involving smart-meter
data, phasor measurement unit (PMU) data, and probabilistic forecasts, respectively.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Queen's University Belfast, Monash University  
Authors: Hyndman, R. J. (Ekstern), Liu, X. A. (Ekstern), Pinson, P. (Intern)  
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Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): SNIP 1.263 SJR 0.942 CiteScore 1.93  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 1.95 SJR 1.142 SNIP 1.825  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 1.319 SNIP 2.133 CiteScore 1.97  
BFI (2014): BFI-level 2  
Scopus rating (2014): SJR 1.279 SNIP 2.106 CiteScore 1.48  
BFI (2013): BFI-level 2  
Scopus rating (2013): SJR 0.996 SNIP 2.445 CiteScore 2.34  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 2  
Scopus rating (2012): SJR 0.705 SNIP 3.12 CiteScore 3.05  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 0.961 SNIP 4.688 CiteScore 3.26  
ISI indexed (2011): ISI indexed no  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 0.742 SNIP 4.08  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.679 SNIP 2.272  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 0.615 SNIP 10.553  
Scopus rating (2007): SJR 0.403 SNIP 5.406  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 0.435 SNIP 1.965  
Scopus rating (2005): SJR 0.469 SNIP 1.17  
Scopus rating (2004): SJR 0.281 SNIP 0.77  
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**Volume of the human hippocampus and clinical response following electroconvulsive therapy**

**Background:** Hippocampal enlargements are commonly reported following electroconvulsive therapy (ECT). To clarify mechanisms, we examined if ECT induced hippocampal volume change relates to dose (number of ECT sessions and electrode placement) and acts as a biomarker of clinical outcome. Methods: Longitudinal neuroimaging and clinical data from ten independent sites participating in the Global ECT-MRI Research Collaboration were obtained for mega analysis. Hippocampal volumes were extracted from structural MR images, acquired before and after patients (n=281) experiencing a major depressive episode completed an ECT treatment series using right unilateral (RUL) and bilateral (BL) stimulation. Untreated non-depressed controls (n=95) were scanned twice. Results: The linear component of hippocampal volume change was 0.28%, 0.08 SE, per ECT session, p<0.001. Volume change varied by electrode placement in the left (BL: 3.3 ± 2.2%, d=1.5; RUL: 1.6 ± 2.1%, d=0.8; p<0.0001), but not the right hippocampus (BL: 3.0 ± 1.7%, d=1.8; RUL: 2.7 ± 2.0%, d=1.4; p=0.36). Volume change for electrode placement per ECT session varied similarly by hemisphere. Individuals with greater treatment-related volume increases had poorer outcomes (MADRS change -1.0, 0.35 SE, per 1% volume increase, p=0.005), although effects were not significant after controlling for ECT number (slope: -0.69, 0.38 SE, p=0.069). Conclusions: The number of ECT sessions and electrode placement impacts the extent and laterality of hippocampal enlargement, but volume change is not positively associated with clinical outcome. Results suggest the high efficacy of ECT is not explained by hippocampal enlargement, which alone, might not serve as a viable biomarker for treatment outcome.

**General information**

State: Accepted/In press

Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, University of Bergen, University of California, University of New Mexico, Cleveland Clinic, Feinstein Institute for Medical Research, University of Münster, Donders Institute for Brain, Cognition and Behavior, Psychiatric Center Copenhagen, Rigshospitalet, Copenhagen University Hospital, KU Leuven, VU University Medical Centre, Donders Institute for Brain, Cognition and Behavior


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Scopus rating (2016): CiteScore 7.63 SJR 6.204 SNIP 2.33

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BFI (2014): BFI-level 2

Scopus rating (2014): SJR 5.725 SNIP 2.34 CiteScore 7.26

Web of Science (2014): Indexed yes

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Scopus rating (2013): SJR 6.016 SNIP 2.376 CiteScore 8.03

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BFI (2012): BFI-level 2

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Water-Based Metasurfaces for Effective Switching of Microwaves

All-dielectric metasurfaces have recently attracted great attention in the artificial material design and related applications. Among a variety of materials, water was recently proposed for strongly resonant inclusions in such configurations due to its relatively high permittivity. We presently design and characterize polarization-sensitive metasurfaces with simple and easily fabricated “rod-like” water inclusions in a low-permittivity host, which may be tuned mechanically by rotation. Excellent agreement is reported between simulations and the experimental results, obtained in an L-band waveguide environment. Moreover, we show effective guiding and switching effects of the fields radiated by a dipole antenna located next to a stack of metasurfaces. The proposed metasurfaces may be very convenient for a variety of microwave applications owing to the low cost, abundance, and bio-friendly nature of water.

General information
State: Published
Organisations: Department of Photonics Engineering, Plasmonics and Metamaterials, Electromagnetic Systems, Department of Electrical Engineering
Authors: Jacobsen, R. E. (Intern), Lavrinenko, A. V. (Intern), Arslanagic, S. (Intern)
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Scopus rating (2017): SNIP 2.013 SJR 1.047 CiteScore 3.96
Web of Science (2017): Indexed Yes
Which Computational Methods Are Good for Analyzing Large Photonic Crystal Membrane Cavities?

By introducing defects into an otherwise periodic photonic crystal lattice, high quality (Q) factor cavities may be formed. However, the size and the lack of simplifying symmetries in the photonic crystal membrane make these types of cavities exceptionally hard to analyze using numerical simulation methods. In this work, we consider two different line defect cavities and we compute their Q factors using state-of-the-art optical simulation tools. We show that certain simulation methods perform much better than others in the analysis of these challenging structures.

General information
State: Published
Organisations: Department of Photonics Engineering, Plasmonics and Metamaterials, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Centre of Excellence for Silicon Photonics for Optical Communications, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Zuse Institute Berlin, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO)
Authors: Malureanu, R. (Intern), de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Gutsche, P. (Ekstern), Burger, S. (Ekstern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Ivinskaya, A. (Ekstern), Wang, F. (Intern), Sigmund, O. (Intern), Häyrynen, T. (Intern), Lavrinenko, A. (Intern), Mørk, J. (Intern), Gregersen, N. (Intern)

BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.45 SJR 1.114 SNIP 1.812
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.486 SNIP 1.89 CiteScore 2.9
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.442 SNIP 1.856 CiteScore 2.79
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.051 SNIP 1.677 CiteScore 2.82
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.877 SNIP 1.56 CiteScore 2.71
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.85 SNIP 1.563 CiteScore 2.32
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.697 SNIP 1.247
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.959 SNIP 1.545
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.724 SNIP 1.205
Scopus rating (2007): SJR 1.344 SNIP 2.136
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.495 SNIP 1.92
Scopus rating (2005): SJR 1.721 SNIP 1.82
Web of Science (2005): Indexed yes
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How to target inter-regional phase synchronization with dual-site Transcranial Alternating Current Stimulation

Large-scale synchronization of neural oscillations is a key mechanism for functional information exchange among brain areas. Dual-site Transcranial Alternating Current Stimulation (ds-TACS) has been recently introduced as non-invasive technique to manipulate the temporal phase relationship of local oscillations in two connected cortical areas. While the frequency of ds-TACS is matched, the phase of stimulation is either identical (in-phase stimulation) or opposite (anti-phase stimulation) in the two cortical target areas. In-phase stimulation is thought to synchronize the endogenous oscillations and thereby to improve behavioral performance. Conversely, anti-phase stimulation is thought to desynchronize neural oscillations in the two areas, which is expected to decrease performance. Critically, in- and anti-phase ds-TACS should only differ with respect to temporal phase, while all other stimulation parameters such as focality and stimulation intensity should be matched to enable an unambiguous interpretation of the behavioral effects. Using electric field simulations based on a realistic head geometry, we tested how well this goal has been met in studies, which have employed ds-TACS up to now. Separating the induced electrical fields in their spatial and temporal components, we investigated how the chosen electrode montages determined the spatial field distribution and the generation of phase variations in the injected electric fields. Considering the basic physical mechanisms, we derived recommendations for an optimized stimulation montage. The latter allows for a principled design of in- and anti-phase ds-TACS conditions with matched spatial distributions of the electric field. This knowledge will help cognitive neuroscientists to design optimal ds-TACS configurations, which are suited to probe unambiguously the causal contribution of phase coupling to specific cognitive processes in the human brain.
Ultra-wideband balanced Schottky envelope detector for data communication with high bitrate to carrier frequency ratio

This paper reports on an ultra-wideband (UWB) Schottky diode based balanced envelope detector for the L-, S-, C- and X-bands. The proposed circuit consists of a balun that splits the input signal into two 180° out of phase signals, a balanced detector, that demodulates the two signals, a low pass filter that rejects the second harmonic spurious from the Schottky diode and a bias tee that selects the optimum rectification point. The manufactured prototype is able to demodulate error free a 4 Gbps amplitude shift keying (ASK) signal at 4 GHz carrier frequency, leading to a record bitrate to frequency carrier ratio (Δb) of 100%. Besides this, the detector achieves error free demodulation for carrier frequencies between 4 and 8 GHz, while keeping the bitrate at 4 Gbps.
Optimal pseudorandom sequence selection for online c-VEP based BCI control applications

Background: In a c-VEP BCI setting, test subjects can have highly varying performances when different pseudorandom sequences are applied as stimulus, and ideally, multiple codes should be supported. On the other hand, repeating the experiment with many different pseudorandom sequences is a laborious process. Aims: This study aimed to suggest an efficient method for choosing the optimal stimulus sequence based on a fast test and simple measures to increase the performance and minimize the time consumption for research trials. Methods: A total of 21 healthy subjects were included in an online wheelchair control task and completed the same task using stimuli based on the m-code, the gold-code, and the Barker-code. Correct/incorrect identification and time consumption were obtained for each identification. Subject-specific templates were characterized and used in a forward-step first-order model to predict the chance of completion and accuracy score. Results: No specific pseudorandom sequence showed superior accuracy on the group basis. When isolating the individual performances with the highest accuracy, time consumption per identification was not significantly increased. The Accuracy Score aids in predicting what pseudorandom sequence will lead to the best performance using only the templates. The Accuracy Score was higher when the template resembled a delta function the most and when repeated templates were consistent. For completion prediction, only the shape of the template was a significant predictor. Conclusions: The simple and fast method presented in this study as the Accuracy Score, allows c-VEP based BCI systems to support multiple pseudorandom sequences without increase in trial length. This allows for more personalized BCI systems with better performance to be tested without increased costs.
A set of robotic building elements

A set of building elements (900), comprising one or more building elements (101;701;901..907) with a housing (119) which is selected from a group of straight, bend, L-shaped, and T-shaped bodies with one or more end-portions (121); wherein the building elements are configured with at least one connector (103) configured as a plug integrated with or installed in at least some of the end-portions (121). The connectors (103) comprise: an abutment face (201) with a centre portion (202); a diagonally magnetized magnet arranged behind the abutment face (201); and a pair of a female engagement member (504) extending radially from the centre portion (202) and a male engagement member (503) extending from the centre portion (202); wherein a depth (D) of the female engagement member and a height (H) of the corresponding male engagement member is greater than a width (Wm) of the male engagement member or greater than a width (Wf) of the female engagement member. At least a first building element among the building elements (101;701) comprises at least a first one of the connectors (103); wherein the at least first one of the connectors (103) is rotatable mounted in a bearing (108) fixed to the first building element. A drive unit (114) is coupled to turn the first one of connectors (103) in response to a control signal and an energy storage unit (117) is coupled to supply operating power the drive unit. Preferably, the body members (119) are tubular or tubular with one or more branches.

General information
State: Published
Resonant power converter with dead-time control of synchronous rectification circuit
The invention relates in a first aspect to a resonant power converter comprising a synchronous rectifier for supplying a DC output voltage. The synchronous rectifier is configured for alternatingly connecting a resonant output voltage to positive and negative DC output nodes via first and second semiconductor switches, respectively, separated by intervening dead-time periods in accordance with first and second rectification control signals. A dead-time controller is coupled to the resonant output voltage or the resonant input voltage and configured for adaptively adjusting lengths of the dead-time periods via the first and second rectification control signals.

Biostable glucose permeable polymer
A new biostable glucose permeable polymer has been developed which is useful, for example, in implantable glucose sensors. This biostable glucose permeable polymer has a number of advantageous characteristics and, for example, does not undergo hydrolytic cleavage and degradation, thereby providing a composition that facilitates long term sensor stability in vivo. The versatile characteristics of this polymer allow it to be used in a variety of contexts, for example to form the body of an implantable glucose sensor. The invention includes the polymer composition, sensor systems formed from this polymer composition, and methods for making and using such sensor systems.
Condition monitoring of a rotor arrangement in particular a wind turbine

The present invention relates to a method of determining the condition of a device comprising a rotor arrangement. The rotor arrangement comprising a rotational shaft and a number rotor blades each connected at the root to the rotational shaft and extending radially from the rotational shaft. Sensors are arranged to measure for each rotor blade corresponding values of one or more of the following parameters: azimuth angle (\(\Phi\)) (or a parameter related to the azimuth angle), root bending moment(s) (\(q\)), such as the edgewise and/or flapwise root bending moments. The method comprises, while the rotor arrangement rotates, recording corresponding values of azimuth angle and edgewise and flap wise root bending moments for a plurality of rotations of rotor arrangement, transforming by use of e.g. a multi blade coordinate transformation, a Park's transformation or similar transformation the recorded edgewise and flap wise root bending moments (\(q\)) into a coordinate system rotating with the rotational shaft, thereby obtaining transformed root bending moments (\(q_f\)). The method further comprising identifying periodicity in each of the transformed root bending moments, determining the condition of the rotor arrangement to be faulty, in case the one or more periodicities are identified in the transformed root bending moments.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Applied Mathematics and Computer Science, Dynamical Systems, Department of Wind Energy, Wind turbine loads & control
Authors: Niemann, H. H. (Intern), Poulsen, N. K. (Intern), Mirzaei, M. (Intern), Henriksen, L. C. (Ekstern)
Publication date: 8 Jun 2017

Resonant power converter comprising adaptive dead-time control.

The invention relates in a first aspect to a resonant power converter comprising: a first power supply rail for receipt of a positive DC supply voltage and a second power supply rail for receipt of a negative DC supply voltage. The resonant power converter comprises a resonant network with an input terminal for receipt of a resonant input voltage from a driver circuit. The driver circuit is configured for alternatingly pulling the resonant input voltage towards the positive and negative DC supply voltages via first and second semiconductor switches, respectively, separated by intervening dead-time periods in accordance with one or more driver control signals. A dead-time controller is configured to adaptively adjusting the dead-time periods based on the resonant input voltage.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Andersen, T. (Intern), Zsurzsan, T. (Intern), Ekhtiari, M. (Intern)
Publication date: 5 Jan 2017
3-D Imaging using Row–Column-Addressed 2-D Arrays with a Diverging Lens: Phantom Study

A double-curved diverging lens over a flat row–column-addressed (RCA) 2-D array can extend its inherent rectilinear 3-D imaging field-of-view (FOV) to a curvilinear volume region, which is necessary for applications such as abdominal and cardiac imaging. A concave lens with radius of 12.7 mm was manufactured using RTV664 silicone. The diverging properties of the lens were evaluated based on measurements on several phantoms. The measured 6 dB FOV in contact with a material similar to human soft tissue was less than 15% different from the theoretical predictions, i.e., a curvilinear FOV of 32°×32°. A synthetic aperture imaging sequence with single element transmissions was designed for imaging down to 14 cm at a volume rate of 88 Hz. The performance was evaluated in terms of signal-to-noise ratio (SNR), FOV, and full-width-at-half-maximum (FWHM). The penetration depth in a tissue mimicking phantom with 0.5 dB/(cm MHz) attenuation was 13 cm. The results of this study confirm that the proposed lens approach is an effective method for increasing the FOV, when imaging with RCA 2-D arrays.

3D MEMS Air-core Inductor in a Very High Frequency Switched-Mode Power Converter

General information
State: Published
Organisations: DTU Danchip, Department of Micro- and Nanotechnology, Silicon Microtechnology, Department of Electrical Engineering, Electronics
Authors: Lê Thanh, H. (Intern), Nour, Y. (Intern), Ouyang, Z. (Intern), Knott, A. (Intern), Jensen, F. (Intern), Han, A. (Intern)
Number of pages: 1
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Electronic versions:
Conf_MNE2017.pdf
3D Printing of Bio-inspired surfaces

The ability of the gecko to scurry across smooth or rough surfaces, regardless of inclination (vertical or even upside down), has been traced to the multiscale hierarchical structures of the gecko toe [1 - 3]. Considering all the strategies to manufacture bio-inspired surfaces, the most common is polymer replica molding (REM) [4]. This project will further study the influence of pillar size, shape, aspect ratio, tilting angle and levels of hierarchies in terms of wettability and adhesion, using a cost effective rapid prototyping method with direct light processing (DLP). The aim of this project will be to seek the feasibility to rapid prototype gecko surface geometries. Furthermore, a micromanufacturing method is proposed using DLP and a mask.

General information

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology
Authors: Méndez Ribó, M. (Intern), Islam, A. (Intern)
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Source: PublicationPreSubmission
Source-ID: 134387201
Publication: Research - peer-review › Poster – Annual report year: 2017

3D thermal simulations and modeling of multi-finger InP DHBTs for millimeter-wave power amplifiers

This paper presents the comparison between the simulated and measured thermal resistance of InP Double Heterojunction Bipolar Transistors (DHBT). 3D thermal simulations were carried out in order to compute the temperature distribution across the full structure due to a constant power excitation of devices with up to 8 emitter fingers. The surface temperature profile was then used to compute the average thermal resistance of the multi-finger devices. The comparison with the corresponding results obtained by electrical measurements show a good agreement. The temperature profiles from several simulations are used to extract the thermal resistance matrix used in the electro-thermal coupling network of a compact large-signal model.

General information

State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, III-V Lab
Authors: Midili, V. (Intern), Nodjiadjim, V. (Ekstern), Johansen, T. K. (Intern), Riet, M. (Ekstern), Squartecchia, M. (Intern), Dupuy, J. (Ekstern), Konczykowska, A. (Ekstern)
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75 GHz InP DHBT power amplifier based on two-stacked transistors

In this paper we present the design and measurements of a two-stage 75-GHz InP Double Heterojunction Bipolar Transistor (DHBT) power amplifier (PA). An optimized two-stacked transistor power cell has been designed, which represents the building block in the power stage as well as in the driver stage of the power amplifier. Besides the series voltage addition of the stacked structure, parallel power combining techniques were adopted to increase the output power of the MMIC amplifier, with four-way and eight-way corporate power combiners at the driver and power stages, respectively. At 75 GHz, the power amplifier exhibits a small signal gain of $G = 12.6$ dB, output power at 1-dB compression of $P_{\text{out, 1dB}} = 18.6$ dBm and a saturated output power of $P_{\text{sat}} > 21.4$ dBm.

A 60 GHz Dual-Polarized Probe for Spherical Near-Field Measurements

Dual-polarized probe systems can be used with some of the advantages: the two electric field components are simultaneously measured within a single scan, amplitude and phase drift affects the two polarization components in the same way, and there is no need for mechanical rotation of the probe. In this work we design and test a dual-polarized probe system at 60 GHz - a conical horn, including the elements: SPDT (single pole double throw) switch, an OMT (orthomode transducer) both components with 40 dB isolation - a square to circular transition (3.75 mm to 3.58 mm), cables and two coaxial to waveguide adapters up to 67 GHz for OMT-switch connection. A 27 dBi gain conical horn is designed by using WIPL-D software and in-house manufactured. The 60 GHz probe system is being assembled and tested in planar near-field (PNF) setup at DTU. The results are validated by comparison with WIPL-D simulations, showing a good agreement within the validity region, down to -30 dB pattern levels. Channel balance is carried out to compensate for the amplitude and phase differences between the signals at the OMT ports.

A Bayesian inference approach to unveil supply curves in electricity markets

With increased competition in wholesale electricity markets, the need for new decision-making tools for strategic producers has arisen. Optimal bidding strategies have traditionally been modeled as stochastic profit maximization problems. However, for producers with non-negligible market power, modeling the interactions with rival participants is
fundamental. This can be achieved through equilibrium and hierarchical optimization models. The efficiency of these methods relies on the strategic producer’s ability to model rival participants’ behavior and supply curve. But a substantial gap remains in the literature on modeling this uncertainty. In this study we introduce a Bayesian inference approach to reveal the aggregate supply curve in a day-ahead electricity market. The proposed algorithm relies on Markov Chain Monte Carlo and Sequential Monte Carlo methods. The major appeal of this approach is that it provides a complete model of the uncertainty of the aggregate supply curve, through an estimate of its posterior distribution. We show on a small case study that we are able to reveal accurately the aggregate supply curve with no prior information on rival participants. Finally we show how this piece of information can be used by a price-maker producer in order to devise an optimal bidding strategy.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.475 SNIP 3.485 CiteScore 5.31
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.523 SNIP 4.243 CiteScore 6.33
ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 1.941 SNIP 3.387 CiteScore 5.84
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Scopus rating (2011): SJR 1.586 SNIP 3.205 CiteScore 5.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
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Scopus rating (2010): SJR 1.708 SNIP 2.759
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.622 SNIP 2.675
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.309 SNIP 2.45
Web of Science (2008): Indexed yes
Accuracy and Precision of Plane Wave Vector Flow Imaging for Laminar and Complex Flow In Vivo

In this study, a comparison between velocity fields for a plane wave 2-D vector flow imaging (VFI) method and a computational fluid dynamics (CFD) simulation is made. VFI estimates are obtained from the scan of a flow phantom, which mimics the complex flow conditions in the carotid artery. Furthermore, the precision of the VFI method is investigated under laminar and complex flow conditions in vivo. The carotid bifurcation of a healthy volunteer was scanned using both fast plane wave ultrasound and magnetic resonance imaging (MRI). The acquired MRI geometry of the bifurcation was used for fabricating an anthropomorphic flow phantom, which was also ultrasound scanned. The same geometry was used in a CFD simulation to calculate the velocity field. Results showed that similar flow patterns and vortices were estimated using CFD and VFI in the phantom. Velocity magnitudes were estimated with a mean difference within 15%, however, it was 23% in the external branch. For the in vivo scan, the precision in terms of mean standard deviation (SD) of estimates aligned to the cardiac cycle was highest in the center of the common carotid artery (SD 4.7° for angles) and lowest in the external branch and close to the vessel wall (SD 15.0° for angles).

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Accuracy of averaged auditory brainstem response amplitude and latency estimates

Objective: The aims were to 1) establish which of the four algorithms for estimating residual noise level and signal-to-noise ratio (SNR) in auditory brainstem responses (ABRs) perform better in terms of post-average wave-V peak latency and amplitude errors and 2) determine whether SNR or noise floor is a better stop criterion where the outcome measure is peak latency or amplitude. Design: The performance of the algorithms was evaluated by numerical simulations using an ABR template combined with electroencephalographic (EEG) recordings obtained without sound stimulus. The suitability of a fixed SNR versus a fixed noise floor stop criterion was assessed when variations in the wave-V waveform shape reflecting inter-subject variation was introduced. Study sample: Over 100 hours of raw EEG noise was recorded from 17 adult subjects, under different conditions (e.g. sleep or movement). Results: ABR feature accuracy was similar for the four algorithms. However, it was shown that a fixed noise floor leads to higher ABR wave-V amplitude accuracy; Conversely, a fixed SNR yields higher wave-V latency accuracy. Conclusion: Similar performance suggests the use of the less computationally complex algorithms. Different stop criteria are recommended if the ABR peak latency or the amplitude is the outcome measure of interest.

General information

State: Published
Authors: Madsen, S. M. K. (Intern), M. Harte, J. (Ekstern), Elberling, C. (Ekstern), Dau, T. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.236 SNIP 1.202 CiteScore 1.79
BFI (2014): BFI-level 2
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.214 SNIP 1.485 CiteScore 1.94
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.242 SNIP 1.313 CiteScore 1.79
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.234 SNIP 1.202 CiteScore 1.78
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.069 SNIP 1.13
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Scopus rating (2009): SJR 1.2 SNIP 1.106
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.231 SNIP 1.351
A Combination of Machine Learning and Cerebellar-like Neural Networks for the Motor Control and Motor Learning of the Fable Modular Robot

We scaled up a bio-inspired control architecture for the motor control and motor learning of a real modular robot. In our approach, the Locally Weighted Projection Regression algorithm (LWPR) and a cerebellar microcircuit coexist, in the form of a Unit Learning Machine. The LWPR algorithm optimizes the input space and learns the internal model of a single robot module to command the robot to follow a desired trajectory with its end-effector. The cerebellar-like microcircuit refines the LWPR output delivering corrective commands. We contrasted distinct cerebellar-like circuits including analytical models and spiking models implemented on the SpiNNaker platform, showing promising performance and robustness results.

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A Combination of Machine Learning and Cerebellar Models for the Motor Control and Learning of a Modular Robot

We scaled up a bio-inspired control architecture for the motor control and motor learning of a real modular robot. In our approach, the Locally Weighted Projection Regression algorithm (LWPR) and a cerebellar microcircuit coexist, forming a Unit Learning Machine. The LWPR optimizes the input space and learns the internal model of a single robot module to command the robot to follow a desired trajectory with its end-effector. The cerebellar microcircuit refines the LWPR output delivering corrective commands. We contrasted distinct cerebellar circuits including analytical models and spiking models implemented on the SpiNNaker platform, showing promising performance and robustness results.
A combined constraint handling framework: an empirical study

This paper presents a new combined constraint handling framework (CCHF) for solving constrained optimization problems (COPs). The framework combines promising aspects of different constraint handling techniques (CHTs) in different situations with consideration of problem characteristics. In order to realize the framework, the features of two popular used CHTs (i.e., Deb’s feasibility-based rule and multi-objective optimization technique) are firstly studied based on their relationship with penalty function method. And then, a general relationship between problem characteristics and CHTs in different situations (i.e., infeasible situation, semi-feasible situation, and feasible situation) is empirically obtained. Finally, CCHF is proposed based on the corresponding relationship. Also, for the first time, this paper demonstrates that multi-objective optimization technique essentially can be expressed in the form of penalty function method. As CCHF combines promising aspects of different CHTs, it shows good performance on the 22 well-known benchmark test functions. In general, it is comparable to the other four differential evolution-based approaches and five dynamic or ensemble state-of-the-art approaches for constrained optimization.
A Combined Reliability Model of VSC-HVDC Connected Offshore Wind Farms Considering Wind Speed Correlation

This paper proposes a combined reliability model of voltage source converter-based high voltage direct current (VSC-HVDC) connected offshore wind farms (WFs) using the frequency and duration technique. Firstly, a two-dimensional multi-state WF model is developed considering wind speed variations and WTGs outage. The wind speed correlation between different WFs is included in the two-dimensional multistate WF model by using an improved k-means clustering method. Then, the entire system with two WFs and a threeterminal VSC-HVDC system is modeled as a multi-state generation unit. The proposed model is applied to the Roy Billinton test system (RBTS) for adequacy studies. Both the probability and frequency indices are calculated. The effectiveness and accuracy of the combined model is validated by comparing results with the sequential Monte Carlo simulation (MCS) method. The effects of the outage of VSC-HVDC system and wind speed correlation on the system reliability were analyzed. Sensitivity analyses were conducted to investigate the impact of repair time of the offshore VSC-HVDC system on system reliability.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 7.8 SJR 2.368 SNIP 2.967
Web of Science (2016): Indexed yes
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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.554 SNIP 3.898 CiteScore 7.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.043 SNIP 3.712 CiteScore 7.03
ISI indexed (2013): ISI indexed no
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Scopus rating (2012): SJR 1.243 SNIP 3.744 CiteScore 6.58
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A comprehensive gaze stabilization controller based on cerebellar internal models

Gaze stabilization is essential for clear vision; it is the combined effect of two reflexes relying on vestibular inputs: the vestibulocollic reflex (VCR), which stabilizes the head in space and the vestibulo-ocular reflex (VOR), which stabilizes the visual axis to minimize retinal image motion. The VOR works in conjunction with the opto-kinetic reflex (OKR), which is a visual feedback mechanism that allows to move the eye at the same speed as the observed scene. Together they keep the image stationary on the retina. In this work we implement on a humanoid robot a model of gaze stabilization based on the coordination of VCR and VOR and OKR. The model, inspired by neuroscientific cerebellar theories, is provided with learning and adaptation capabilities based on internal models. We present the results for the gaze stabilization model on three sets of experiments conducted on the SABIAN robot and on the iCub simulator, validating the robustness of the proposed control method. The first set of experiments focused on the controller response to a set of disturbance frequencies along the vertical plane. The second shows the performances of the system under three-dimensional disturbances. The last set of experiments was carried out to test the capability of the proposed model to stabilize the gaze in locomotion tasks. The results confirm that the proposed model is beneficial in all cases reducing the retinal slip (velocity of the image on the retina) and keeping the orientation of the head stable.
A Continuous-Time Delta-Sigma ADC for Portable Ultrasound Scanners

A fully differential fourth-order 1-bit continuous-time delta-sigma ADC designed in a 65nm process for portable ultrasound scanners is presented in this paper. The circuit design, implementation and measurements on the fabricated die are shown. The loop filter consists of RC-integrators, programmable capacitor arrays, resistors and voltage feedback DACs. The quantizer contains a pulse generator, a high-speed clocked comparator and a pull-down clocked latch to ensure constant delay in the feedback loop. Using this implementation, a small and low-power solution required for portable ultrasound scanner applications is achieved. The converter has a supply voltage of 1.2V, a bandwidth of 10MHz and an oversampling ratio of 16 leading to an operating frequency of 320MHz. The design occupies a die area of 0.0175mm². Simulations with extracted parasitics show a SNR of 45.2dB and a current consumption of 489 µA. However, by adding a model of the measurement setup used, the performance degrades to 42.1dB. The measured SNR and current consumption are 41.6dB and 495 µA, which closely fit with the expected simulations. Several dies have been measured, and an estimation of the die spread distribution is given.

General information
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Authors: Llimos Muntal, P. (Intern), Jørgensen, I. H. H. (Intern), Bruun, E. (Intern)
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Scopus rating (2014): SJR 0.223 SNIP 0.61 CiteScore 0.64
Adoption of Battery Energy Storage Systems (BESSs) for provision of grid services is increasing. This paper investigates the applications of BESS for the grid upgrade deferral and voltage support of Medium Voltage (MV) distribution systems. A BESS is modelled in Matlab/Simulink to perform peak load shaving and voltage support service from the perspective of Distribution System Operators (DSOs). An active power support algorithm is implemented and the effects of various load profiles as well as different Photovoltaic (PV) penetration scenarios on the operation of BESS and the optimal BESS converter size for peak load shaving are investigated. The BESS annual lifetime degradation is also estimated using a rainflow counting algorithm. A reactive power support algorithm embedded with Q-U droop control is proposed in order to reduce the voltage drop in a part of 10 kV distribution network of Nordhavn in Copenhagen, and the effects of active and reactive power support by BESS on the grid voltage are investigated.

**General information**

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**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management

**Authors:** Wang, J. (Intern), Hashemi Toghroljerdi, S. (Intern), You, S. (Intern), Træholt, C. (Intern)
Active Distribution Grid Management based on Robust AC Optimal Power Flow

Further integration of distributed renewable energy sources in distribution systems requires a paradigm change in grid management by the distribution system operators (DSO). DSOs are currently moving to an operational planning approach based on activating flexibility from distributed energy resources in day/hour-ahead stages. This paper follows the DSO trends by proposing a methodology for active grid management by which robust optimization is applied to accommodate spatial-temporal uncertainty. The proposed method entails the use of a multi-period AC-OPF, ensuring a reliable solution for the DSO. Wind and PV uncertainty is modeled based on spatial-temporal trajectories, while a convex hull technique to define uncertainty sets for the model is used. A case study based on real generation data allows illustration and discussion of the properties of the model. An important conclusion is that the method allows the DSO to increase system reliability in the real-time operation. However, the computational effort grows with increases in system robustness.
Increasing environmental concerns are driving an evolution of the energy system, in which the electrification of the transport sector is considered to be a crucial element. Successful electric vehicle (EV) introduction potentially allows the reduction of CO2 emissions, but also represents a substantial challenge for the power system, especially at the distribution level where high EV concentrations cause various detrimental effects. More specifically, the low-voltage grid operation becomes challenging since uncontrolled EV charging typically coincides with the peak residential consumption, resulting in a considerable peak load and severe voltage deviations. However, EVs hold potential for providing services beyond transportation and, thus, should not be considered merely as passive loads. If managed properly, EVs become flexible resources which can enhance the grid operation, making them an attractive asset for the distribution system operator (DSO). This thesis investigates how EVs can mitigate the self-induced adverse effects and actively help the distribution grid operation, either autonomously or in coordination, e.g., with an EV aggregator. The general framework for EV integration is presented, including the contemporary technology, the relevant stakeholders and the most important challenges. EV flexibility provision to DSOs is studied both from the technical and the regulatory perspective in order to identify the barriers for active EV involvement, and provide a set of policy recommendations for overcoming them. The potential benefits and drawbacks of introducing EV reactive power capability for voltage support are analysed. A decentralised reactive power control is proposed which can, given the appropriate equipment sizing, support the distribution grid independent of the active power modulation. Such an autonomous controller relies only on the local voltage measurement and can be implemented in the short-term future by using the inherent functionality of the EV power electronics. The impact of the proposed control is investigated on a Danish low-voltage grid with the assessment of grid parameters in various conditions. A multi-objective framework is developed for the optimal EV day-ahead scheduling in unbalanced distribution grids. The framework assesses the trade-off between the DSO’s and the EV aggregator’s economic concerns, and uses a fuzzy-satisfying method to balance the interest of both parties. Moreover, the impact of the additional EV reactive power support is analysed when EVs are the only flexible resource, as well as when combined with other demand response. Experimental activities were conducted to validate the technical feasibility of contemporary EVs to provide flexibility services, both in a laboratory environment and in a real distribution grid. The emphasis was put on assessing several EV parameters, such as EV responsiveness and EV accuracy, to provide basis for future theoretical work, as well as recommendations for improvement. Overall, it is shown that EVs can actively support the distribution grid operation, but there is a critical gap between the political sustainability plans, and the implemented standards and regulatory framework. Moreover, it is demonstrated that DSOs can benefit from the potential EV reactive power control without substantially influencing the losses or the EV aggregator’s cost. Finally, it is proven that series-produced EVs are capable of providing various flexibility services within several seconds, but their accuracy might arise as a topic of concern.
Acute dosing of vortioxetine strengthens event-related brain activity associated with engagement of attention and cognitive functioning in rats

Studies of the antidepressant vortioxetine have demonstrated beneficial effects on cognitive dysfunction associated with depression. To elucidate how vortioxetine modulates neuronal activity during cognitive processing we investigated the effects of vortioxetine (3 and 10 mg/kg) in rats performing an auditory oddball (deviant target) task. We investigated neuronal activity in target vs non-target tone responses in vehicle-treated animals using electroencephalographic (EEG) recordings. Furthermore, we characterized task performance and EEG changes in target tone responses of vortioxetine vs controls. Quantification of event-related potentials (ERPs) was supplemented by analyses of spectral power and inter-trial phase-locking. The assessed brain regions included prelimbic cortex, the hippocampus, and thalamus. As compared to correct rejection of non-target tones, correct target tone responses elicited increased EEG power in all regions. Additionally, neuronal synchronization was increased in vehicle-treated rats during both early and late ERP responses to target tones. This indicates a significant consistency of local phases across trials during high attentional load. During early sensory processing, vortioxetine increased both thalamic and frontal synchronized gamma band activity and EEG power in all brain regions measured. Finally, vortioxetine increased the amplitude of late hippocampal P3-like ERPs, the rodent correlate of the human P300 ERP. These findings suggest differential effects of vortioxetine during early sensory registration and late endogenous processing of auditory discrimination. Strengthened P3-like ERP response may relate to the pro-cognitive profile of vortioxetine in rodents. Further investigations are warranted to explore the mechanism by which vortioxetine increases network synchronization during attentive and cognitive processing.
Adapted wavelet transform improves time-frequency representations: a study of auditory elicited P300-like event-related potentials in rats.

Objective. Active auditory oddball paradigms are simple tone discrimination tasks used to study the P300 deflection of event-related potentials (ERPs). These ERPs may be quantified by time-frequency analysis. As auditory stimuli cause early high frequency and late low frequency ERP oscillations, the continuous wavelet transform (CWT) is often chosen for decomposition due to its multi-resolution properties. However, as the conventional CWT traditionally applies only one mother wavelet to represent the entire spectrum, the time-frequency resolution is not optimal across all scales. To account for this, we developed and validated a novel method specifically refined to analyse P300-like ERPs in rats. Approach. An adapted CWT (aCWT) was implemented to preserve high time-frequency resolution across all scales by commissioning of multiple wavelets operating at different scales. First, decomposition of simulated ERPs was illustrated using the classical CWT and the aCWT. Next, the two methods were applied to EEG recordings obtained from prefrontal cortex in rats performing a two-tone auditory discrimination task. Main results. While only early ERP frequency changes between responses to target and non-target tones were detected by the CWT, both early and late changes were successfully described with strong accuracy by the aCWT in rat ERPs. Increased frontal gamma power and phase synchrony was observed particularly within theta and gamma frequency bands during deviant tones. Significance. The study suggests superior performance of the aCWT over the CWT in terms of detailed quantification of time-frequency properties of ERPs. Our methodological investigation indicates that accurate and complete assessment of time-frequency components of short-time neural signals is feasible with the novel analysis approach which may be advantageous for characterisation of several types of evoked potentials in particularly rodents.

General information
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Adaptive feedforward control of exhaust recirculation in large diesel engines

Environmental concern has led the International Maritime Organization to restrict NO\textsubscript{x} emissions from marine diesel engines. Exhaust gas recirculation (EGR) systems have been introduced in order to comply to the new standards. Traditional fixed-gain feedback methods are not able to control the EGR system adequately in engine loading transients so alternative methods are needed. This paper presents the design, convergence proofs and experimental validation of an adaptive feedforward controller that significantly improves the performance in loading transients. First the control concept is generalized to a class of first order Hammerstein systems with sensor delay and exponentially converging bounds of the control error are proven analytically. It is then shown how to apply the method to the EGR system of a two-stroke crosshead diesel engine. The controller is validated by closed loop simulation with a mean-value engine model, on an engine test bed and on a vessel operating at sea. A significant reduction of smoke formation during loading transients is observed both visually and with an opacity sensor.
Adaptive heart rate-based epileptic seizure detection using real-time user feedback

Automated seizure detection in a home environment has been of increased interest the last couple of decades. Heart rate-based seizure detection is a way to detect temporal lobe epilepsy seizures at home, but patient-independent algorithms showed to be insufficiently accurate due to the high patient-dependency of heart rate features. Therefore a real-time adaptive seizure detection algorithm is proposed here. The algorithm starts as a patient-independent algorithm, but gradually converges towards a patient-specific algorithm while more patient-specific data becomes available on-the-run. This is done by using real-time user feedback to annotate previously generated alarms, causing an immediate update to the used support vector machine classifier. Extra procedures are added to the updating procedure in order to cope with potential incorrect user feedback. The adaptive seizure detection algorithm resulted in an overall sensitivity of 77.12% and 1.24 false alarms per hour on over 2833 hours of heart rate data from 19 patients with 153 clinical seizures. This is around 30% less false alarms compared to the patient-independent algorithm. This low-complex adaptive algorithm showed to be able to deal well with incorrect user feedback, making it ideal for implementation in a home environment for a seizure warning system.

General information
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Scopus rating (2017): SNIP 1.177 SJR 0.731 CiteScore 2.39
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 0.689 SNIP 1.073
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.828 SNIP 1.366 CiteScore 2.24
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.608 SNIP 1.376 CiteScore 2.2
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.745 SNIP 1.623 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.541 SNIP 1.272 CiteScore 2
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.671 SNIP 1.239 CiteScore 2.19
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.653 SNIP 1.517
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.67 SNIP 1.407
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.691 SNIP 1.317
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.848 SNIP 1.383
Web of Science (2007): Indexed yes
Addressing the Conflict of Interest between Aggregators and DSOs in Deregulated Energy Markets

This paper investigates potential conflicts of interest between distribution system operators (DSOs) and aggregators. We propose a method to quantify the allowed operating range of residential flexible loads in a local distribution network. The calculated bounds can be used to formulate DSO services, tradable on a potential DSO service market platform. Aggregators are considered, concentrating thermostatically controlled loads and electric vehicles with vehicle2grid technology in order to perform arbitrage on the power market and to offer ancillary services.

A Decision Support Tool for Transient Stability Preventive Control

The paper presents a decision support tool for transient stability preventive control contributing to increased situation awareness of control room operators by providing additional information about the state of the power system in terms of transient stability. A time-domain approach is used to assess the transient stability for potentially critical faults. Potential critical fault locations are identified by a critical bus screening through analysis of pre-disturbance steady-state conditions. The identified buses are subject to a fast critical contingency screening determining the actual critical contingencies/buses. These two screenings aim at reducing the computational burden of the assessment, since only contingencies considered as critical are taken into account. The critical clearing times for the critical contingencies are determined. A preventive re-d dispatch of generators to ensure a predefined minimum critical clearing time for faults at all buses is proposed, while costs are minimized. The results of the assessment are presented to the control room operator, who decides to accept the suggested dispatch or to repeat the assessment considering additional user-specific constraints. The effectiveness of the proposed method is demonstrated on a standard nine-bus and the New England test system.
A Design Method for Mode-Selective Waveguide Couplers in Dual-Polarized Wideband Matched-Feed Antennas

A novel type of multihole directional coupler is presented as well as a design method involving novel procedures. The device couples two orthogonal TE11 modes in a circular waveguide into two orthogonal TE21 modes with specified excitations in a surrounding coaxial waveguide, which has the circular waveguide as inner conductor. A simple, novel analytical procedure is used to determine azimuthal hole positions, such that each of the input modes couples to only the desired coaxial TE21 mode. The method is applied to a specific coupler which is designed to couple –14 dB to both higher-order coaxial modes in the band from 10 GHz to 14 GHz. The suppression of undesired modes is generally better than 40 dB. The coupler is intended for broadband, dual-polarized matched feeds, which are able to compensate the intrinsically high cross polarization of offset single reflector antenna systems.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, TICRA
Authors: Palvig, M. F. (Intern), Meincke, P. (Ekstern), Jørgensen, E. (Ekstern), Breinbjerg, O. (Intern)
Pages: 990 - 995
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Main Research Area: Technical/natural sciences

Publication information
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Volume: 66
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 2.244 SJR 1.309 CiteScore 4.65
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.8 SJR 1.226 SNIP 2.013
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.743 SNIP 2.432 CiteScore 3.48
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.766 SNIP 2.56 CiteScore 3.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.377 SNIP 2.219 CiteScore 3.65
ISI indexed (2013): ISI indexed yes
Compared with conventional 2-D ultrasound imaging, real-time 3-D (or 4-D) ultrasound imaging has several advantages, resulting in a significant progress in the ultrasound imaging instrumentation over the past decade. Viewing the patient’s anatomy as a volume helps physicians to comprehend the important diagnostic information in a noninvasive manner. Diagnostic and therapeutic decisions often require accurate estimates of e.g., organ, cyst, or tumor volumes. 3-D ultrasound imaging can provide these measurements without relying on the geometrical assumptions and operator-dependent skills involved in such estimations using 2-D scans. Although the detail resolution of ultrasound cannot compete with 3-D imaging modalities such as CT and MRI, the combination of patient safety by using nonionizing radiation, cost-effectiveness, portability, and real-time imaging ability makes ultrasound the preferred choice in many clinical applications. Real-time 3-D ultrasound imaging is still not as widespread in use in the clinics as 2-D ultrasound imaging. Two limiting factors have traditionally been the low image quality as well as low volume rate achievable with a 2-D transducer array using the conventional 3-D beamforming technique, Parallel Beamforming. The first part of the scientific contributions of this Ph.D. project demonstrate that 3-D synthetic aperture imaging achieves a better sensitivity and a higher volume rate than the parallel beamforming technique. Data were obtained using both Field II simulations and...
measurements with the ultrasound research scanner SARUS and a 3.8 MHz 1024 element 2-D transducer array. In all investigations, 3-D synthetic aperture imaging achieved a better resolution, lower side-lobes, higher contrast, and better signal to noise ratio than parallel beamforming. This is achieved partly because synthetic aperture imaging removes the limitation of a fixed transmit focal depth and instead enables dynamic transmit focusing. Particularly, synthetic aperture imaging could increase the achievable volume rate compared with parallel beamforming, to almost 50 times. Lately, the major ultrasound companies have produced ultrasound scanners using 2-D transducer arrays with enough transducer elements to produce high quality 3-D images. Because of the large matrix transducers with integrated custom electronics, these systems are extremely expensive. The relatively low price of ultrasound scanners is one of the factors for the widespread use of ultrasound imaging. The high price tag on the high quality 3-D scanners is limiting their market share. Row-column addressing of 2-D transducer arrays is a low cost alternative to fully addressed 2-D arrays, for 3-D ultrasound imaging. Using row-column addressing, the number of transducer elements is dramatically reduced. This reduces the interconnection cost and removes the need to integrate custom made electronics into the probe. Two downsides of row-column addressing 2-D arrays are its lower lateral resolution due to its one-way focusing compared with two-way focusing in fully addressed 2-D arrays and also the inherent forward-looking imaging field of view. In the second part of the scientific contributions of this Ph.D. project, row-column addressing of 2-D arrays was investigated to assess the possibilities and drawbacks associated with transducer arrays using this addressing scheme, when integrated into probe handles. For that reason, two in-house prototyped 62+62 row-column addressed 2-D array transducer probes were manufactured using capacitive micromachined ultrasonic transducer (CMUT) and piezoelectric transducer (PZT) technology. Based on a set of acoustical measurements the center frequency, bandwidth, surface pressure, sensitivity, and acoustical cross-talks were evaluated and discussed. The imaging quality assessments were carried out based on Field II simulations as well as phantom measurements. Moreover, an analysis on comparing the lateral resolution with a fully addressed array were presented. To improve the imaging sensitivity, spatial matched filter beamforming was used as well as delay-and-sum approach. An analysis on increasing the inherent forward-looking achievable field of view of a flat row-column addressed 2-D array by using a double curved row-column addressed 2-D array was presented. A delay-and-sum beamforming approach suitable for a double curved row-column addressed 2-D array was introduced. Due to challenges on manufacturing double curved 2-D arrays, using a diverging acoustical lens was proposed and its imaging abilities were evaluated based on Field II simulations and measurements. Thereby, the inherent imaging limitation with flat row-column addressed 2-D arrays was overcome by using a diverging lens. Overall, having a low channel count and a large field of view, offers the potential to fabricate arrays with large aperture sizes, which is important for abdominal scans. Thus by using a curved row-column addressed 2-D array, 3-D imaging with equipment in the price range of conventional 2-D imaging could be possible. The main part of the thesis consists of eight scientific papers submitted for international conferences and journals during the Ph.D. project.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Biomedical Engineering, BK Medical Aps  
Authors: Bouzari, H. (Intern), Jensen, J. A. (Intern), Nikolov, S. I. (Ekstern), Stuart, M. B. (Intern)  
Number of pages: 302  
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Publisher: Technical University of Denmark, Department of Electrical Engineering  
Original language: English  
Main Research Area: Technical/natural sciences  
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**Relations**

Projects:  
Advanced 3-D Ultrasound Imaging: 3-D Synthetic Aperture Imaging using Fully Addressed and Row-Column Addressed 2-D Transducer Arrays.  
Source: PublicationPreSubmission  
Source-ID: 129911888  
Publication: Research › Ph.D. thesis – Annual report year: 2017

**A Full-Size High-Temperature Superconducting Coil Employed in a Wind Turbine Generator Setup**

A full-size stationary experimental setup, which is a pole pair segment of a 2 MW high-temperature superconducting (HTS) wind turbine generator, has been built and tested under the HTS-GEN project in Denmark. The performance of the HTS coil is crucial to the setup, and further to the development of the full generator. This paper deals with the HTS coil employed in the setup. The coil utilizing YBCO tapes is double-layered with 152 turns per layer and is wound on an FeNi9 iron core. Several sensors are installed to monitor the operating status of the coil, e.g., temperature, field, and voltage. The coil is tested in LN2 first, and then tested in the setup so that the magnetic environment in a real generator is reflected. The experimental results are reported, followed by a finite-element simulation and a discussion on the deviation of the results. The tested and estimated Ic in LN2 are 148 A and 143 A, respectively. When tested in the setup, the maximum temperature of the coil is controlled at 77 K and 40 K, and the I-V curves under both conditions are presented. It is found that the lower half coil that is closer to the stator has a smaller Ic due to a higher field level. The study is of
significance to the development of HTS generators.

**General information**

State: Published
Authors: Song, X. (Intern), Mijatovic, N. (Intern), Kellers, J. (Ekstern), Bührer, C. (Ekstern), Rebsdorf, A. V. (Ekstern), Hansen, J. (Ekstern), Christensen, M. (Ekstern), Krause, J. (Ekstern),Wiezoreck, J. (Ekstern), Pütz, H. (Ekstern), Holbøll, J. (Intern)
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.45 SJR 0.408 SNIP 0.962
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.42 SJR 0.398 SNIP 1.145
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.403 SNIP 1.06 CiteScore 1.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.478 SNIP 1.13 CiteScore 0.83
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.443 SNIP 1.156 CiteScore 1.32
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.555 SNIP 1.274 CiteScore 1.11
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.368 SNIP 1.062 CiteScore 1.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.473 SNIP 1.065
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.447 SNIP 1.021
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.884 SNIP 0.981
Scopus rating (2007): SJR 0.629 SNIP 1.093
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.734 SNIP 1.05
Scopus rating (2005): SJR 0.652 SNIP 0.992
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.882 SNIP 0.904
Scopus rating (2003): SJR 0.51 SNIP 1.054
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.226 SNIP 1.024
Scopus rating (2001): SJR 0.552 SNIP 1.368
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.498 SNIP 0.998
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 1.054 SNIP 2.065

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a.c. machines, Finite element analysis, High-temperature superconducting materials, Superconducting coils and magnets, Wind power plants, barium compounds, copper compounds, finite element analysis, high-temperature superconductors, iron alloys, nickel alloys, superconducting coils, turbogenerators, wind turbines, yttrium compounds, wind turbine generator setup, HTS wind turbine generator, Denmark, HTS coil, YBCO tapes, iron core, finite-element simulation, I–V curves, full-size high-temperature superconducting coil, full-size stationary experimental setup, pole pair segment, HTS-GEN project, magnetic environment, power 2 MW, current 148 A, current 143 A, temperature 77 K to 40 K, FeNi9, YBCO

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Aggregation of Single-phase Electric Vehicles for Frequency Control Provision Based on Unidirectional Charging
As the use of electric vehicles grows there is a greater possibility of using aggregated sets of electric vehicles as a large flexible unit to assist with the control of the power system. In this paper, the possibility of using electric vehicles as a flexible load for frequency control is investigated. The investigations are performed in a Pan-European interconnected grid with varying wind power penetration and different operational scenarios. Within this grid, the paper focuses on primary frequency control provision from electric vehicles and how the system behaves as the vehicles are being controlled within their respective areas. The investigations show that electric vehicles can be used for primary frequency control with different wind power penetration. By controlling the vehicles, the steady state frequency is improved and, since the vehicles react fast enough to the frequency changes, also frequency nadir and rate of change of frequency are positively affected.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources, Technical University of Denmark
Authors: Sæmundsson, V. T. (Ekstern), Rezkalla, M. M. (Intern), Zecchino, A. (Intern), Marinelli, M. (Intern)
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Publisher: IEEE
Main Research Area: Technical/natural sciences
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Electric vehicles, Frequency control, Power system stability, Power system modeling

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Aggregation_of_single_phase_electric_vehicles_full_paper_Final.pdf

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Source: PublicationPreSubmission
Source-ID: 133576074
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A high-speed Schottky detector for ultra-wideband communications
This letter reviews the design procedure of a high-speed Schottky video detector for high-data-rate communications within the ultra-wideband (UWB) frequencies. The classic design approach for video detectors is extended with a mixer-like analysis, which results in a more detailed assessment of the detector performance. The designed circuit is reviewed and measurements are provided for a manufactured prototype. The detector can successfully demodulate 2.5 Gbps video signals around a 7 GHz carrier. The bitrate to carrier frequency ratio of 35.7% is the highest reported for detectors at UWB frequencies. Using 0 dBm carrier power, the lowest measured conversion loss is 10 dB for a video frequency of 1.1 GHz and better than 13 dB up to 1.8 GHz.
Allocation of synchronous condensers for restoration of system short-circuit power

Modern power systems, employing an increasing number of converter-based renewable energy sources (RES) and decreasing the usage of conventional power plants, are leading to lower levels of short-circuit power and rotational inertia. A solution to this is the employment of synchronous condensers in the grid, in order to provide sufficient short-circuit power. This results in the increase of the short-circuit ratio (SCR) at transmission system bus-bars serving as points of interconnection (POI) to renewable generation. Evaluation of the required capacity and grid-location of the synchronous condensers, is inherently a mixed integer non-linear optimization problem, which could not be done on manual basis considering each type of machine and all bus-bars. This study therefore proposes a method of optimal allocation of synchronous condensers in a hypothetic future scenario of a transmission system fed by renewable generation. Total cost of synchronous condenser installations in the system is minimized and the SCRs at the POIs of central renewable power plants are strengthened. The method has potential for application on larger grids, aiding grid-integration of RES.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark, Siemens A/S
Authors: Marrazi, E. (Ekstern), Yang, G. (Intern), Weinreich-Jensen, P. (Ekstern)
Pages: 17–26
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Main Research Area: Technical/natural sciences

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Scopus rating (2017): CiteScore 3.81
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 3.35
Web of Science (2016): Indexed yes
Scopus rating (2015): SNIP 1.478 CiteScore 2.45
Web of Science (2015): Indexed yes
Scopus rating (2014): SNIP 0.678
Web of Science (2014): Indexed yes
ISI indexed (2013): ISI indexed no
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Electronic versions:
10.1007_2Fs40565_017_0346_4.pdf
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Source: PublicationPreSubmission
A Measure Based on Beamforming Power for Evaluation of Sound Field Reproduction Performance

This paper proposes a measure to evaluate sound field reproduction systems with an array of loudspeakers. The spatially-averaged squared error of the sound pressure between the desired and the reproduced field, namely the spatial error, has been widely used, which has considerable problems in two conditions. First, in non-anechoic conditions, room reflections substantially deteriorate the spatial error, although these room reflections affect human localization to a lesser degree. Second, for 2.5-dimensional reproduction of spherical waves, the spatial error increases consistently due to the difference in the amplitude decay rate, whereas the degradation of human localization performance is limited. The measure proposed in this study is based on the beamforming powers of the desired and the reproduced fields. Simulation and experimental results show that the proposed measure is less sensitive to room reflections and the amplitude decay than the spatial error, which is likely to agree better with the human perception of source localization.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Korea Research Institute of Standards and Science
Authors: Chang, J. (Ekstern), Jeong, C. (Intern)
Number of pages: 15
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Main Research Area: Technical/natural sciences

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Volume: 7
Issue number: 3 - Special Issue 'Spatial Audio'
Article number: 249
ISSN (Print): 1454-5101
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.494 SJR 0.172 CiteScore 1.09
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.03 SJR 0.109 SNIP 0.101
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.213 SNIP 0.346 CiteScore 0.34
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.115 SNIP 0.198 CiteScore 0.21
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.234 SNIP 0.898 CiteScore 0.42
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.334 SNIP 0.951 CiteScore 0.67
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.283 SNIP 0.712 CiteScore 0.51
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.304 SNIP 0.711
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.218 SNIP 0.344
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.151 SNIP 0.525
Scopus rating (2007): SJR 0.144 SNIP 1.15
Scopus rating (2006): SJR 0.116 SNIP 0.185
Scopus rating (2005): SJR 0.101 SNIP 0
Scopus rating (2004): SJR 0.101 SNIP 0
Scopus rating (2003): SJR 0.101 SNIP 0
Scopus rating (2002): SJR 0.121 SNIP 0.019
Scopus rating (2001): SJR 0.101 SNIP 0
A Meteorological Information Mining-Based Wind Speed Model for Adequacy Assessment of Power Systems With Wind Power

Accurate wind speed simulation is an essential prerequisite to analyze the power systems with wind power. A wind speed model considering meteorological conditions and seasonal variations is proposed in this paper. Firstly, using the path analysis method, the influence weights of meteorological factors are calculated. Secondly, the meteorological data are classified into several states using an improved Fuzzy C-means (FCM) algorithm. Then the Markov chain is used to model the chronological characteristics of meteorological states and wind speed. The proposed model was proved to be more accurate in capturing the characteristics of probability distribution, auto-correlation and seasonal variations of wind speed compared with the traditional Markov chain Monte Carlo (MCMC) and autoregressive moving average (ARMA) model. Furthermore, the proposed model was applied to adequacy assessment of generation systems with wind power. The assessment results of the modified IEEE-RTS79 and IEEE-RTS96 demonstrated the effectiveness and accuracy of the proposed model.
A Methodology for Anatomic Ultrasound Image Diagnostic Quality Assessment

This paper discusses methods for assessment of ultrasound image quality based on our experiences with evaluating new methods for anatomic imaging. It presents a methodology to ensure a fair assessment between competing imaging methods using clinically relevant evaluations. The methodology is valuable in the continuing process of method optimization and guided development of new imaging methods. It includes a three phased study plan covering from initial prototype development to clinical assessment. Recommendations to the clinical assessment protocol, software, and statistical analysis are presented. Earlier uses of the methodology has shown that it ensures validity of the assessment, as it separates the influences between developer, investigator, and assessor once a research protocol has been established. This separation reduces confounding influences on the result from the developer to properly reveal the clinical value. The paper exemplifies the methodology using recent studies of Synthetic Aperture Sequential Beamforming tissue harmonic imaging.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, University of Copenhagen
Authors: Hemmsen, M. C. (Intern), Lange, T. (Ekstern), Brandt, A. H. (Ekstern), Nielsen, M. B. (Ekstern), Jensen, J. A. (Intern)
Number of pages: 12
Publication date: 2017
A method to investigate the biomechanical alterations in Perthes' disease by hip joint contact modeling

Perthes' disease is a destructive hip joint disorder characterized by malformation of the femoral head in young children. While the morphological changes have been widely studied, the biomechanical effects of these changes still need to be further elucidated. The objective of this study was to develop a method to investigate the biomechanical alterations in Perthes' disease by finite element (FE) contact modeling using MRI. The MRI data of a unilateral Perthes' case was obtained to develop the three-dimensional FE model of the hip joint. The stress and contact pressure patterns in the unaffected hip were well distributed. Elevated concentrations of stress and contact pressure were found in the Perthes' hip. The highest femoral cartilage von Mises stress 3.9 MPa and contact pressure 5.3 MPa were found in the Perthes' hip, whereas 2.4 MPa and 4.9 MPa in the healthy hip, respectively. The healthy bone in the femoral head of the Perthes' hip carries additional loads as indicated by the increase of stress levels around the necrotic-healthy bone interface. Identifying the biomechanical changes, such as the location of stress and contact pressure concentrations, is a prerequisite for the preoperative planning to obtain stress relief for the highly stressed areas in the malformed hip. This single-patient study demonstrated that the biomechanical alterations in Perthes' disease can be evaluated individually by patient-specific finite element contact modeling using MRI. A multi-patient study is required to test the strength of the proposed method as a pre-surgery planning tool.
A microwave window for K band electromagnetic systems
This article proposes a solution for microwave window at K band. Properties of the window such as performance (transparency) at microwave frequencies, dimensions, and mounting place are discussed. The dimensions of the window were optimized in a full-wave simulator. To verify the design and simulation results the prototype of the window is realized by implementing into transition section and tested experimentally. The microwave window provides low return loss $|S_{11}|$ below $-30$ dB, low insertion loss $|S_{21}|$ below $-0.5$ dB and can be used for electromagnetic systems where vacuum sealing is required. © 2017 Wiley Periodicals, Inc.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance
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Pages: 834-7
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
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BFI (2017): BFI-level 1
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.87 SJR 0.278 SNIP 0.561
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.318 SNIP 0.506 CiteScore 0.72
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.347 SNIP 0.578 CiteScore 0.71
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.34 SNIP 0.63 CiteScore 0.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.333 SNIP 0.585 CiteScore 0.83
A Model of Electrically Stimulated Auditory Nerve Fiber Responses with Peripheral and Central Sites of Spike Generation

A computational model of cat auditory nerve fiber (ANF) responses to electrical stimulation is presented. The model assumes that (1) there exist at least two sites of spike generation along the ANF and (2) both an anodic (positive) and a cathodic (negative) charge in isolation can evoke a spike. A single ANF is modeled as a network of two exponential integrate-and-fire point-neuron models, referred to as peripheral and central axons of the ANF. The peripheral axon is excited by the cathodic charge, inhibited by the anodic charge, and exhibits longer spike latencies than the central axon; the central axon is excited by the anodic charge, inhibited by the cathodic charge, and exhibits shorter spike latencies than the peripheral axon. The model also includes subthreshold and suprathreshold adaptive feedback loops which continuously modify the membrane potential and can account for effects of facilitation, accommodation, refractoriness, and spike-rate adaptation in ANF. Although the model is parameterized using data for either single or paired pulse stimulation with monophasic rectangular pulses, it correctly predicts effects of various stimulus pulse shapes, stimulation pulse rates, and level on the neural response statistics. The model may serve as a framework to explore the effects of different stimulus parameters on psychophysical performance measured in cochlear implant listeners.

General information

State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Joshi, S. N. (Intern), Dau, T. (Intern), Epp, B. (Intern)
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An Acoustic Hypersingular Boundary Element Formulation Including Viscous and Thermal Losses

General information
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Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering, Solid Mechanics, Technical University of Munich
Authors: Andersen, P. R. (Intern), Cutanda Henriquez, V. (Intern), Aage, N. (Intern), Marburg, S. (Ekstern)
Number of pages: 1
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An adaptive, data driven sound field control strategy for outdoor concerts
One challenge of outdoor concerts is to ensure adequate levels for the audience while avoiding disturbance of the surroundings. We outline the initial concept of a sound field control (SFC) system for tackling this issue using sound-zoning. The system uses Bayesian inference to update a sound propagation model. We present a simulation in which SFC and propagation model work together.

General information
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Analysis and Modeling of Integrated Magnetics for LLC resonant Converters
Shunt-inserted transformers are widely used to obtain high leakage inductance. This paper investigates this method in depth to make it applicable to integrate resonantinductor for the LLC resonant converters. The analysis and model of magnetizing inductance and leakage inductance forshunt-inserted planar transformers with and without air gaps are presented. Magnetic shunt permeability and thicknesssignificantly affect the magnetizing inductance and leakageinductance. Air gaps in traditional transformers only have a slight influence on the leakage inductance. However, air gaps in shunt-inserted planar transformers can provide a significant difference. The way to obtain the desirable magnetizing andleakage inductance value for LLC resonant converters is simplified by the creation of air gaps together with a magneticshunt. The calculation and relation are validated by finite element analysis (FEA) simulations and experimentalmeasurements. AC resistances for the shunt-inserted planar transformers are discussed and three transformers with the same magnetizing inductance are selected for comparison. The resultssuggest that the magnetic shunt can in some extent minimizefringing effects.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Analysis and optimisation of coupled winding in magnetic resonant wireless power transfer systems with orthogonal experiment results

The coupled magnetic resonant unit (CMRU) has great effect on the transmitting power capability and efficiency of magnetic resonant wireless power transfer system. The key objective i.e. the efficiency coefficient $k_Q$ is introduced in the design of CMRU or the coupled windings based on the mutual inductance model. Then the design method with orthogonal experiments and finite element method simulation is proposed to maximize the $k_Q$ due to low precise analytical model of AC resistance and inductance for PCB windings at high-frequency. The method can reduce the design iterations and thereby can get more optimal design results. The experiments verified the design objective of $k_Q$ as well as the design method effectively. In the optimal PCB windings prototype at operating frequency of 4 MHz, the $k_Q$ and the maximum efficiency are increased by about 12% and 4% respectively.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Fuzhou University, Gutian River Hydropower Plant
Authors: Yudi, X. (Ekstern), Xingkui, M. (Ekstern), Mao, L. (Ekstern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 6
Publication date: 2017
Conference: 21st International Conference ELECTRONICS 2017, Palanga, Lithuania, 19/06/2017 - 19/06/2017
Main Research Area: Technical/natural sciences

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Journal: Elektronika ir Elektrotechnika
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Scopus rating (2016): CiteScore 0.85 SJR 0.294 SNIP 0.677
Web of Science (2016): Indexed yes
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Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 0.253 SNIP 0.656 CiteScore 0.53
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.226 SNIP 0.756 CiteScore 0.49
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 0.204 SNIP 1.075 CiteScore 0.84
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.216 SNIP 0.274
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.191 SNIP 0.101
Web of Science (2004): Indexed yes
Original language: English
Wireless power transfer, Magnetic resonant, Orthogonal experiments, Magnetic coupling structure optimization
Analysis and optimization of coupled windings in magnetic resonant wireless power transfer systems with orthogonal experiment method

The coupled magnetic resonant unit (CMRU) has great effect on the transmitting power capability and efficiency of magnetic resonant wireless power transfer system. The key objective i.e. the efficiency coefficient KQ is introduced in the design of CMRU or the coupled windings based on the mutual inductance model. Then the design method with orthogonal experiments and finite element method simulation is proposed to maximize the KQ due to low precise analytical model of AC resistance and inductance for PCB windings at high-frequency. The method can reduce the design iterations and thereby can get more optimal design results. The experiments verified the design objective of KQ as well as the design method effectively. In the optimal PCB windings prototype at operating frequency of 4 MHz, the KQ and the maximum efficiency are increased by about 12% and 4% respectively.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Gutian River Hydropower Plant, Fuzhou University
Authors: Yudi, X. (Ekstern), Xingkui, M. (Ekstern), Mao, L. (Ekstern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 6
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Main Research Area: Technical/natural sciences

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Journal: Elektronika ir Elektrotechnika
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Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.337 SNIP 0.601 CiteScore 0.71
Scopus rating (2014): SJR 0.305 SNIP 0.658 CiteScore 0.66
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 0.253 SNIP 0.656 CiteScore 0.53
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.226 SNIP 0.756 CiteScore 0.49
ISI indexed (2012): ISI indexed yes
Scopus rating (2011): SJR 0.204 SNIP 1.075 CiteScore 0.84
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.216 SNIP 0.274
Web of Science (2010): Indexed yes
Scopus rating (2009): SJR 0.191 SNIP 0.101
Web of Science (2004): Indexed yes
Original language: English

Wireless power transfer, Magnetic resonant, Orthogonal experiments, Magnetic coupling structure optimization

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Source: PublicationPreSubmission
Source-ID: 133321466
Publication: Research - peer-review › Journal article – Annual report year: 2018
Analysis, Design, Modeling, and Control of an Interleaved-Boost Full-Bridge Three-Port Converter for Hybrid Renewable Energy Systems

This paper presents the design, modeling, and control of an isolated dc-dc three-port converter (TPC) based on an interleaved-boost full-bridge converter with pulsewidth modulation (PWM) and phase-shift control for hybrid renewable energy systems. In the proposed topology, the switches are driven by phase-shifted PWM signals, where both phase angle and duty cycle are the controlled variables. The power flow between the two inputs is controlled through the duty cycle, whereas the output voltage can be regulated effectively through the phase shift. The primary-side MOSFETs can achieve zero-voltage-switching (ZVS) operation without additional circuitry. Additionally, due to the ac output inductor, the secondary-side diodes can operate under zero-current-switching (ZCS) conditions. In this study, the operation principles of the converter are analyzed and the critical design considerations are discussed. The dynamic behavior of the proposed ac-inductor-based TPC is investigated by performing state-space modeling. Moreover, the derived mathematical models are validated by simulation and measurements. In order to verify the validity of the theoretical analysis, design, and power decoupling control scheme, a prototype is constructed and tested under the various modes, depending on the availability of the renewable energy source and the load consumption. The experimental results show that the two decoupled control variables achieve effective regulation of the power flow among the three ports.
Analytical Comparison of Dual-Input Isolated dc-dc Converter with an ac or dc Inductor for Renewable Energy Systems

This paper presents two configurations of dual-input (DI) or three-port (TPC) isolated dc-dc converters for hybrid renewable energy systems such as photovoltaics and batteries. These two converters are derived by integrating an interleaved boost converter and a single-active bridge converter with an ac inductor as a power interfacing element or phase-shift softswitching converter with an output dc inductor. Both converters are controlled by a pulse-width modulation and phase-shift hybrid modulation scheme. The two converter topologies are, even though quite similar from the topological and control perspective, distinct in operation principles, voltage/power transfer functions, loss distributions, soft-switching constraints, and power efficiency under the same operating conditions. Moreover, the inductor design differs greatly between these two cases. In this paper, a comprehensive comparison is given for the first time and thereby the corresponding design tradeoffs are discussed. Finally, a laboratory 1 kW prototype is constructed and tested to verify the theoretical analysis.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Zhang, Z. (Intern), Mira Albert, M. D. C. (Intern), Andersen, M. A. E. (Intern)
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ISBN (Print): 9781509051571
Main Research Area: Technical/natural sciences
Conference: IEEE International Future Energy Electronics Conference 2017, Kaohsiung, Taiwan, Province of China, 03/06/2017 - 03/06/2017
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Electronic versions: PID4700879.pdf
A narrow line UV-induced non-persistent radical in view of generating highly polarized transportable glucose solid samples

**General information**
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Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Aix Marseille Universite, University of Cambridge, Technical University of Denmark, Aix-Marseille University
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Main Research Area: Technical/natural sciences
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Source: PublicationPreSubmission
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Publication: Research › Conference abstract for conference – Annual report year: 2018

An evolving experience learned for modelling thermal dynamics of buildings from live experiments: the Flexhouse story: Power and Energy Systems Engineering

Abstract This paper shares an evolving experience learned for modelling the thermal dynamics of buildings from live experiments run in Flexhouse1 at Risø Campus of Technical University of Denmark (DTU). Among different trials, circuit based grey-box models approach have been developed and improved from time to time. Although the intension of modelling the thermal dynamics of Flexhouse1 remains unchanged, the details of experiments and applied modelling approach do evolve over time due to the increase of knowledge and the improvement made to the experimental platform. In addition to presenting a summary of these details, additional suggestions on future improvements are discussed and preliminarily investigated.

**General information**
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BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.44 SJR 0.495 SNIP 0.799
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.464 SNIP 0.598
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.359 SNIP 0.562 CiteScore 0.92
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.429 SNIP 0.807 CiteScore 1.09
A New Wavelet-Based ECG Delineator for the Evaluation of the Ventricular Innervation

T-wave amplitude (TWA) has been proposed as a marker of the innervation of the myocardium. Until now, TWA has been calculated manually or with poor algorithms, thus making its use not efficient in a clinical environment. We introduce a new wavelet-based algorithm for the delineation QRS complexes and T-waves, and the automatic calculation of TWA. When validated in the MIT/BIH Arrhythmia database, the QRS detector achieved sensitivity and positive predictive value of 99.84% and 99.87%, respectively. The algorithm was validated also on the QT database and it achieved sensitivity of 99.50% for T-peak detection. In addition, the algorithm achieved delineation accuracy that is similar to the differences in delineation between expert cardiologists. We applied the algorithm for the evaluation of the influence in TWA of anticholinergic and antiadrenergic drugs (i.e., atropine and metoprolol) for healthy subjects. We found that the TWA decreased significantly with atropine and that metoprolol caused a significant increase in TWA, thus confirming the clinical hypothesis that the TWA is a marker of the innervation of the myocardium. The results of this paper show that the proposed algorithm can be used as a useful and efficient tool in clinical practice for the automatic calculation of TWA and its interpretation as a non-invasive marker of the autonomic ventricular innervation.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Copenhagen Center for Health Technology, Copenhagen University Hospital, University of Copenhagen
Authors: Cesari, M. (Intern), Mehlsen, J. (Ekstern), Mehlsen, A. (Ekstern), Sørensen, H. B. D. (Intern)
Number of pages: 15
Publication date: 2017
Main Research Area: Technical/natural sciences

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An experimental and computational investigation of high-accuracy calibration techniques for gain reference antennas

We present a comparative investigation of the pattern integration technique and the two-antenna technique for calibration of standard gain horns; the investigation involves high-accuracy spherical near-field antenna measurements as well as high-accuracy integral equation / method of moments simulations. The experimental results are thus supported by computational results, and the agreement between these demonstrates the high accuracy of both. For the pattern integration technique the computational and experimental directivities are within 0.01 dB. For the two-antenna technique the proximity effect and the mutual reflections are clearly observed, and it is demonstrated that the use of the phase centers separation in Friis' transmission formula significantly reduces the necessary distance between antennas for a required accuracy.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Technical University of Denmark
Authors: Breinbjerg, O. (Intern), Kaslis, K. (Intern), Nielsen, J. M. (Ekstern)
Number of pages: 6
Pages: 1-6
Publication date: 2017

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Main Research Area: Technical/natural sciences
Conference: 39th Annual Meeting and Symposium of the Antenna Measurement Techniques Association Symposium (AMTA) 2017, Atlanta, United States, 15/10/2017 - 15/10/2017
DOIs: 10.23919/AMTAP.2017.8123708
Source: FindIt
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An experimentally validated simulation model for a four-stage spray dryer

In this paper, we develop a dynamic model of an industrial type medium size four-stage spray dryer. The purpose of the model is to enable simulations of the spray dryer at different operating points, such that the model facilitates development and comparison of control strategies. The dryer is divided into four consecutive stages: a primary spray drying stage, two heated fluid bed stages, and a cooling fluid bed stage. Each of these stages in the model is assumed ideally mixed and the dynamics are described by mass- and energy balances. These balance equations are coupled with constitutive equations such as a thermodynamic model, the water evaporation rate, the heat transfer rates, and an equation for the stickiness of the powder (glass transition temperature). Laboratory data is used to model the equilibrium moisture content and the glass transition temperature of the powder. The resulting mathematical model is an index-1 differential algebraic equation (DAE) model with 12 states, 9 inputs, 8 disturbances, and 30 parameters. The parameters in the model are identified from well-excited experimental data obtained from the industrial type spray dryer. The simulated outputs of the model are validated using independent well-excited experimental data from the same spray dryer. The simulated temperatures, humidities, and residual moistures in the spray dryer compare well to the validation data. The model also provides the profit of operation, the production rate, the energy consumption, and the energy efficiency. In addition, it computes stickiness of the powder in different stages of the spray dryer. These facilities make the model well suited as a simulation model for comparison of the process economics associated to different control strategies.

General information
An Improved On-line Contingency Screening for Power System Transient Stability Assessment

This paper presents a contingency screening method and a framework for its on-line implementation. The proposed method carries out contingency screening and on-line stability assessment with respect to first-swing transient stability. For that purpose, it utilizes the single machine equivalent method and aims at improving the prior developed contingency screening approaches. In order to determine vulnerability of the system with respect to a particular contingency, only one time-domain simulation needs to be performed. An early stop criteria is proposed so that in a majority of the cases the simulation can be terminated after a few hundred milliseconds of simulated system response. The method's outcome is an assessment of the system's stability and a classification of each considered contingency. The contingencies are categorized by exploiting parameters of an equivalent one machine infinite bus system. A novel island detection approach, appropriate for an on-line application since it utilizes efficient algorithms from graph theory and enables stability assessment of individual islands, is also introduced. The New England and New York system as well as the large-scale model of the Continental-European interconnected system are used to test the proposed method with respect to assessment accuracy and computation time.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of Liege
Authors: Weckesser, J. T. G. (Intern), Jóhannsson, H. (Intern), Glavic, M. (Ekstern), Østergaard, J. (Intern)
Number of pages: 12
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.707 SJR 0.373 CiteScore 1.62
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Scopus rating (2016): CiteScore 1.53 SJR 0.384 SNIP 0.76
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.339 SNIP 0.693 CiteScore 1.27
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.549 SNIP 1.168 CiteScore 2.15
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.386 SNIP 0.828 CiteScore 1.07
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.335 SNIP 0.827 CiteScore 1.04
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.323 SNIP 0.814 CiteScore 1.09
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
An improved partially interleaved transformer structure for high-voltage high-frequency multiple-output applications

This paper proposes an improved partially interleaved structure for high-voltage (Several kV) high-frequency (Several hundred kHz) multiple output applications. Six structures are compared with the leakage inductance, AC capacitance and the rate of AC-DC resistance taken into consideration. The proposed structure features lower leakage inductance, smaller AC capacitance and lower rate of AC-DC resistance, which is suitable for high-frequency high-efficiency applications. A planar transformer with the proposed structure was built and tested in an LCLC resonant converter, where the input voltage is 40V, output is 4800V, switching frequency 500 kHz and the efficiency is 96.8%, which validates the analysis.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, National University of Ireland, Galway
Authors: Zhao, B. (Intern), Ouyang, Z. (Intern), Andersen, M. A. E. (Intern), Duffy, M. (Ekstern), Hurley, W. G. (Ekstern)
Number of pages: 7
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Publication date: 2017

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Title of host publication: Proceedings of the IECON 2017 - 43rd Annual Conference of the IEEE Industrial Electronics Society
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 43rd Annual Conference of the IEEE Industrial Electronics Society, Beijing, China, 29/10/2017 - 29/10/2017
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Source: FindIt
Source-ID: 2394329482
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

An Integrated Research Infrastructure for Validating Cyber-Physical Energy Systems
Renewables are key enablers in the plight to reduce greenhouse gas emissions and cope with anthropogenic global warming. The intermittent nature and limited storage capabilities of renewables culminate in new challenges that power system operators have to deal with in order to regulate power quality and ensure security of supply. At the same time, the increased availability of advanced automation and communication technologies provides new opportunities for the derivation of intelligent solutions to tackle the challenges. Previous work has shown various new methods of operating highly interconnected power grids, and their corresponding components, in a more effective way. As a consequence of these developments, the traditional power system is being transformed into a cyber-physical energy system, a smart grid.
Previous and ongoing research have tended to mainly focus on how specific aspects of smart grids can be validated, but until there exists no integrated approach for the analysis and evaluation of complex cyber-physical systems configurations. This paper introduces integrated research infrastructure that provides methods and tools for validating smart grid systems in a holistic, cyber-physical manner. The corresponding concepts are currently being developed further in the European project ERIGrid.

An introduction to Deep learning on biological sequence data - Examples and solutions

Deep neural network architectures such as convolutional and long short-term memory networks have become increasingly popular as machine learning tools during the recent years. The availability of greater computational resources, more data, new algorithms for training deep models and easy to use libraries for implementation and training of neural networks are the drivers of this development. The use of deep learning has been especially successful in image recognition; and the development of tools, applications and code examples are in most cases centered within this field rather than within biology. Here, we aim to further the development of deep learning methods within biology by providing application examples and ready to apply and adapt code templates. Given such examples, we illustrate how architectures consisting of convolutional and long short-term memory neural networks can relatively easily be designed and trained to state-of-the-art performance on three biological sequence problems: prediction of subcellular localization, protein secondary structure and the binding of peptides to MHC Class II molecules. All implementations and datasets are available online to the scientific community at https://github.com/vanessajurtz/lasagne4bio . Supplementary data are available at Bioinformatics online.

An introduction to Deep learning on biological sequence data - Examples and solutions

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A Nonlinear Transmission Line Model of the Cochlea With Temporal Integration Accounts for Duration Effects in Threshold Fine Structure

For normal-hearing listeners, auditory pure-tone thresholds in quiet often show quasi periodic fluctuations when measured with a high frequency resolution, referred to as threshold fine structure. Threshold fine structure is dependent on the stimulus duration, with smaller fluctuations for short than for long signals. The present study demonstrates how this effect can be captured by a nonlinear and active model of the cochlear in combination with a temporal integration stage. Since this cochlear model also accounts for fine structure and connected level dependent effects, it is superior to filter-based approaches and hence allows the investigation of the contributions of cochlear- and retro-cochlear processing on behavioural data, including stimulus-duration dependent effects of threshold fine structure.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Otto-von-Guericke University Magdeburg, University of Oldenburg
Authors: Verhey, J. L. (Ekstern), Mauermann, M. (Ekstern), Epp, B. (Intern)
Number of pages: 4
Pages: 721-724
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BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 0.982 SJR 0.472 CiteScore 1.28
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.12 SJR 0.487 SNIP 0.889
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.579 SNIP 1.097 CiteScore 1.11
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.581 SNIP 1.052 CiteScore 0.89
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.573 SNIP 1.574 CiteScore 1.05
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.557 SNIP 0.986 CiteScore 0.81
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.46 SNIP 0.913 CiteScore 0.65
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.481 SNIP 0.916
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.536 SNIP 0.769
An optical flow-based state-space model of the vocal folds

High-speed movies of the vocal fold vibration are valuable data to reveal vocal fold features for voice pathology diagnosis. This work presents a suitable Bayesian model and a purely theoretical discussion for further development of a framework for continuum biomechanical features estimation. A linear and Gaussian nonstationary state-space model is proposed and thoroughly discussed. The evolution model is based on a self-sustained three-dimensional finite element model of the vocal folds, and the observation model involves a dense optical flow algorithm. The results show that the method is able to capture different deformation patterns between the computed optical flow and the finite element deformation, controlled by the choice of the model tissue parameters.

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State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Granados, A. (Intern), Brunskog, J. (Intern)
Pages: EL543-8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
Antioxidant treatment attenuates lactate production in diabetic nephropathy

The early progression of diabetic nephropathy is notoriously difficult to detect and quantify before the occurrence of substantial histological damage. Recently, hyperpolarized [1-13C]pyruvate has demonstrated increased lactate production in the kidney early after the onset of diabetes, implying increased lactate dehydrogenase activity as a consequence of increased nicotinamide adenine dinucleotide substrate availability due to upregulation of the polyol pathway, i.e., pseudohypoxia. In this study, we investigated the role of oxidative stress in mediating these metabolic alterations using state-of-the-art hyperpolarized magnetic resonance (MR) imaging. Ten-week-old female Wistar rats were randomly divided into three groups: healthy controls, untreated diabetic (streptozotocin treatment to induce insulinopenic diabetes), and diabetic, receiving chronic antioxidant treatment with TEMPOL (4-hydroxy-2,2,6,6-tetramethylpiperidin-1-oxyl) via the drinking water. Examinations were performed 2, 3, and 4 wk after the induction of diabetes by using a 3T Clinical MR system equipped with a dual tuned 13C/1H-volume rat coil. The rats received intravenous hyperpolarized [1-13C]pyruvate and were imaged using a slice-selective 13C-IDEAL spiral sequence. Untreated diabetic rats showed increased renal lactate production compared with that shown by the controls. However, chronic TEMPOL treatment significantly attenuated diabetes-induced lactate production. No significant effects of diabetes or TEMPOL were observed on [13C]alanine levels, indicating an intact glucose-alanine cycle, or [13C]bicarbonate, indicating normal flux through the Krebs cycle. In conclusion, this study demonstrates that diabetes-induced pseudohypoxia, as indicated by an increased lactate-to-pyruvate ratio, is significantly attenuated by antioxidant treatment. This demonstrates a pivotal role of oxidative stress in renal metabolic alterations occurring in early diabetes.
A Numerical Approach for Hybrid Simulation of Power System Dynamics Considering Extreme Icing Events

The global climate change leads to more extreme meteorological conditions such as icing weather, which have caused great losses to power systems. Comprehensive simulation tools are required to enhance the capability of power system risk assessment under extreme weather conditions. A hybrid numerical simulation scheme integrating icing weather events with power system dynamics is proposed to extend power system numerical simulation. A technique is developed to efficiently simulate the interaction of slow dynamics of weather events and fast dynamics of power systems. An extended package for PSS/E enabling hybrid simulation of icing event and power system disturbance is developed, based on which a hybrid simulation platform is established. Numerical studies show that the functionality of power system simulation is greatly extended by taking into account the icing weather events.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University
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An X-band Schottky diode mixer in SiGe technology with tunable Marchand balun

In this paper, we propose a double balanced mixer with a tunable Marchand balun. The circuit is designed in a SiGe BiCMOS process using Schottky diodes. The tunability of the Marchand balun is used to enhance critical parameters for double balanced mixers. The local oscillator-IF isolation can be changed from –51 to –60.5 dB by tuning. Similarly, the IIP2 can be improved from 41.3 to 48.7 dBm at 11 GHz, while the input referred 1-dB compression point is kept constant at 8 dBm. The tuning have no influence on conversion loss, which remains at 8.8 dB at a LO power level of 11 dBm at the center frequency of 11 GHz. The mixer has a 3 dB bandwidth from 8 to 13 GHz, covering the entire X-band. The full mixer has a size of 2050 μm × 1000 μm.
Aortic Valve Stenosis Increases Helical Flow and Flow Complexity: A Study of Intra-operative Cardiac Vector Flow Imaging

Aortic valve stenosis alters blood flow in the ascending aorta. Using intra-operative vector flow imaging on the ascending aorta, secondary helical flow during peak systole and diastole, as well as flow complexity of primary flow during systole, were investigated in patients with normal, stenotic and replaced aortic valves. Peak systolic helical flow, diastolic helical flow and flow complexity during systole differed between the groups (p < 0.0001), and correlated to peak systolic velocity (R = 0.94, 0.87 and 0.88, respectively). The study indicates that aortic valve stenosis increases helical flow and flow complexity, which are measurable with vector flow imaging. For assessment of aortic stenosis and optimization of valve surgery, vector flow imaging may be useful.
A Personalized Rolling Optimal Charging Schedule for Plug-In Hybrid Electric Vehicle Based on Statistical Energy Demand Analysis and Heuristic Algorithm

To alleviate the emission of greenhouse gas and the dependence on fossil fuel, Plug-in Hybrid Electrical Vehicles (PHEVs) have gained an increasing popularity in current decades. Due to the fluctuating electricity prices in the power market, a charging schedule is very influential to driving cost. Although the next-day electricity prices can be obtained in a day-ahead power market, a driving plan is not easily made in advance. Although PHEV owners can input a next-day plan into a charging system, e.g., aggregators, day-ahead, it is a very trivial task to do everyday. Moreover, the driving plan may not be very accurate. To address this problem, in this paper, we analyze energy demands according to a PHEV owner's historical driving records and build a personalized statistic driving model. Based on the model and the electricity spot prices, a rolling optimization strategy is proposed to help make a charging decision in the current time slot. On one hand, by employing a heuristic algorithm, the schedule is made according to the situations in the following time slots. On the other hand, however, after the current time slot, the schedule will be remade according to the next tens of time slots. Hence, the schedule is made by a dynamic rolling optimization, but it only decides the charging decision in the current time slot. In this way, the fluctuation of electricity prices and driving routine are both involved in the scheduling. Moreover, it is not necessary for PHEV owners to input a day-ahead driving plan. By the optimization simulation, the results demonstrate that the proposed method is feasible to help owners save charging costs and also meet requirements for driving.

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Organisations: Center for Electric Power and Energy, Department of Electrical Engineering, Shanghai Development Center of Computer Software Technology, Tongji University

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A Pole Pair Segment of a 2-MW High-Temperature Superconducting Wind Turbine Generator

A 2-MW high-temperature superconducting (HTS) generator with 24 pole pairs has been designed for the wind turbine application. In order to identify potential challenges and obtain practical knowledge prior to production, a full-size stationary experimental setup, which is one pole pair segment of the full generator, has been built and tested. The experimental setup comprises a consequent-pole HTS rotor and a conventional three-phase copper stator. This paper first presents the electromagnetic designs of the full generator and the setup, then it goes to compare the performance of the full generator and the setup in terms of the flux density, the operating condition of the HTS winding, and the force-generation capability. Finite element (FE) software MagNet is used to carry out numerical simulations. The findings show that the HTS winding in the setup is a good surrogate for those that would be used in the full generator. The FE simulations also tell that the maximum tangential force generated in the setup is 3.77% lower than that in the full generator. Good agreement between the values of interest in the setup and those projected in the full generator has revealed a cost-effective prototyping methodology for developing HTS machines.
Application of visual servoing for grasping and placing operation in slaughterhouse

In food industry due to the high variety of the object including the shape, size and structure the involvement of real time robotic system is limited compared to the applications of robotic systems in automotive industry. For completing operations within food industry it is generally necessary to contain dynamical adjustment to each target in the control loop. This work focuses on using visual feedback to capture information of each piece of work for robotic control. A grasping and placing operation is selected as a case study of using visual servoing in slaughterhouse. For detecting the location of the target the color information provided by a visual sensor is utilized. The control command for the robot is generated based on the real time visual feedback. An industrial robot arm UR10 is applied to complete the operation. A lab-scale experimental setup is constructed for system validation. The experimental results show that the proposed visual servoing system works well for the grasping and placing task in slaughterhouse. The system is implemented in ROS and can be easily extended to similar operation tasks using different hardware.

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A Review of Cyber-Physical Energy System Security Assessment
Increasing penetration of renewable energy resources (RES) and electrification of services by implementing distributed energy resources (DER) has caused a paradigm shift in the operation of the power system. The controllability of the power system is predicted to be shifted from the generation side to the consumption side. This transition entails that the future power system evolves into a complex cyber-physical energy system (CPES) with strong interactions between the power, communication and neighboring energy systems. Current power system security assessment methods are based on centralized computation and N-1 contingencies, while these risks should still be considered in the future CPES, additional factors are affecting the system security. This paper serves as a review of the challenges entailed by transforming the power system into a CPES from a security assessment perspective. It gives an indication of theoretical solutions to CPES challenges.
and proposes a new framework for security assessment in CPES.

A review of Danish integrated multi-energy system flexibility options for high wind power penetration
The current status of wind power and the energy infrastructure in Denmark is reviewed in this paper. The reasons for why Denmark is a world leader in wind power are outlined. The Danish government is aiming to achieve 100% renewable energy generation by 2050. A major challenge is balancing load and generation. In addition, the current and future solutions of enhancing wind power penetration through optimal use of cross-energy sector flexibility, so-called indirect electric energy storage options, are investigated. A conclusion is drawn with a summary of experiences and lessons learned in Denmark related to wind power development.

Bibliographical note
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A Review on Grid-connected Converter Control for Short Circuit Power Provision under Grid Unbalanced Faults

As an increasing amount of converter-based generation on power electronics is connected to power systems, transmission system operators (TSOs) are revising the grid connection requirements to streamline the connectivity of the devices to maintain security of supply. Converter-based generation can behave significantly different from the traditional alternators under grid faults. In order to evaluate the potential impact of future converter-based power systems on protective relays, it is necessary to consider diverse current control strategies of voltage source converters (VSC) under unbalanced faults as the performance of converters primarily depends on their control objectives. In this paper, current control strategies of VSC under unbalanced faults for short circuit power provision are reviewed in two groups, namely power-characteristic-oriented and voltage-support-oriented control strategy respectively. As the fault current provided by converters should be restricted within secure operation limits considering semiconductor capabilities, converter current limit issue is also discussed.

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A Scalable Neuro-inspired Robot Controller Integrating a Machine Learning Algorithm and a Spiking Cerebellar-like Network

Combining Fable robot, a modular robot, with a neuroinspired controller, we present the proof of principle of a system that can scale to several neurally controlled compliant modules. The motor control and learning of a robot module are carried out by a Unit Learning Machine (ULM) that embeds the Locally Weighted Projection Regression algorithm (LWPR) and a spiking cerebellar-like microcircuit. The LWPR guarantees both an optimized representation of the input space and the learning of the dynamic internal model (IM) of the robot. However, the cerebellar-like sub-circuit integrates LWPR input-driven contributions to deliver accurate corrective commands to the global IM. This article extends the earlier work by including the Deep Cerebellar Nuclei (DCN) and by reproducing the Purkinje and the DCN layers using a spiking neural network (SNN) implemented on the neuromorphic SpiNNaker platform. The performance and robustness outcomes from the real robot tests are promising for neural control scalability.
This study examines a near-field acoustic holography method consisting of a sparse formulation of the equivalent source method, based on the compressive sensing (CS) framework. The method, denoted Compressive–Equivalent Source Method (C-ESM), encourages spatially sparse solutions (based on the superposition of few waves) that are accurate when the acoustic sources are spatially localized. The importance of obtaining a non-redundant representation, i.e., a sensing matrix with low column coherence, and the inherent ill-conditioning of near-field reconstruction problems is addressed. Numerical and experimental results on a classical guitar and on a highly reactive dipolelike source are presented. C-ESM is valid beyond the conventional sampling limits, making wideband reconstruction possible. Spatially extended sources can also be addressed with C-ESM, although in this case the obtained solution does not recover the spatial extent of the source.
Assessing the efficacy of hearing-aid amplification using a phoneme test

Consonant-vowel (CV) perception experiments provide valuable insights into how humans process speech. Here, two CV identification experiments were conducted in a group of hearing-impaired (HI) listeners, using 14 consonants followed by the vowel /ɑ/. The CVs were presented in quiet and with added speech-shaped noise at signal-to-noise ratios of 0, 6, and 12 dB. The HI listeners were provided with two different amplification schemes for the CVs. In the first experiment, a frequency-independent amplification (flat-gain) was provided and the CVs were presented at the most-comfortable loudness level. In the second experiment, a frequency-dependent prescriptive gain was provided. The CV identification results showed that, while the average recognition error score obtained with the frequency-dependent amplification was lower than that obtained with the flat-gain, the main confusions made by the listeners on a token basis remained the same in a majority of the cases. An entropy measure and an angular distance measure were proposed to assess the highly individual effects of the frequency-dependent gain on the consonant confusions in the HI listeners. The results suggest that the proposed measures, in combination with a well-controlled phoneme speech test, may be used to assess the impact of hearing-aid signal processing on speech intelligibility.

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Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.56 SNIP 1.306
Assessing the Energy Content of System Frequency and Electric Vehicle Charging Efficiency for Ancillary Service Provision

The purpose of this paper is to quantify the effect of biased system frequency deviations and charger losses in order for an aggregation of electric vehicles (EVs) to provide reliable primary frequency control (PFC). A data set consisting of one year of frequency measurements of the Nordic synchronous zone is used for the analysis. The average system frequency can be biased over the hour, which can lead storage units, performing PFC, to become fully charged or depleted. This paper presents statistical bounds on how variable the average system frequency can be on different time scales. Additionally, a method for calculating the expected energy loss caused by continuous charging and discharging is presented together with efficiency measurements of a commercial bidirectional EV charger. It is found that during a year, the energy balance of the service provider, relative to the grid, is within the calculated bounds. The efficiency losses are calculated and validated to have a linear relationship with the reserve capacity and the provision time.

Assessing the need for better forecasting and observability of pv.

In its review of the challenges and opportunities associated with massive deployment of solar PV generation, the Grid integration working group of the ETIP PV identified forecasting and observability as critical technologies for the planning and operation of the power system with large PV penetration. In this white paper ETIP PV set out to spell out in more details what features are needed from these technologies and what is the state of the art.
Assessment of broadband SNR estimation for hearing aid applications

An accurate estimation of the broadband input signal-to-noise ratio (SNR) is a prerequisite for many hearing-aid algorithms. An extensive comparison of three SNR estimation algorithms was performed. Moreover, the influence of the duration of the analysis window on the SNR estimation performance was systematically investigated.

The most accurate approach utilized an estimation of the clean speech power spectral density (PSD) and the noisy speech power across a sliding window of 1280 ms and achieved an total SNR estimation error below 3 dB across a wide variety of background noises and input SNRs.

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Assessment of perceptual diffuseness in the time domain

This study proposes a numerical and experimental framework for evaluating the perceptual aspect of the diffuse field condition with intended final use in music auditoria. Multiple Impulse Responses are simulated based on the time domain Poisson process with increasing reflection density. Different diffuseness conditions are realized by altering the directions of arrival of the reflected waves. This model also considers room characteristics such as the volume, absorption of surfaces, air absorption and geometrical divergence. Listening tests are performed in an anechoic 64-loudspeaker based virtual acoustic environment to examine how sensitive the human auditory system is to changes in the diffuseness condition, which factors are most crucial and which conditions are most favourable in music halls. Two types of stimuli, a music signal and an impulse response, are tested under the same diffuseness conditions. The study shows that subjective diffuseness is highly correlated to the parameters of Surround, Source Width, and Timbre, and is modelled with relevant acoustic parameters such as LG, LF and uniformity of the incident sound.

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A Statistical Method for Aggregated Wind Power Plants to Provide Secondary Frequency Control

The increasing penetration of wind power brings significant challenges to power system operators due to the wind’s inherent uncertainty and variability. Traditionally, power plants and more recently demand response have been used to
balance the power system. However, the use of wind power as a balancing-power source has also been investigated, especially for wind power dominated power systems such as Denmark. The main drawback is that wind power must be curtailed by setting a lower operating point, in order to offer upward regulation. We propose a statistical approach to reduce wind power curtailment for aggregated wind power plants providing secondary frequency control (SFC) to the power system. By using historical SFC signals and wind speed data, we calculate metrics for the reserve provision error as a function of the scheduled wind power. We show that wind curtailment can be significantly reduced compared to a robust and conservative scheduling, by appropriately choosing a higher operating point based on the error's expected value and the service error requirement.

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***A total generalized variation approach for near-field acoustic holography***

Near-field methods based on microphone array measurements are useful to understand how a source radiates sound. Due to discretization errors, these methods are typically restricted to low frequencies. Sparse approaches have gained considerable attention, as they can potentially recover a seemingly under-sampled signal with remarkable accuracy, extending the valid frequency range. However, near-field problems are generally not spatially sparse, and it is more appropriate to promote block-sparse solutions (i.e. spatially extended) rather than direct spatial sparsity. In this paper, a method is examined that promotes solutions with sparse spatial derivatives. The method seeks spatially extended solutions, valid over a wide frequency range, and suitable to near-fields and extended sources. The methodology is based on a Total Variation approach using higher order derivatives. The frequency range of validity is examined, as well as the robustness to noise. The performance of different finite difference stencils is investigated. Numerical and experimental results are presented, with particular focus on the estimated power radiated by the source. The method is benchmarked against conventional approaches.

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Attribution mechanisms for ancillary service costs induced by variability in power delivery

The increased penetration of renewable energy sources in existing power systems has led to necessary developments in electricity market mechanisms. Most importantly, renewable energy generation is increasingly made accountable for deviations between scheduled and actual energy generation. However, there is no mechanism to enforce accountability for the additional costs induced by power fluctuations. These costs are socialized and eventually supported by electricity customers. We propose some metrics for assessing the contribution of all market participants to power regulation needs, as well as an attribution mechanism for fairly redistributing related power regulation costs. We discuss the effect of various metrics used by the attribution mechanisms, and we illustrate, in a game-theoretical framework, their consequences on the strategic behavior of market participants. We also illustrate, by using the case of Western Denmark, how these mechanisms may affect revenues and the various market participants.

General information
State: Published
Authors: Bona, F. (Intern), Gast, N. (Ekstern), Le Boudec, J. (Ekstern), Pinson, P. (Intern), Tomozei, D. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.315 SNIP 3.386 CiteScore 6.6
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.475 SNIP 3.485 CiteScore 5.31
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.523 SNIP 4.243 CiteScore 6.33
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 1.941 SNIP 3.387 CiteScore 5.84
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.586 SNIP 3.205 CiteScore 5.34
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.708 SNIP 2.759
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Auditory brainstem response latency in forward masking, a marker of sensory deficits in listeners with normal hearing thresholds

In rodent models, acoustic exposure too modest to elevate hearing thresholds can nonetheless cause auditory nerve fiber deafferentation, interfering with the coding of supra-threshold sound. Low-spontaneous rate nerve fibers, important for encoding acoustic information at supra-threshold levels and in noise, are more susceptible to degeneration than high-spontaneous rate fibers. The change in auditory brainstem response (ABR) wave-V latency with noise level has been shown to be associated with auditory nerve deafferentation. Here, we measured ABR in a forward masking paradigm and evaluated wave-V latency changes with increasing masker-to-probe intervals. In the same listeners, behavioral forward masking detection thresholds were measured. We hypothesized that 1) auditory nerve fiber deafferentation increases forward masking thresholds and increases wave-V latency and 2) a preferential loss of low-spontaneous rate fibers results in a faster recovery of wave-V latency as the slow contribution of these fibers is reduced. Results showed that in young audiometrically normal listeners, a larger change in wave-V latency with increasing masker-to-probe interval was related to a greater effect of a preceding masker behaviorally. Further, the amount of wave-V latency change with masker-to-probe interval was positively correlated with the rate of change in forward masking detection thresholds. Although we cannot rule out central contributions, these findings are consistent with the hypothesis that auditory nerve fiber deafferentation occurs in humans and may predict how well individuals can hear in noisy environments. (C) 2017 Elsevier B.V. All rights reserved.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Broad Institute of Harvard University and Massachusetts Institute of Technology
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.12 SJR 1.533 SNIP 1.334
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.886 SNIP 1.462 CiteScore 3.28
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.718 SNIP 1.353 CiteScore 3.11
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.52 SNIP 1.471 CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.658 SNIP 1.191 CiteScore 2.81
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.343 SNIP 1.218 CiteScore 2.73
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.522 SNIP 1.13
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.335 SNIP 1.086
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.531 SNIP 0.987
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.174 SNIP 1.058
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.988 SNIP 0.918
Scopus rating (2005): SJR 1.036 SNIP 0.967
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.014 SNIP 0.895
Scopus rating (2003): SJR 1.208 SNIP 0.958
Scopus rating (2002): SJR 1.05 SNIP 1.016
Scopus rating (2001): SJR 1.01 SNIP 0.917
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A Unified Trading Model Based on Robust Optimization for Day-Ahead and Real-Time Markets with Wind Power Integration

In a conventional electricity market, trading is conducted based on power forecasts in the day-ahead market, while the power imbalance is regulated in the real-time market, which is a separate trading scheme. With large-scale wind power connected into the power grid, power forecast errors increase in the day-ahead market which lowers the economic efficiency of the separate trading scheme. This paper proposes a robust unified trading model that includes the forecasts of real-time prices and imbalance power into the day-ahead trading scheme. The model is developed based on robust optimization in view of the undefined probability distribution of clearing prices of the real-time market. For the model to be used efficiently, an improved quantum-behaved particle swarm algorithm (IQPSO) is presented in the paper based on an in-depth analysis of the limitations of the static character of quantum-behaved particle swarm algorithm (QPSO). Finally, the impacts of associated parameters on the separate trading and unified trading model are analyzed to verify the superiority of the proposed model and algorithm.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Fuzhou University
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Number of pages: 19
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Scopus rating (2017): CiteScore 3.11 SJR 0.67 SNIP 1.34
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.5 SJR 0.662 SNIP 1.106
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.785 SNIP 1.399 CiteScore 2.87
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.844 SNIP 1.565 CiteScore 2.66
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.613 SNIP 1.331 CiteScore 2.29
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.852 SNIP 1.53 CiteScore 2.46
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.651 SNIP 1.396 CiteScore 2.24
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.302 SNIP 0.734
Auralizations with loudspeaker arrays from a phased combination of the image source method and acoustical radiosity

In order to create a simulation tool that is well-suited for small rooms with low diffusion and highly absorbing ceilings, a new room acoustic simulation tool has been developed that combines a phased version of the image source with acoustical radiosity and that considers the angle dependence of the surface properties. The new tool is denoted PARISM, and here PARISM is used to create loudspeaker array-based auralizations. Different auralization techniques are compared, such as Ambisonics, vector-based panning, and the method of nearest loudspeaker. The implementations of the auralization techniques with PARISM are described and compared to implementations of auralizations with another geometrical acoustic simulation tool, i.e., ODEON and the LoRA toolbox that applies Ambisonics to ODEON simulations. In opposition to the LoRA toolbox, higher order Ambisonics are also applied to the late part of the PARISM impulse response, because more directional information is available with acoustical radiosity. Small rooms with absorbing surfaces are tested, because this is the room type that PARISM is particularly useful for.

General information

State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Interacoustics A/S
Authors: Marbjerg, G. H. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern), Zapata-Rodriguez, V. (Ekstern)
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  - Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
  - Web of Science (2017): Indexed yes
  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 2
  - Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
Automatic Atrial Fibrillation Detection: A Novel Approach Using Discrete Wavelet Transform and Heart Rate Variability

Early detection of Atrial Fibrillation (AF) is crucial in order to prevent acute and chronic cardiac rhythm disorders. In this study, a novel method for robust automatic AF detection (AAFD) is proposed by combining atrial activity (AA) and heart rate variability (HRV), which could potentially be used as a screening tool for patients suspected to have AF. The method includes an automatic peak detection prior to the feature extraction, as well as a noise cancellation technique followed by a bagged tree classification. Simulation studies on the MIT-BIH Atrial Fibrillation database was performed to evaluate the performance of the proposed method. Results from these extensive studies showed very promising results, with an average sensitivity of 96.51%, a specificity of 99.19%, and an overall accuracy of 98.22%.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark, Cortrium ApS
Authors: Bruun, I. H. (Ekstern), Hissabu, S. M. S. (Ekstern), Poulsen, E. S. (Ekstern), Puthusserypady, S. (Intern)
Pages: 3981-3984
Publication date: 2017
Automatic minimization of ocular artifacts from electroencephalogram: A novel approach by combining Complete EEMD with Adaptive Noise and Renyi’s Entropy

Ocular artifacts (OAs) are one of the major interferences that obscure electroencephalogram (EEG) signals. In this paper, a novel, completely automatic, adaptive and fast method that combines the Complete Empirical Mode Decomposition with Adaptive Noise (CEEMDAN) and Renyi’s Entropy (RE) is proposed for minimizing the OAs from corrupted EEG signals. The RE criterion is suggested to automatically select the Intrinsic Mode Functions (IMFs) to reconstruct the artifact minimized EEG signals. The scheme requires only a single channel OAs corrupted EEG recording and a reasonable computation time. The method is first evaluated on simulated OAs (one, two, and several blinks as well as saccadic eye movements) corrupted EEG signals and then extended to real EEG signals. The signal-to-noise ratio improvement (SNRimp) along with time and power spectral density (PSD) plots are used for evaluating the performance of the scheme. The method is compared to the one based on the CEEMDAN and manual choice of IMFs for OAs minimization from EEG. Results from extensive simulation studies clearly indicate the efficacy of the proposed scheme in automatically minimizing the OAs from the corrupted EEG signals.
Automatic Segmentation of Vessels in In Vivo Ultrasound Scans

Ultrasound has become highly popular to monitor atherosclerosis, by scanning the carotid artery. The screening involves measuring the thickness of the vessel wall and diameter of the lumen. An automatic segmentation of the vessel lumen, can enable the determination of lumen diameter. This paper presents a fully automatic segmentation algorithm, for robustly segmenting the vessel lumen in longitudinal B-mode ultrasound images. The automatic segmentation is performed using a combination of B-mode and power Doppler images. The proposed algorithm includes a series of preprocessing steps, and performs a vessel segmentation by use of the marker-controlled watershed transform. The ultrasound images used in the study were acquired using the bk3000 ultrasound scanner (BK Ultrasound, Herlev, Denmark) with two transducers “8L2 Linear” and “10L2w Wide Linear” (BK Ultrasound, Herlev, Denmark). The algorithm was evaluated empirically and applied to a dataset of in-vivo 1770 images recorded from 8 healthy subjects. The segmentation results were compared to manual delineation performed by two experienced users. The results showed a sensitivity and specificity of 90.41 ± 11.2 % and 97.93 ± 5.7 % (mean ± standard deviation), respectively. The amount of overlap of segmentation and manual segmentation, was measured by the Dice similarity coefficient, which was 91.25 ± 11.6 %. The empirical results demonstrated the feasibility of segmenting the vessel lumen in ultrasound scans using a fully automatic algorithm.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Technical University of Denmark
Authors: Tamimi-Sarnikowski, P. (Ekstern), Brink-Kjær, A. (Ekstern), Moshavegh, R. (Intern), Jensen, J. A. (Intern)
Number of pages: 9
Publication date: 2017
Available Resources for Reconfigurable Systems in 5G Networks

In this paper, the concept of a Radio-over-Fiber based Centralized Radio Access Network is explained and analyzed, in order to identify a set of resources within the network that can be used as a base in the design of reconfigurable systems. This analysis is then used to design a different reconfigurable systems to be implemented as part of the next generation Radio Access Unit. These systems are then implemented and experimentally tested, allowing to demonstrate their operation. The obtained results allow to show the feasibility of the systems and the implementation of a flexible architecture for the next generation of networks.

General information
State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Electromagnetic Systems
Authors: Rodríguez Páez, J. S. (Intern), Vegas Olmos, J. J. (Intern)
Number of pages: 6
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Publication date: 2017

A Vector Flow Imaging Method for Portable Ultrasound Using Synthetic Aperture Sequential Beamforming

This paper presents a vector flow imaging method for the integration of quantitative blood flow imaging in portable ultrasound systems. The method combines directional transverse oscillation (TO) and synthetic aperture sequential beamforming to yield continuous velocity estimation in the whole imaging region. Six focused emissions are used to create a high-resolution image (HRI), and a dual-stage beamforming approach is used to lower the data throughput between the probe and the processing unit. The transmit/receive focal points are laterally separated to obtain a TO in the HRI that allows for the velocity estimation along the lateral and axial directions using a phase-shift estimator. The performance of the method was investigated with constant flow measurements in a flow rig system using the SARUS scanner and a 4.1-MHz linear array. A sequence was designed with interleaved B-mode and flow emissions to obtain continuous data acquisition. A parametric study was carried out to evaluate the effect of critical parameters. The vessel was placed at depths from 20 to 40 mm, with beam-to-flow angles of 65°, 75°, and 90°. For the lateral velocities at 20 mm, a bias between -5% and -6.2% was obtained, and the standard deviation (SD) was between 6% and 9.6%. The axial bias was lower than 1% with an SD around 2%. The mean estimated angles were 66.70° ± 2.86°, 72.65° ± 2.48°, and 89.13° ± 0.79° for the three cases. A proof-of-concept demonstration of the real-time processing and wireless transmission was tested in a commercial tablet obtaining a frame rate of 27 frames/s and a data rate of 14 MB/s. An in vivo measurement of a common carotid artery of a healthy volunteer was finally performed to show the potential of the method in a realistic setting. The relative SD averaged over a cardiac cycle was 4.33%.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital, Alexandra Institute
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.73 SJR 0.986 SNIP 1.402
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.814 SNIP 1.494 CiteScore 2.43
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 1.088 SNIP 1.627 CiteScore 2.18
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BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.872 SNIP 1.496 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
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ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.733 SNIP 1.325 CiteScore 1.95
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.928 SNIP 1.562
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.296 SNIP 1.775
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 1.324 SNIP 1.567
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.328 SNIP 1.924
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.197 SNIP 2.162
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.104 SNIP 1.768
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.114 SNIP 1.918
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 1.437 SNIP 1.742
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.525 SNIP 1.916
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.703 SNIP 1.6
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.749 SNIP 2.005
Scopus rating (1999): SJR 0.808 SNIP 1.386

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In order to compensate multiple time scales power fluctuation resulted from distributed energy resources and loads, hybrid energy storage systems are employed as the buffer unit in DC microgrid. In this paper, a wireless hierarchical control strategy is proposed to realize power sharing between energy density storage unit and power density storage unit in reasonable fashion. Primary control introduces change rate of voltage as virtual information carrier, and urges supercapacitor unit to pick up major dynamic power immediately in the load switching moment, by setting sensitivity of different storage interface converters. The steady state error produced in primary control is eliminated by secondary control, in which voltage magnitude is maintained and zero steady state current in supercapacitor is guaranteed. In this framework, autonomous and coordinated control is achieved using only local information of each unit, therefore economic and reliability issues born along communication network can be avoided. The feasibility and effectiveness of the proposed control strategy are validated by experimental results.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Beijing Jiaotong University, Collaborative Innovation Center of Electric Vehicles in Beijing
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Scopus rating (2014): CiteScore 1.41
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Source: FindIt
Source-ID: 2373093387
Publication: Research - peer-review › Journal article – Annual report year: 2017

Backlash Estimation for Industrial Drive-Train Systems

Backlash in gearing and other transmission components is a common positioning-degrading phenomenon that develops over time in industrial machines. High-performance machine tool controls use backlash compensation algorithms to maintain accurate positioning of the tool to cope with such deadzone phenomena. As such, estimation of the magnitude of deadzones is essential. This paper addresses the generic problem of accurately estimating the width of the deadzone in a single-axis mechanical drive train. The paper suggests a scheme to estimate backlash between motor and load, employing a sliding mode observer and a nonlinear adaptive estimator. The efficacy of the approach is illustrated via simulations.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Siemens
Authors: Papageorgiou, D. (Intern), Blanke, M. (Intern), Niemann, H. H. (Intern), Richter, J. H. (Ekstern)
Pages: 3336-3341
Publication date: 2017
Bayesian inference of the flow resistivity of a sound absorber and the room's influence on the Sabine absorption coefficients

A Bayesian analysis is applied to determine the flow resistivity of a porous sample and the influence of the test chamber based on measured Sabine absorption coefficient data. The Sabine absorption coefficient measured in a reverberation chamber according to ISO 354 is influenced by the test chamber significantly, whereas the flow resistivity is a rather reproducible material property, from which the absorptive characteristics can be calculated through reliable models. Using Sabine absorption coefficients measured in 13 European reverberation chambers, the maximum a posteriori and the uncertainty of the flow resistivity and the test chamber's influence are estimated. Inclusion of more than one chamber's absorption data helps the flow resistivity converge towards a reliable value with a standard deviation below 17%.
This paper presents an inexpensive, low temperature and rapid fabrication method for capacitive micromachined ultrasonic transducers (CMUT). The fabrication utilizes the bonding and dielectric properties of the photosensitive polymer Benzocyclobutene (BCB). A BCB based row-column addressed CMUT with integrated apodization has been fabricated and characterized with initial impedance measurement. Furthermore, two linear BCB CMUT arrays have been fabricated with different bottom electrode designs and characterized acoustically. All the fabricated arrays have a center frequency of 2.5 MHz when immersed into water and a pull-in voltage of 75 V. Stability tests have showed a stable coupling coefficient of approximately 0.1 during 10 hours of biased operation. Acoustic measurements, with a hydrophone positioned 1 cm from the CMUTs, have showed a peak-to-peak pressure of 14 kPa.

**General information**

**State:** Published  
**Organisations:** Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Silicon Microtechnology, Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging  
**Authors:** Havreland, A. S. (Intern), Ommen, M. L. (Intern), Silvestre, C. (Intern), Engholm, M. (Intern), Jensen, J. A. (Intern), Thomsen, E. V. (Intern)
Benchmarking five computational methods for analyzing large photonic crystal membrane cavities

We benchmark five state-of-the-art computational methods by computing quality factors and resonance wavelengths in photonic crystal membrane L5 and L9 line defect cavities. The convergence of the methods with respect to resolution, degrees of freedom and number of modes is investigated. Convergence is not obtained for some of the methods, indicating that some are more suitable than others for analyzing line defect cavities.

General information
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Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Plasmonics and Metamaterials, Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Electromagnetic Systems, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO), Zuse Institute Berlin
Authors: Gregersen, N. (Intern), de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Häyrynen, T. (Intern), Lavrinenko, A. (Intern), Mark, J. (Intern), Wang, F. (Intern), Sigmund, O. (Intern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Ivinskaya, A. (Ekstern), Gutsche, P. (Ekstern), Burger, S. (Ekstern)
Pages: 89-90
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Breathing disturbances without hypoxia are associated with objective sleepiness in sleep apnea

Determine if defining two subtypes of sleep-disordered breathing (SDB) events - with or without hypoxia - results in measures that are more strongly associated with hypertension and sleepiness. A total of 1,022 subjects with 2,112 nocturnal polysomnograms (PSGs) from the Wisconsin Sleep Cohort were analyzed with our automated algorithm, developed to detect breathing disturbances and desaturations. Breathing events were time-locked to desaturations, resulting in 2 indices - desaturating (H-BDI) and non-desaturating (NH-BDI) events - regardless of arousals. Measures of subjective (Epworth Sleepiness Scale) and objective (2,981 multiple sleep latency tests from a subset of 865 subjects) sleepiness were analyzed, in addition to clinically relevant clinicodemographic variables. Hypertension was defined as BP ≥140/90 or antihypertensive use. H-BDI, but not NH-BDI, correlated strongly with SDB severity indices that included hypoxia (r=0.89, p<0.001 with 3% ODI and AHI with 4%-desaturations). A doubling of desaturation-associated events was associated with hypertension prevalence, which was significant for ODI but not H-BDI (3% ODI OR=1.06, 95% CI=1.00-1.12, p
This paper proposes a new method for measuring capacitor voltages in multilevel flying capacitor (FC) converters that requires only one voltage sensor per phase leg. Multiple dc voltage sensors traditionally used to measure the capacitor voltages are replaced with a single voltage sensor at the ac side of the phase leg. The proposed method is subsequently used to balance the capacitor voltages using only the measured ac voltage. The operation of the proposed measurement and balancing method is independent of the number of the converter levels. Experimental results presented for a five-level FC converter verify effective operation of the proposed method.
Sound textures, such as crackling fire or chirping crickets, represent a broad class of sounds defined by their homogeneous temporal structure. It has been suggested that the perception of texture is mediated by time-averaged summary statistics measured from early auditory representations. In this study, we investigated the perception of sound textures that contain rhythmic structure, specifically second-order amplitude modulations that arise from the interaction of different modulation rates, previously described as "beating" in the envelope-frequency domain. We developed an auditory texture model that utilizes a cascade of modulation filterbanks that capture the structure of simple rhythmic patterns. The model was examined in a series of psychophysical listening experiments using synthetic sound textures-stimuli generated using time-averaged statistics measured from real-world textures. In a texture identification task, our results indicated that second-order amplitude modulation sensitivity enhanced recognition. Next, we examined the contribution of the second-order modulation analysis in a preference task, where the proposed auditory texture model was preferred over a range of model deviants that lacked second-order modulation rate sensitivity. Lastly, the discriminability of textures that included second-order amplitude modulations appeared to be perceived using a time-averaging process. Overall, our results demonstrate that the inclusion of second-order modulation analysis generates improvements in the perceived quality of synthetic textures compared to the first-order modulation analysis considered in previous approaches.
Centre-surround organization of fast sensorimotor integration in human motor hand area

Using the short-latency afferent inhibition (SAI) paradigm, transcranial magnetic stimulation (TMS) of the primary motor hand area (M1HAND) can probe how sensory input from limbs modulates corticomotor output in humans. Here we applied a novel TMS mapping approach to chart the spatial representation of SAI in human hand-knob. We hypothesized SAI is somatotopically expressed in M1HAND depending on both the site of peripheral electrical nerve stimulation and the cortical spot targeted by TMS within M1HAND. The left index or little finger was stimulated 23 ms before focal single-pulse TMS of the right M1HAND. Using frameless stereotaxy, we applied biphasic-TMS pulses at seven stimulation positions above right M1HAND and recorded the motor evoked potentials (MEPs) from relaxed left first-dorsal-interosseous (FDI) and abductor-digitii-minimi (ADM) muscles. Homotopic stimulation of the finger close to the muscle targeted by TMS revealed a somatotopic expression of afferent inhibition matching the somatotopic representation of unconditioned MEPs (homotopic SAI). Conversely, heterotopic stimulation of a finger distant to the muscle targeted by TMS induced short-latency afferent facilitation (SAF) of MEPs in M1HAND. Like homotopic SAI, heterotopic SAF was somatotopically expressed in M1HAND. Together, the results provide first-time evidence that fast sensorimotor integration involves centre-inhibition and surround-facilitation in human M1HAND.
Changes in distributional patterns of plaice Pleuronectes platessa in the central and eastern North Sea; do declining nutrient loadings play a role?

Since the beginning of the 1990s, there has been a change in the relative distribution of smaller age-classes of plaice Pleuronectes platessa (age 1–3) in the North Sea. The abundances have increased in deeper, more offshore areas, while coastal abundances have been stagnant or declining. For the same time period available time series data on nutrient conditions in the coastal North Sea area show that the freshwater nitrogen loading has decreased by about 50%. While nutrient concentrations in the ambient environment have been shown to influence growth in juvenile plaice through influence on their prey, we here inspect the potential linkage between distributional changes in plaice and the decline in nutrient loading. We compare plaice observations in coastal areas in the eastern North Sea, which have experienced large changes in eutrophication, with observations for the Dogger Bank, a large sandbank in a shallow offshore area of the North Sea. The Dogger Bank, was used as a reference location assuming this area has been less influenced from coastal eutrophication but similar regional climate conditions, and here we found no changes in the abundances of juvenile plaice. The increase in the use of offshore habitats as nursery areas by juvenile plaice in the North Sea appears not related to water depth per se but driven by specific processes dominating in near-shore areas and may be related to changes in nutrient loadings. This point to the importance of separating more general depth-related factors from conditions specific for near-shore areas, such as nutrient loadings in coastal waters and export offshore. The concurrent changes in environment and in distribution of juvenile plaice may have implications for environmental and fisheries management.
Characterization and flip angle calibration of 13C surface coils for hyperpolarization studies
The aim of the present work is to address the challenge of optimal flip angle calibration of C surface coils in hyperpolarization studies. To this end, we characterize the spatial profile of the flip angle and demonstrate that it allows for a simple calibration improving the signal-to-noise ratio for hyperpolarized C magnetic resonance spectroscopic imaging.

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Characterizing cochlear hearing impairment using advanced electrophysiological methods

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Organisations: Department of Electrical Engineering, Hearing Systems
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Choreographing Cyber-Physical Distributed Control Systems for the Energy Sector
Energy Systems are facing a significant change in the way their management and control is conceived. With the introduction of distributed and renewable energy based resources, a shift to a more distributed operation paradigm is emerging, overturning the conventional top-down design and operation principles. This shift creates a
demand for distributed control systems (DCS) to facilitate a more adaptive and efficient operation of power networks. One key challenge here is to ensure the required reliability of distributed control systems. Whereas proven strategies exist for reliable control for coordination of physical actions, with increasing distribution of such control, the reliability and degradation properties in response to communications issues become more important. We build on the notion of Quality Choreographies, a formal model for the development of failure-aware distributed systems, and discuss how quality choreographies respond to the needs presented by DCS. We demonstrate their applicability by modelling the Bully Algorithm, one of the de-facto election algorithms used in coordination of DCS.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Center for Electric Power and Energy, Energy System Management, Department of Applied Mathematics and Computer Science, Formal Methods
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Combined Active and Reactive Power Control of Wind Farms based on Model Predictive Control

This paper proposes a combined wind farm controller based on Model Predictive Control (MPC). Compared with the conventional decoupled active and reactive power control, the proposed control scheme considers the significant impact of active power on voltage variations due to the low X=R ratio of wind farm collector systems. The voltage control is improved. Besides, by coordination of active and reactive power, the Var capacity is optimized to prevent potential failures due to Var shortage, especially when the wind farm operates close to its full load. An analytical method is used to calculate the sensitivity coefficients to improve the computation efficiency and overcome the convergence problem. Two control modes are designed for both normal and emergency conditions. A wind farm with 20 wind turbines was used to verify the proposed combined control scheme.
Combined shape and topology optimization for minimization of maximal von Mises stress

This work shows that a combined shape and topology optimization method can produce optimal 2D designs with minimal stress subject to a volume constraint. The method represents the surface explicitly and discretizes the domain into a simplicial complex which adapts both structural shape and topology. By performing repeated topology and shape optimizations and adaptive mesh updates, we can minimize the maximum von Mises stress using the p-norm stress measure with p-values as high as 30, provided that the stress is calculated with sufficient accuracy.

General information
State: Published
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Combined time-varying forecast based on the proper scoring approach for wind power generation

Compared with traditional point forecasts, combined forecast have been proposed as an effective method to provide more accurate forecasts than individual model. However, the literature and research focus on wind-power combined forecasts are relatively limited. Here, based on forecasting error distribution, a proper scoring approach is applied to combine plausible models to form an overall time-varying model for the next day forecasts, rather than weights-based combination. Simulation results demonstrate that the proposed method improves the accuracy of overall forecasts, even compared with a numerical weather prediction.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Hohai University
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Common Carotid Artery Flow Measured by 3-D Ultrasonic Vector Flow Imaging and Validated with Magnetic Resonance Imaging

Ultrasound (US) examination of the common carotid artery was compared with a through-plane magnetic resonance imaging (MRI) sequence to validate a recently proposed technique for 3-D US vector flow imaging. Data from the first volunteer examined were used as the training set, before volume flow and peak velocities were calculated for the remaining eight volunteers. Peak systolic velocities (PSVs) and volume flow obtained with 3-D US were, on average, 34% higher and 24% lower than those obtained with MRI, respectively. A high correlation was observed for PSV (r = 0.79), whereas a lower correlation was observed for volume flow (r = 0.43). The overall standard deviations were ±5.7% and ±5.7% for volume flow and PSV with 3-D US, compared with ±2.7% and ±3.2% for MRI. Finally, the data were re-processed with a change in the parameter settings for the echo-canceling filter to investigate its influence on overall performance. PSV was less affected by the re-processing, whereas the difference in volume flow between 3-D vector flow imaging and MRI was reduced to -9%, and with an improved overall standard deviation of ±4.7%. The results illustrate the feasibility of using 3-D US for precise and angle-independent volume flow and PSV estimation in vivo.

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Web of Science (2017): Indexed Yes
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Compact First-Order Probe for Spherical Near-Field Antenna Measurements at Low Frequencies

Guidelines for designing compact and lightweight first-order probes for spherical near-field antenna measurements at frequencies below 1 GHz that exploit first-order properties of electrically small self-resonant radiators combined into superdirective endfire arrays are established theoretically, exemplified numerically, and validated experimentally. A prototype of the probe designed to operate at a central frequency of 435 MHz exhibits the impedance bandwidth of 15 MHz with a directivity of more than 9 dBi and parasitic $|\mu| \neq 1$ spherical modes suppressed to at least −42 dB. The probe height is just 343 mm above a 720-mm circular ground plane and weighs about 5 kg.

General information
Comparing TMS perturbations to occipital and parietal cortices in concurrent TMS-fMRI studies - Methodological considerations

Neglect and hemianopia are two neuropsychological syndromes that are associated with reduced awareness for visual signals in patients' contralesional hemifield. They offer the unique possibility to dissociate the contributions of retinogeniculate and retino-colliculo circuitries in visual perception. Yet, insights from patient fMRI studies are limited by heterogeneity in lesion location and extent, long-term functional reorganization and behavioural compensation after stroke. Transcranial magnetic stimulation (TMS) has therefore been proposed as a complementary method to investigate the effect of transient perturbations on functional brain organization. This concurrent TMS-fMRI study applied TMS perturbation to occipital and parietal cortices with the aim to 'mimick' neglect and hemianopia. Based on the challenges and interpretational limitations of our own study we aim to provide tutorial guidance on how future studies should compare TMS to primary sensory and association areas that are governed by distinct computational principles, neural dynamics and functional architecture.
Comparison between AGC and a tuningless LFC approach based on direct observation of DERs

Automatic Generation Control (AGC) used in secondary frequency control requires manual tuning to maintain a balance between reaction speed and stability. This task becomes increasingly difficult due to the rising number of inverter-coupled devices and High-Voltage Direct Current (HVDC) links, and the resulting reduction of available inertia. In this paper, we propose a tuningless Load-Frequency Control (LFC) approach able to cope with the changing dynamics of electric power grids. Harnessing the possibilities of modern monitoring and communication means, the so-called Direct Load-Frequency Control (DLFC) employs two concurrently operating processes: a power matching stage responsible for secondary power adjustment using directly observed area imbalances; and a frequency control stage that adjusts primary reserves’ frequency setpoints in a systematic manner. As opposed to the AGC, the DLFC does not require an integrator to mitigate frequency deviations. The only free parameter is the secondary control interval, from which all other parameters are derived. Small-signal stability investigations show that the DLFC exhibits 40 dB falloff of steady-state deviations versus the AGC's 20 dB. Simulations on the non-linear singlearea system confirm the DLFC's response speed and stability advantage.

General information
Comparison between Synthetic Inertia and Fast Frequency Containment Control Based on Single Phase EVs in a Microgrid

The increasing share of distributed and inertia-less resources entails an upsurge in balancing and system stabilisation services. In particular, the displacement of conventional generation reduces the available rotational inertia in the power system, leading to high interest in synthetic inertia solutions. The objective of this paper is twofold: first, it aims to implement and validate fast frequency control and synthetic (virtual) inertia control, employing single phase electric vehicles as flexibility resources. Second, it proposes a trade-off analysis between the two controllers. The interdependency between frequency containment and synthetic inertia control on the transient frequency variation is shown analytically. The capabilities and limits of series produced EVs in providing such services are investigated, first on a simulation based approach and subsequently by using real hardware. The results show that fast frequency control can improve the transient frequency behaviour. However, both on the simulation and on the experimental level, the implementation of synthetic inertia control is more challenging. In fact, due its derivative nature and the system dynamics, its performance is limited. Furthermore, the crucial importance of the EVs’ response time for both controllers is highlighted.
Comparison of Five Computational Methods for Computing Q Factors in Photonic Crystal Membrane Cavities

Five state-of-the-art computational methods are benchmarked by computing quality factors and resonance wavelengths in photonic crystal membrane L5 and L9 line defect cavities. The convergence of the methods with respect to resolution, degrees of freedom and number of modes is investigated. Special attention is paid to the influence of the size of the computational domain. Convergence is not obtained for some of the methods, indicating that some are more suitable than others for analysing line defect cavities.
Comparison of Five Numerical Methods for Computing Quality Factors and Resonance Wavelengths in Photonic Crystal Membrane Cavities

Among several behavioural methods for estimating the basilar membrane input/output function, the temporal masking curve is the most popular. Distortion product otoacoustic emissions provide an objective measure for estimating cochlear compression. However, estimates from both methods have been poorly correlated in previous studies. We hypothesise that this could be due to the interplay between generator and reflection components in the recorded otoacoustic emissions. Here, compression estimates obtained with the two methods were compared at three audiometric frequencies (1, 2, and 4 kHz) for 10 normal-hearing and 6 hearing-impaired listeners. Distortion-product otoacoustic emissions were evoked using continuouslyswept tones, to separate the generator component and investigate the corresponding compressive characteristic. For hearing impaired listeners, the estimates from the two methods were highly correlated.
Comparison of three control strategies for optimization of spray dryer operation

Spray drying is the preferred process to reduce the water content of many chemicals, pharmaceuticals, and foodstuffs. A significant amount of energy is used in spray drying to remove water and produce a free flowing powder product. In this paper, we present and compare the performance of three controllers for operation of a four-stage spray dryer. The three controllers are a proportional-integral (PI) controller that is used in industrial practice for spray dryer operation, a linear model predictive controller with real-time optimization (MPC with RTO, MPC-RTO), and an economically optimizing nonlinear model predictive controller (E-NMPC). The MPC with RTO is based on the same linear state space model in the MPC and the RTO layer. The E-NMPC consists of a single optimization layer that uses a nonlinear system of ordinary differential equations for its predictions. The PI control strategy has a fixed target that is independent of the disturbances, while the MPC-RTO and the E-NMPC adapt the operating point to the disturbances. The goal of spray dryer operation is to optimize the profit of operation in the presence of feed composition and ambient air humidity variations; i.e. to maximize the production rate, while minimizing the energy consumption, keeping the residual moisture content of the powder below a maximum limit, and avoiding that the powder sticks to the chamber walls. We use an industrially recorded disturbance scenario in order to produce realistic simulations and conclusions. The key performance indicators such as the profit of operation, the product flow rate, the specific energy consumption, the energy efficiency, and the residual moisture content of the produced powder are computed and compared for the three controllers. In this simulation study, we find that the economic performance of the MPC with RTO as well as the E-NMPC is considerably improved compared to the PI control strategy used in industrial practice. The MPC with RTO improves the profit of operation by 8.61%, and the E-NMPC improve.
Comparison of zero-sequence injection methods in cascaded H-bridge multilevel converters for large-scale photovoltaic integration

Photovoltaic (PV) power generation levels in the three phases of a multilevel cascaded H-bridge (CHB) converter can be significantly unbalanced, owing to different irradiance levels and ambient temperatures over a large-scale solar PV power plant. Injection of a zero-sequence voltage is required to maintain three-phase balanced grid currents with unbalanced power generation. This study theoretically compares power balance capabilities of various zero-sequence injection methods based on two metrics which can be easily generalised for all CHB applications to PV systems. Experimental results based on a 430 V, 10 kW, three-phase, seven-level cascaded H-bridge converter prototype confirm superior performance of the optimal zero-sequence injection technique.

General information
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Compensating for evanescent modes and estimating characteristic impedance in waveguide acoustic impedance measurements

The ear-canal acoustic impedance and reflectance are useful for assessing conductive hearing disorders and calibrating stimulus levels in situ. However, such probe-based measurements are affected by errors due to the presence of evanescent modes and incorrect estimates or assumptions regarding characteristic impedance. This paper proposes a method to compensate for evanescent modes in measurements of acoustic impedance, reflectance, and sound pressure in waveguides, as well as
estimating the characteristic impedance immediately in front of the probe. This is achieved by adjusting the characteristic impedance and subtracting an acoustic inertance from the measured impedance such that the non-causality in the reflectance is minimized in the frequency domain using the Hilbert transform. The method is thus capable of estimating plane-wave quantities of the sought-for parameters by supplying only an arbitrary initial value for the characteristic impedance. From a comparison with a simulated waveguide, it is shown that this method can accurately estimate these quantities in a waveguide that is uniform at the position of the probe. Finally, it is demonstrated how evanescent modes, characteristic impedance, and the proposed methodology can affect the measured acoustic impedance and reflectance of an occluded-ear simulator.
Computing the resonance wavelength and Q of PhC resonators and plasmonic nanoparticles with the surface integral equation method

Integral equation method is an efficient approach for finding the resonance frequency and computing the Q-factor of open resonators due to the radiation boundary condition at infinity inherently built into the formulation, thus allowing the losses associated with radiation to be properly accounted. In this contribution, it is shown how to apply the surface integral equation to analysis of photonic crystal (PhC) defect cavities and plasmonic nanoparticles.

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Congestion management of electric distribution networks through market based methods
Rapidly increasing share of intermittent renewable energy production poses a great challenge of the management and operation of the modern power systems. Deployment of a large number of flexible demands, such as electrical vehicles (EVs) and heat pumps (HPs), is believed to be a promising solution for handling the challenge. Equipped with batteries and hot water storage systems, EVs and HPs are able to shift the consumption according to the production level of renewable energy. However, most of today's distribution networks are not able to accommodate such large number of flexible demands if coordination is not exercised. Congestion can occur on distribution networks if the EVs and HPs consume power simultaneously. This thesis is dedicated to handle the congestion problems on distribution networks when there is high penetration of distributed energy resources (DERs), including EVs and HPs. Market-based congestion management methods are the focus of the thesis. They handle the potential congestion at the energy planning...
stage; therefore, the aggregators can optimally plan the energy consumption and have the least impact on the customers. After reviewing and identifying the shortcomings of the existing methods, the thesis fully studies and improves the dynamic tariff (DT) method, and proposes two new market-based congestion management methods, namely the dynamic subsidy (DS) method and the flexible demand swap method. The thesis improves the DT method from four aspects. Firstly, the formulation of the DT method has been improved. Based on the locational marginal pricing (LMP) concept, the DT method has been proposed in several previous works for congestion management in a decentralized manner. However, linear programming models are not suitable for determining DT due to the multiple-response issue (one price set can have multiple flexible demand responses from aggregators). The thesis proposes a quadratic programming model for the DT method which can avoid the multiple-response issue and make the DT method an efficient decentralized congestion management method. Secondly, the combination of the DT method and direct control methods is studied and the feeder reconfiguration based DT method is proposed for more efficient congestion management and loss reduction on distribution networks. Thirdly, the stochastic nature of flexible demands is studied and a method for uncertainty management of the DT method is proposed to be under a certain level through the modified DT method, where the behavior and parameters of the flexible demands have a given probability distribution. At last, a convex relaxation based AC optimal power flow (OPF) model is proposed for determining DT where voltage constraints are included. Moreover, a sufficient condition for exact convex relaxation is proposed and validated. The condition is that there is no reverse power flow, or only active or reactive reverse power flow on the distribution network. After the study of the DT method, the thesis proposes the DS method for day-ahead congestion management, which is conceptually opposite to the DT method; however, it doesn’t discriminate the customers. Finally, the thesis proposes the flexible demand swap method for real-time congestion management, which handles the residual congestion after the day-ahead market and the congestion caused by forecast errors and contingent events. As such, a series of market-based methods, including DT, DS and flexible demand swap, are formed systematically in this thesis for handling congestion more comprehensively and efficiently.

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Authors: Huang, S. (Intern), Wu, Q. (Intern), Nielsen, A. H. (Intern)
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Construction of Lightweight Loudspeaker Enclosures
On the basis of bass cabinets, this paper deals with the problem of reducing loudspeaker enclosure weight. An introductory market analysis emphasizes that lighter cabinets are sought, but maintenance of sound quality is vital. The problem is challenged through experiments and simulations in COMSOL Multiphysics, which indicate that weight reduction and sound quality maintenance is possible by reducing wall thickness and using adequate bracing and lining.

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State: Published
Organisations: Office for Innovation & Sector Services, Department of Mechanical Engineering, Engineering Design and Product Development, Department of Electrical Engineering, Electronics, Technical University of Denmark
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Contribution of low- and high-frequency bands to binaural unmasking in hearing-impaired listeners

This study investigated the contribution of interaural timing differences (ITDs) in different frequency regions to binaural unmasking (BU) of speech. Speech reception thresholds (SRTs) and binaural intelligibility level differences (BILDs) were measured in two-talker babble in 6 young normal-hearing (NH) and 9 elderly hearing-impaired (HI) listeners with normal or close-to-normal hearing at and below 1.5 kHz. Target sentences were presented diotically, embedded in a stream of diotic or dichotic maskers. Both target and masker sentences were split into frequency regions above and below 1.25 kHz. In the dichotic listening conditions, the maskers were lateralized to the left side by introducing 0.68-ms ITDs in either the low-frequency band, the high-frequency band, or both bands simultaneously. BILDs were found to be similar in both listener groups when the ITDs were imposed on the low-frequency band only. ITDs in the high-frequency band alone did not produce any BILD in any of the groups. However, when ITDs were imposed in both frequency bands, the NH listeners yielded significantly greater BILDs than the HI listeners. The results suggest that, on a group level, HI listeners relied solely on ITDs in the low-frequency band while NH listeners were able to utilize envelope ITDs above 1.25 kHz to facilitate the BU of speech.

Controllability and stability of primary frequency control from thermostatic loads with delays

There is an increasing interest in exploiting the flexibility of loads to provide ancillary services to the grid. In this paper we study how response delays and lockout constraints affect the controllability of an aggregation of refrigerators offering primary frequency control (PFC). First we examine the effect of delays in PFC provision from an aggregation of refrigerators, using a two-area power system. We propose a framework to systematically address frequency measurement and response delays and we determine safe values for the total delays via simulations. We introduce a controllability index to evaluate PFC provision under lockout constraints of refrigerators compressors. We conduct extensive simulations to study the effects of measurement delay, ramping times, lockout durations and rotational inertia on the controllability of the aggregation and system stability. Finally, we discuss solutions for offering reliable PFC provision from thermostatically controlled loads under lockout constraints and we propose a supervisory control to enhance the robustness of their controllers.

Control of exceptional points in photonic crystal slabs

Various ways of controlling the extent of the ring of exceptional points in photonic crystal slabs are investigated. The extent of the ring in photonic crystal slabs is found to vary with the thickness of the slab. This enables recovery of Dirac cones in open, non-Hermitian systems, such as a photonic crystal slab. In this case, all three bands exhibit a bound state in the continuum in close proximity of the Γ point. These results may lead to new designs of small photonic-crystal-based lasers exhibiting high-quality factors.
Accidental Dirac cones of linear dispersion can occur in photonic crystal (PhC) structures [1]. These configurations can be easily manufactured providing an accessible platform for studying topological properties of Dirac cones and their influence on light-matter interactions. Recently, it has been shown that when the system becomes non-Hermitian, e.g. it is an open...
system exhibiting radiation losses, Dirac cones can be deformed spawning rings of exceptional points [2]. Within the ring, the dispersion follows the two-dimensional flat band which provides a high density of states and therefore high Purcell factors. Moreover, strong dispersion of loss in the center of the Brillouin zone allows to significantly improve the performance of large-area single mode PhC lasers [3]. These lasers exploit bound states in the continuum [4], and we discuss their relation to Dirac cones.

**General information**

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Authors: Kaminski, P. M. (Intern), Breinbjerg, O. (Intern), Mark, J. (Intern), Arslanagic, S. (Intern)
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**Convex Relaxations of Chance Constrained AC Optimal Power Flow**

High penetration of renewable energy sources and the increasing share of stochastic loads require the explicit representation of uncertainty in tools such as the optimal power flow (OPF). Current approaches follow either a linearized approach or an iterative approximation of non-linearities. This paper proposes a semidefinite relaxation of a chance constrained AC-OPF which is able to provide guarantees for global optimality. Using a piecewise affine policy, we can ensure tractability, accurately model large power deviations, and determine suitable corrective control policies for active power, reactive power, and voltage. We state a tractable formulation for two types of uncertainty sets. Using a scenario-based approach and making no prior assumptions about the probability distribution of the forecast errors, we obtain a robust formulation for a rectangular uncertainty set. Alternatively, assuming a Gaussian distribution of the forecast errors, we propose an analytical reformulation of the chance constraints suitable for semidefinite programming. We demonstrate the performance of our approach on the IEEE 24 and 118 bus system using realistic day-ahead forecast data and obtain tight near-global optimality guarantees.

**General information**

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, ETH Zurich
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Scopus rating (2011): SJR 1.586 SNIP 3.205 CiteScore 5.34
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Coordinated Control Strategies for Offshore Wind Farm Integration via VSC-HVDC for System Frequency Support

Coordinated control strategies to provide system inertia support for main grid from offshore wind farm that is integrated through HVdc transmission is the subject matter of this paper. The strategy that seeks to provide inertia support to the main grid through simultaneous utilization of HVdc capacitors energy, and wind turbines (WTs) inertia without installing the remote communication of two HVdc terminals is introduced in details. Consequently, a novel strategy is proposed to improve system inertia through sequentially exerting dc capacitors energy and then WTs inertia via a cascading control scheme. Both strategies can effectively provide inertia support while the second one minimizes the control impacts on harvesting wind energy with the aid of communication between onshore and offshore ac grids. Case studies of a wind farm connecting with a HVdc system considering sudden load variations have been successfully conducted to compare and demonstrate the effectiveness of the control strategies in DigSILENT/PowerFactory.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Guangdong University of Technology, Hong Kong Polytechnic University, University of Hong Kong
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This paper proposes a coordinated voltage control scheme based on model predictive control (MPC) for voltage source converter-based high voltage direct current (VSC-HVDC) connected wind power plants (WPPs). In the proposed scheme, voltage regulation capabilities of VSC and WTGs are fully utilized and optimally coordinated. Two control modes, namely operation optimization mode and corrective mode, are designed to coordinate voltage control and economic operation of the system. In the first mode, the control objective includes the bus voltages, power losses and dynamic Var reserves of wind turbine generators (WTGs). Only the terminal voltages of WTGs are taken into account in the second mode. The predictive model of the system including VSC and WTGs is developed firstly. The calculation of sensitivity coefficients is done by an analytical method to improve the computational efficiency. Simulation results are presented to demonstrate the effectiveness of the proposed controller and the control performance is compared with conventional optimal control and loss minimization control. Besides, the robustness of the proposed controller to communication time delay and measurement errors is investigated in the last.
Coordinating Flexibility under Uncertainty in Multi-Area AC and DC Grids

In the future, mixed AC and DC grids, spanning multiple areas operated by different transmission system operators (TSO), are expected to offer the necessary controllability for integrating large amounts of intermittent renewable generation. This is facilitated by high voltage direct current transmission based on voltage source converter technology that can offer recourse actions in the form of preventive and corrective control of both active and reactive power. Market-clearing procedures, based on optimal power flow algorithms, need to be revised to account for DC transmission, flexibility and privacy requirements. To this end, we propose a decentralized two-stage stochastic market-clearing algorithm that incorporates meshed DC grids and allows the sharing of flexibility resources between areas. The benefit of this approach lies in its pricing mechanism, used for coordinating the different area subproblems and requiring only a moderate exchange of information while ensuring system-wide optimality. Case studies are presented to illustrate the methodology and to demonstrated the benefits of additional controllability provided by DC grids.
Coplanar transitions based on aluminum nitride interposer substrate for terabit transceivers

This paper presents two types of coplanar transitions based on aluminum nitride (AlN) substrate for interposer designs of terabit transceivers. The designs of coupled coplanar waveguide (CCPW), coupled line, coplanar waveguide (CPW), and coplanar stripline (CPS) based on AlN substrate are explained. The effects of absorber layer and wire bonding bridges are described. Two types of coplanar transitions are designed and simulated in back-to-back configuration with wire bonding bridges. When driven by differential signal pair, the proposed CCPW-to-coupled line transition in back-to-back configuration with wire bonding bridges achieves a simulated return loss of 11 dB and insertion loss of 2 dB up to 110 GHz. As for single-ended signals, a CPW-to-CPS transition in back-to-back configuration with wire bonding bridges has been designed, fabricated, and measured. The fabricated CPW-to-CPS transition can provide a −3 dB transmission bandwidth up to 80 GHz with associated return loss better than 12 dB.

General information
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III-V semiconductor materials, Substrates, Aluminum nitride, Bridges, Coplanar waveguides, Wires, Bonding

Corrections to "Lower Bounds on Q for Finite Size Antennas of Arbitrary Shape"

Equations (24) and (25) in [1, Appendix B] should, respectively, read as:
\[
\begin{align*}
&\int_{V_{\infty}} \nabla G_{1} G_{2}^{*} - \hat{r} jk \frac{e^{jk(\hat{r}_{1}-\hat{r}_{2})}}{16\pi^{2}|\hat{r}|^{2}} dV = -\frac{\hat{r}_{12}}{|\hat{r}_{12}|} \frac{\cos (k|\hat{r}_{12}|)}{8\pi} \\
&- j\frac{2\hat{r}_{1}}{8\pi k^{2}} \left( \frac{\sin (k|\hat{r}_{12}|)}{|\hat{r}_{12}|^{3}} - \frac{k\cos (k|\hat{r}_{12}|)}{|\hat{r}_{12}|^{2}} \right) \\
&- j\frac{|\hat{r}_{1}|^{2} - |\hat{r}_{2}|^{2}}{8\pi k^{2}} \frac{\hat{r}_{12}}{|\hat{r}_{12}|^{2}} \left( \frac{k^{2}\sin (k|\hat{r}_{12}|)}{|\hat{r}_{12}|} - 3\left( \frac{\sin (k|\hat{r}_{12}|)}{|\hat{r}_{12}|^{3}} - \frac{k\cos (k|\hat{r}_{12}|)}{|\hat{r}_{12}|^{2}} \right) \right) \\
&\equiv j\frac{\hat{r}_{12}}{2} \text{Re}\{G_{12}\} - \frac{1}{2k^{2}} \text{Im}\{\nabla_{1} G_{12}\} \\
&- \frac{\hat{r}_{1} + \hat{r}_{2}}{2k^{2}} \text{Im}\left\{\nabla_{1} G_{12} \cdot \frac{\hat{r}_{12}}{|\hat{r}_{12}|^{2}}\right\} \\
&+ \frac{|\hat{r}_{1}|^{2} - |\hat{r}_{2}|^{2}}{2k^{2}|\hat{r}_{12}|^{2}} \text{Im}\{k^{2}\hat{r}_{12}G_{12} + 3\nabla_{1} G_{12}\}. 
\end{align*}
\]
Correlations of current parameters with flash density from winter thunderstorms in Japan

In this work, Lightning Location System (LLS) data from the Japanese Lightning Detection Network (JLDN) are correlated with lightning current measurements from the New Energy and Industrial Technology Development Organization (NEDO) project which conducted lightning measurements on wind turbines during 2008-2013. The terminology of active and inactive winter thunderstorms from Fujii et al. (2013) [1] will be used as a reference to classify the discharge characteristics of the particular storm type. The results indicate that winter thunderstorms with a higher lightning activity are also characterized by higher charge, specific energy, and peak current. On the contrary, inactive winter thunderstorms produce not only fewer discharges but also show lower transferred charge amounts. Average charge and specific energy of individual flashes from very active winter thunderstorms with more than 1000 discharges are also lower compared to winter thunderstorms with 100 – 1000 discharges. Furthermore, it is shown that the height of the -10 degree isotherm is increasing with increasing lightning activity.

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Co-simulation with DlgsILENT PowerFactory and Matlab: Optimal integration of plug-in electric vehicles in distribution networks

Smart grid concept is gaining more and more importance in electric power systems. In near term, electric grids will be more intelligent, interconnected and decentralised. Dealing with a significant number of distributed resources in a smart way, frequently requires the use of optimal control techniques, which find the best solution according to a defined objective function. Taking into account all these aspects, the simulation of these types of problems are characterised by having a
great number of controlled resources and the use of advanced control techniques. In this context, DlgSILENT
PowerFactory provides useful tools to simulate complex systems. On the one hand, the DlgSILENT
Programming Language (DPL) can be used for multiple purposes such as automation of simulations, automatic generation
of simulation scenarios, analysis of results, etc. On the other hand, the DlgSILENT Simulation Language (DSL) and the
digexfun interface allow the implementation of advanced control techniques. Using the digexfun interface, DlgSILENT
PowerFactory can send and receive data from other
mathematical software APIs such as Matlab. This chapter presents a co-simulation framework developed to test optimal
control methods for root mean square (RMS) simulations on DlgSILENT PowerFactory. As an example, the
implementation of a smart charging control for plug-in electric vehicles in electric distribution networks is explained.

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University of the Basque Country, Basque Country
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Cost-Benefit Analysis of a Novel DC Fast-Charging Station with a Local Battery Storage for EVs
The increasing penetration of Electric Vehicles (EVs) and their charging systems is representing new highpower
consumption loads for the distribution system operators (DSOs). To solve the problem of the EV range in terms of driving
kilometers, the car manufacturers have invested resources on new EV models by increasing the size of the batteries. To
satisfy EV load demand of the new EV models in urban areas the public DC Fast-Charging Station (DCFCS) is
indispensable to recharge EVs rapidly. The introduction of the Battery Energy Storage within the DCFCSs is considered in
this paper an alternative solution to reduce the operational costs of the charging stations as well as the ability to mitigate
negative impacts during the congestion on the power grids. An accurate description of the DCFCS and its design system,
which is able to decouple the peak load demand caused by EVs on the main grid and decrease the connection fees.
Finally, an economic evaluation is done to evaluate the feasibility and the cost-benefit analysis (CBA) of the DCFCSs. The
proposed approach considers various technical and economic issues, such as cost of installation, connection fees and life
cycle cost of the batteries. The proposed cost-benefit analysis can be used to verify the effectiveness and applicability of
DCFCS in large scale.

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Cost_Benefit_Analysis_of_a_Novel_DC_Fast_Charging_Station_with_a_Local_Battery_Storage_for_EVs.pdf
Curvilinear 3-D Imaging Using Row–Column-Addressed 2-D Arrays with a Diverging Lens: Feasibility Study

Constructing a double-curved row–column-addressed (RCA) 2-D array or applying a diverging lens over the flat RCA 2-D array can extend the imaging field-of-view (FOV) to a curvilinear volume without increasing the aperture size, which is necessary for applications such as abdominal and cardiac imaging. Extended FOV and low channel count of double-curved RCA 2-D arrays make 3-D imaging possible with equipment in the price range of conventional 2-D imaging. This study proposes a delay-and-sum beamformation scheme specific to double-curved RCA 2-D arrays and validates its focusing ability based on simulations. A synthetic aperture imaging sequence with single element transmissions is designed for imaging down to 14 cm at a volume rate of 88 Hz. Using a diverging lens with f-number of -1 circumscribing the underlying RCA array, the imaging quality of a double-curved λ/2-pitch 3 MHz 62+62 RCA 2-D array is investigated as a function of depth within a curvilinear FOV of 60°×60°. The simulated double-curved 2-D array exhibits the same full-width-at-halfmaximum values for a point scatterer within its curvilinear FOV at a fixed radial distance compared with a flat 2-D array within its rectilinear FOV. The results of this study demonstrate that the proposed beamforming approach is accurate for achieving correct time-of-flight calculations, and hence avoids geometrical distortions.

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Cyber-Physical Energy Systems Modeling, Test Specification, and Co-Simulation Based Testing

The gradual deployment of intelligent and coordinated devices in the electrical power system needs careful investigation of the interactions between the various domains involved. Especially due to the coupling between ICT and power systems a holistic approach for testing and validating is required. Taking existing (quasi-) standardised smart grid system and test specification methods as a starting point, we are developing a holistic testing and validation approach that allows a very flexible way of assessing the system level aspects by various types of experiments (including virtual, real, and mixed lab settings). This paper describes the formal holistic test case specification method and applies it to a particular co-simulation experimental setup. The various building blocks of such a simulation (i.e., FMI, mosaik, domain-specific simulation federates) are covered in more detail. The presented method addresses most modeling and specification challenges in cyber-physical energy systems and is extensible for future additions such as uncertainty quantification.
Cylindrical and Spherical Active Coated Nanoparticles as Nanoantennas: Active nanoparticles as nanoantennas

In this article, we review the fundamental properties of several spherical and cylindrical, passive, and active coated nanoparticles (CNPs) with an emphasis on their potential for nanoantenna and nanoamplifier synthesis. For the spherical geometries, the nanoparticles are excited by an electric Hertzian dipole (EHD), which represents, e.g., a stimulated atom or molecule. The cylindrical nanoparticles are excited by a magnetic line source (MLS). In the active cases, gain is added to the core region of the particle. For simplicity, it is represented by a canonical, frequency-independent gain model. We demonstrate that specific CNPs can be designed to be resonant and well matched to their respective excitation sources. With active cores, these designs can lead to extremely large total radiated powers. For both configurations, insights into the effects of the nanoparticle material composition, source location, and orientation will be given on the basis of studying their near-field and power-flow density distributions, total radiated powers, and directivity properties.
Data-driven approach for auditory profiling

Nowadays, the pure-tone audiogram is the main tool used to characterize hearing loss and to fit hearing aids. However, the perceptual consequences of hearing loss are typically not only associated with a loss of sensitivity, but also with a clarity loss that is not captured by the audiogram. A detailed characterization of hearing loss has to be simplified to efficiently explore the specific compensation needs of the individual listener. We hypothesized that any listener's hearing can be characterized along two dimensions of distortion: type I and type II. While type I can be linked to factors affecting audibility, type II reflects non-audibility-related distortions. To test our hypothesis, the individual performance data from two previous studies were re-analyzed using an archetypal analysis. Unsupervised learning was used to identify extreme patterns in the data which form the basis for different auditory profiles. Next, a decision tree was determined to classify the listeners into one of the profiles. The new analysis provides evidence for the existence of four profiles in the data. The most significant predictors for profile identification were related to binaural processing, auditory non-linearity and speech-in-noise perception. The current approach is promising for analyzing other existing data sets in order to select the most relevant tests for auditory profiling.

General information
Data-driven Demand Response Characterization and Quantification

Analysis of load behavior in demand response (DR) schemes is important to evaluate the performance of participants. Very few real-world experiments have been carried out and quantification and characterization of the response is a difficult task. Nevertheless it will be a necessary tool for portfolio management of consumers in a DR framework. In this paper we develop methods to quantify and characterize the amount of DR in a load. The contribution to the aggregated load from each household is quantified on a daily basis, showing the potential variability of the response in time. Clustering on the average values and standard deviation of the contribution regroups households with the same average response. Independent Component Analysis (ICA) is used to characterize different DR delivery profiles.

Data-Driven Security-Constrained OPF

In this paper we unify electricity market operations with power system security considerations. Using data-driven techniques, we address both small signal stability and steady-state security, derive tractable decision rules in the form of line flow limits, and incorporate the resulting constraints in market clearing algorithms. Our goal is to minimize redispatching actions, and instead allow the market to determine the most cost-efficient dispatch while considering all security constraints. To maintain tractability of our approach we perform our security assessment offline, examining large datasets, both from measurements and simulations, in order to determine stable and unstable operating regions. With the help of decision trees, we transform this information to linear decision rules for line flow constraints. We propose conditional line transfer limits, which can accurately capture security considerations, while being less conservative than current approaches. Our approach can be scalable for large systems, accounts explicitly for power system security, and enables the electricity market to identify a cost-efficient dispatch avoiding redispatching actions. We demonstrate the performance of our method in a case study.
DC Fast-Charging Stations for EVs Controlled by a Local Battery Storage in Low Voltage Grids

Electric Vehicles (EVs) are representing a great opportunity for major car manufacturers to invest resources in new technologies in order to support sustainable transportation and the reduction of CO₂ emissions, in particular in the metropolitan areas. In recent years, the increasing penetration of EVs and their charging systems are going through a series of changes. This paper addresses the design of a new DC Fast Charging Station (DFCFS) for EVs coupled with a local Battery Energy Storage (BES) by using the IEC 15118, which provides a communication interface among different actors. DFCFS is equipped with a bidirectional AC/DC converter for feeding power back to the grid, two lithium batteries and a DC/DC converter. The proposed solution decreases the charging time of EVs and facilitates the integration of fast chargers in existing low voltage (LV) grids. The charging station can also be used as a multifunctional grid-utility for ancillary services such as primary frequency control, load levelling and congestion management.

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DC_Fast_Charging_Stations_for_EVs_Controlled_by_a_Local_Battery_Storage_in_Low_Voltage_Grids.pdf
**DC Voltage Droop Control Structures and its Impact on the Interaction Modes in Interconnected AC-HVDC Systems**

Different dc voltage droop control structures for future multi-terminal HVDC systems have been proposed in literature. This paper contributes to the evaluation of those structures by an analysis of their impact on the coupling of the interconnected subsystems. In particular, the modes of the systems are classified in different subsets according to the participation of the various subsystems. Those subsets are then evaluated qualitatively and quantitatively indicating which impact the choice of the droop control structure has on the degree of coupling between the connected ac and dc systems respectively the different HVDC converters. The lowest damped interaction modes of the different subsets are analyzed in more detail.

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**dDNP as an emerging real time analytical method for catalytic reactions**

**General information**

State: Published  
Organisations: Department of Chemistry, Organic Chemistry, Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance  
Number of pages: 1  
Publication date: 2017  
Event: Abstract from EUROMAR 2017, Warsaw, Poland.  
Main Research Area: Technical/natural sciences  
Electronic versions:  
Abstract_PANBO_Euromar_17.pdf

**Relations**

Activities:  
dDNP as an emergent real time analytical method for catalytic reactions  
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Decentralised control method for DC microgrids with improved current sharing accuracy**

A decentralised control method that deals with current sharing issues in dc microgrids (MGs) is proposed in this study. The proposed method is formulated in terms of ‘modified global indicator’ concept, which was originally proposed to improve reactive power sharing in ac MGs. In this work, the ‘modified global indicator’ concept is extended to coordinate dc MGs, which aims to preserve the main features offered by decentralised control methods such as no need of communication.
links, central controller or knowledge of the microgrid topology and parameters. This global indicator is inserted between current and voltage variables by adopting a virtual capacitor, which directly produces an output current sharing performance that is less relied on mismatches of the multi-bus network. Meanwhile, a voltage stabiliser is complementary developed to maintain output voltage magnitude at steady state through a shunt virtual resistance. The operation under multiple dc-buses is also included in order to enhance the applicability of the proposed controller. A detailed mathematical model including the effect of network mismatches is derived for analysis of the stability of the proposed controller. The feasibility and effectiveness of the proposed control strategy are validated by simulation and experimental results.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Beijing Jiaotong University, University of New South Wales, University of Technology, Sydney
Authors: Yang, J. (Ekstern), Jin, X. (Ekstern), Wu, X. (Ekstern), Acuna, P. (Ekstern), Aguilera, R. P. (Ekstern), Morstyn, T. (Ekstern), Agelidis, V. (Intern)
Pages: 696-706
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: I E T Generation, Transmission and Distribution
Volume: 11
Issue number: 3
ISSN (Print): 1751-8687
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.31 SJR 0.907 SNIP 1.305
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.2 SJR 1.03 SNIP 1.457
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.01 SNIP 1.496 CiteScore 2.74
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.923 SNIP 1.61 CiteScore 2.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.088 SNIP 1.923 CiteScore 2.73
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.899 SNIP 1.782 CiteScore 2.58
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.766 SNIP 1.768 CiteScore 2.27
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.723 SNIP 1.444
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.747 SNIP 1.254
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.596 SNIP 1.114
Scopus rating (2007): SJR 0.615 SNIP 1.151
Scopus rating (2006): SJR 0.606 SNIP 1.246
Scopus rating (2005): SJR 0.757 SNIP 1.189
Decision support program for congestion management using demand side flexibility

In the past decades, Distribution System Operators (DSOs) have been mitigating distribution networks (DNs) contingencies by opting to grid reinforcements. However, this approach is not always cost and time efficient. Demand Side Flexibility (DSF) is one of the recent alternatives used in DNs congestion management. Consequently, new market players such as aggregators are needed to handle DSF transaction between customers and DSOs. This paper proposes and models a decision support program (DSP) to optimize the total cost charged by the DSO for using DSF services. Moreover, the energy rebound effect is taken into consideration as well as the uncertain behavior of customers. Finally, the distribution grid of the Danish Bornholm Island is used to illustrate the merits of the DSP. The total cost incurred by the DSO is calculated and presented.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets , Universidad Carlos III de Madrid
Authors: Esmat, A. (Ekstern), Pinson, P. (Intern), Usaola, J. (Ekstern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 IEEE Manchester PowerTech
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 12th IEEE Power and Energy Society PowerTech Conference, Manchester, United Kingdom, 18/06/2017 - 18/06/2017
Congestion Management, Decision Support Program, Demand Side Flexibility, Rebound Effect
DOIs: 10.1109/PTC.2017.7980976
Source: FindIt
Source-ID: 2372482990
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Delta-Connected Cascaded H-Bridge Multilevel Converters for Large-Scale Photovoltaic Grid Integration
The cascaded H-bridge (CHB) converter is becoming a promising candidate for use in next generation large-scale photovoltaic (PV) power plants. However, solar power generation in the three converter phase-legs can be significantly unbalanced, especially in a large geographically-dispersed plant. The power imbalance between the three phases defines a limit for the injection of balanced three-phase currents to the grid. This paper quantifies the performance of, and experimentally confirms, the recently proposed delta-connected CHB converter for PV applications as an alternative configuration for large-scale PV power plants. The required voltage and current overrating for the converter is analytically developed and compared against the star-connected counterpart. It is shown that the delta-connected CHB converter extends the balancing capabilities of the star-connected CHB and can accommodate most imbalance cases with relatively small overrating. Experimental results from a laboratory prototype are provided to validate the operation of the delta-connected CHB converter under various power imbalance cases.

General information
State: Published
AC–DC power converters, Cascaded Hbridge (CHB) converter, Multilevel converter, Photovoltaic (PV)
Demand response evaluation and forecasting — Methods and results from the EcoGrid EU experiment

Understanding electricity consumers participating in new demand response schemes is important for investment decisions and the design and operation of electricity markets. Important metrics include peak response, time to peak response, energy delivered, ramping, and how the response changes with respect to external conditions. Such characteristics dictate the services DR is capable of offering, like primary frequency reserves, peak load shaving, and system balancing. In this paper, we develop methods to characterise price-responsive demand from the EcoGrid EU demonstration in a way that was bid into a real-time market. EcoGrid EU is a smart grid experiment with 1900 residential customers who are equipped with smart meters and automated devices reacting to five-minute electricity pricing. Customers are grouped and analysed according to the manufacturer that controlled devices. A number of advanced statistical models are used to show significant flexibility in the load, peaking at 27% for the best performing groups.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Austrian Institute of Technology, Danish Energy Association
Authors: Larsen, E. M. (Ekstern), Pinson, P. (Intern), Leimgruber, F. (Ekstern), Judex, F. (Ekstern)
Pages: 75-83
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Sustainable Energy, Grids and Networks
Volume: 10
ISSN (Print): 2352-4677
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 2.76 SJR 0.769 SNIP 0.841
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.33 SJR 0.604 SNIP 1.394
Web of Science (2016): Indexed yes
Original language: English
Control and Systems Engineering, Renewable Energy, Sustainability and the Environment, Energy Engineering and Power Technology, Electrical and Electronic Engineering, Demand forecasting, Demand response (DR), Real-time pricing, Smart grid

Demonstration of visualization techniques for the control room engineer in 2030.: ELECTRA Deliverable D8.1. WP8: Future Control Room Functionality

Deliverable 8.1 reports results on analytics and visualizations of real time flexibility in support of voltage and frequency control in 2030+ power system. The investigation is carried out by means of relevant control room scenarios in order to derive the appropriate analytics needed for each specific network events

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Automation and Control, Energy System Management, Tecnalia, Parque Científico y Tecnológico de Bizkaia, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, University of Strathclyde, Austrian Institute of Technology
Number of pages: 83
Publication date: 2017
In recent years, formalized facility comparison activities have become important for the documentation and validation of laboratory proficiency and competence and mandatory for achieving accreditation such as that of the International Organization for Standardization (ISO) 17025 or similar organizations [1]. Different intercomparison campaigns have been conducted on antenna measurements in the framework of various European activities. Such activities were initiated in 2004 with the Sixth Framework Program of the European Union (EU) Antenna Center of Excellence (ACE) [2]. The work continued under the management of the European Association on Antennas and Propagation (EurAAP), supported by the European Cooperation in Science and Technology (COST) in the programs Antenna Systems and Sensors for Information Society Technologies (ASSIST) IC0603 and Versatile, Integrated, and Signal-Aware Technologies for Antennas (VISTA) IC1102, including still ongoing campaigns [3]-[5]. Results of these activities have led to improvements in antenna measurement procedures and protocols in facilities and standards [6], [7]. Due to the direct benefits available to the participants, the activities have been very successful, and partial outcomes have been published in IEEE-referenced articles [8]-[18].
Description of the detailed Functional Architecture of the Frequency and Voltage control solution (functional and information layer)

This D4.2 document provides the description of the detailed functional architecture of the selected solutions that will be implemented and tested. This is documented by combining a function-based IEC 62559 Use Case description with an SGAM mapping of these functions and the interactions among these functions on the Function and Information layer.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Automation and Control, Distributed Energy Resources, Flemish Institute for Technological Research, University of Strathclyde, Tecnalia, Parque Cientifico y Tecnologico de Bizkaia, Instytut Energetyki, TUBITAK, Ricerca sul Sistema Energetico, Centre for Renewable Energy Sources, Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek, OFFIS - Institute for Information Technology
Number of pages: 115
Publication date: 2017

Publication information
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
D4.2_Description_of_the_detailed_Functional_Architecture_of_the_Frequency_and_Voltage_control_solution.pdf
**Bibliographical note**

**Relations**
Projects:
Description of the detailed Functional Architecture of the Frequency and Voltage control solution (functional and information layer)
Source: PublicationPreSubmission
Source-ID: 128888072
Publication: Research - peer-review › Report – Annual report year: 2017

**Design, development and testing of low-cost controllers for fuel-shift technologies**
EnergyLab Nordhavn – New Urban Energy Infrastructures is an exciting project which will continue until the year 2019. The project will use Copenhagen’s Nordhavn as a full-scale smart city energy lab, which main purpose is to research as well as to develop and demonstrate future energy solutions for renewable energy systems. The goal is to identify the most cost-effective smart energy systems, which can contribute to solve the major climate challenges the world are facing.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy
Authors: Thingvad, A. (Intern)
Number of pages: 29
Publication date: 2017

**Publication information**
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
D4.4d_Low_cost_controllers_specification_design_and_test_report.pdf

**Bibliographical note**
Source: PublicationPreSubmission
Source-ID: 146598580
Publication: Research - peer-review › Report – Annual report year: 2018

**Designing a Tool System for Lowering Friction during the Ejection of In-Die Sintered Micro Gears**
The continuous improvements in micro-forging technologies generally involve process, material, and tool design. The field assisted sintering technique (FAST) is a process that makes possible the manufacture of near-net-shape components in a closed-die setup. However, the final part quality is affected by the influence of friction during the ejection phase, caused by radial expansion of the compacted and sintered powder. This paper presents the development of a pre-stressed tool system for the manufacture of micro gears made of aluminum. By using the hot isostatic pressing (HIP) sintering process and different combinations of process parameters, the designed tool system was compared to a similar tool system designed without a pre-stressing strategy. The comparison between the two tool systems was based on the ejection force and part fidelity. The ejection force was measured during the tests, while the part fidelity was documented using an optical microscope and computed tomography in order to obtain a multi-scale characterization. The results showed that the use of pre-stress reduced the porosity in the gear by 40% and improved the dimensional fidelity by more than 75% compared to gears produced without pre-stress.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Electrical Engineering, Automation and Control
Authors: Cannella, E. (Intern), Nielsen, E. K. (Intern), Stolfi, A. (Intern)
Number of pages: 15
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Designing high efficient solar powered lighting systems

Some major challenges in the development of L2L products is the lack of efficient converter electronics, modelling tools for dimensioning and furthermore, characterization facilities to support the successful development of the products. We report the development of 2 Three-Port-Converters respectively for 1-10Wp and 10-50 Wp with a peak efficiency of 97% at 1.8 W of PV power for the 10 Wp version. Furthermore, a modelling tool for L2L products has been developed and a laboratory for feeding in component data not available in the datasheets to the model is described.

General information

State: Published
Organisations: Department of Photonics Engineering, Photovoltaic Materials and Systems, Diode Lasers and LED Systems, Department of Electrical Engineering, Electronics, Out-sider A/S, Technical University of Denmark
Authors: Poulsen, P. B. (Intern), Thorsteinsson, S. (Intern), Lindén, J. (Intern), Ploug, R. O. (Intern), Knott, A. (Intern), Mira Albert, M. D. C. (Intern), Mogensen, I. (Ekstern), Retoft, K. (Ekstern)
Number of pages: 3
Publication date: 2017

Host publication information

Title of host publication: Proceedings of the 2017 IEEE 44th Photovoltaic Specialist Conference (PVSC)
Publisher: IEEE
Main Research Area: Technical/natural sciences
DOI: 10.1109/PVSC.2017.8366632
Source-ID: 2434953375
Publication: Research - peer-review › Journal article – Annual report year: 2017

Design of a planar ultra-wideband four-way power divider/combiner using defected ground structures

This work presents the design of a planar ultra-wideband (UWB) four-way power divider/combiner. A prototype has been fabricated on a printed circuit board and characterized. For achieving the frequency response required in UWB applications, each branch of the divider is conceived as a three-section Chebyshev impedance transformer. The defected ground structure (DGS) technique has been used to obtain the required high impedance lines. The power divider's
insertion loss is 1 dB at 3.1 GHz and 2.9 dB at 10 GHz; the input reflection is lower than −10 dB, and the isolation between the output ports is better than 13 dB from 3 GHz to 10 GHz. A back-to-back configuration has been implemented as well. Its insertion loss is lower than 5 dB and its input reflection is lower than −10 dB over the UWB frequency range.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Metro-Access and Short Range Systems
Authors: Squartecchia, M. (Intern), Cimoli, B. (Intern), Midili, V. (Intern), Johansen, T. K. (Intern), Zhurbenko, V. (Intern)
Pages: 9-12
Publication date: 2017

Host publication Information
Title of host publication: Proceedings of the European Microwave Conference (EuMC), 2017 47th
Publisher: IEEE

Design of Passive Acoustic Wave Shaping Devices and Their Experimental Validation
We discuss a topology optimization based approach for designing passive acoustic wave shaping devices and demonstrate its application to; directional sound emission [1], sound focusing and wave splitting. Optimized devices, numerical and experimental results are presented and benchmarked against other designs proposed in the literature. We focus on design problems where the size of the device is on the order of the wavelength, a problematic region for traditional design methods, such as ray tracing. The acoustic optimization problem is formulated in the frequency domain and modeled by the Helmholtz equation. An exterior 2D model domain is used and an array of point sources is considered as sound emitters. The optimization goal is to identify a distribution of solid material in a design sub-domain which produces a desired spatial sound field pattern across a frequency band of interest in a target sub-domain. The objective is the integral of the deviation in pressure magnitude, between a prescribed sound field and the solution to the model problem for a given design realization over the target sub-domain. Filtering is used for regularization and to allow for meaningful optimization for geometric robustness [2]. The Globally Convergent Method of Moving Asymptotes is used to perform the optimization [3].

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Acoustic Technology
Authors: Christiansen, R. E. (Intern), Sigmund, O. (Intern), Fernandez Grande, E. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 12th World Congress of Structural and Multidisciplinary Optimization, Braunschweig, Germany.
Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_WCSMO_2017_RaElCh.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Detecting Elusive Intermediates in Carbohydrate Conversion: A Dynamic Ensemble of Acyclic Glucose-Catalyst Complexes
The role of acyclic carbohydrates in pathways towards value-added chemicals has remained poorly characterized due to the low population of acyclic forms, and due to their instability under reaction conditions. We conduct steady-state and pre-steady state measurements by direct reaction progress monitoring with sensitivity-optimized NMR spectroscopy in the molybdate-catalyzed epimerization of glucose to mannose. We detect an exchanging pool of at least five acyclic glucose-catalyst complexes under near-optimum reaction conditions. In the presence of catalyst, the acyclic glucose population increases within few seconds prior to reaching a steady state. Exchange between the acyclic intermediates increases at conditions that favor epimerization. Species accounting for less than 0.05% of total glucose can be monitored with sub-second time resolution to allow kinetic analysis of intermediate formation and catalytic conversion. Epimerization occurs 2-3 orders of magnitude faster than the binding of acyclic glucose to the catalyst at near-optimum reaction conditions. The current study brings insight in to the nature of acyclic intermediate-catalyst complexes of very low population and into
experimental strategies for characterizing very minor intermediates in carbohydrate conversion to value-added compounds.

**General information**
State: Published
Organisations: Department of Chemistry, Organic Chemistry, Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance
Authors: Meier, S. (Intern), Karlsson, M. (Intern), Jensen, P. R. (Intern)
Pages: 5571-5577
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: ACS Sustainable Chemistry & Engineering
Volume: 5
Issue number: 6
ISSN (Print): 2168-0485
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 6.45 SJR 1.657 SNIP 1.369
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.92 SJR 1.572 SNIP 1.434
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.389 SNIP 1.353 CiteScore 5.39
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.218 SNIP 1.188 CiteScore 4.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
ISI indexed (2013): ISI indexed no
Original language: English
Acyclic tautomer, Epimerization, Glucose, Homogenous catalysis, Pre-steady-state, Reaction intermediate
Electronic versions:
Meier_etal_acs_sustainable_Chemistry_Engineering_.pdf. Embargo ended: 15/04/2018
DOIs:
10.1021/acssuschemeng.7b00985
Source: PublicationPreSubmission
Source-ID: 131295247
Publication: Research - peer-review › Journal article – Annual report year: 2017

**Detecting Topological Errors with Pre-Estimation Filtering of Bad Data in Wide-Area Measurements**
It is expected that bad data and missing topology information will become an issue of growing concern when power system state estimators are to exploit the high measurement reporting rates from phasor measurement units. This paper suggests to design state estimators with enhanced resilience against those issues. The work presented here include a review of a pre-estimation filter for bad data. A method for detecting branch status errors which may also be applied before the state estimation is then proposed. Both methods are evaluated through simulation on a novel test platform for wide-area measurement applications. It is found that topology errors may be detected even under influence of the large dynamics following the loss of a heavily loaded branch.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Electric Power Systems, Technical University of Denmark
Authors: Møller, J. G. (Intern), Sørensen, M. (Ekstern), Jóhannsson, H. (Intern), Østergaard, J. (Intern)
Number of pages: 6
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of 12th IEEE Power and Energy Society PowerTech Conference
Detection of Paroxysms in Long-Term, Single Channel EEG-Monitoring of Patients with Typical Absence Seizures.

Absence seizures are associated with generalized 2.5-5 Hz spike-wave discharges in the EEG. Rarely are patients, parents or physicians aware of duration or incidence of seizures. Six patients were monitored with a portable EEG-device over four times 24 hours to evaluate how easily outpatients are monitored and how well an automatic seizure detection algorithm can identify the absences. Based on patient-specific modeling, we achieved a sensitivity of 98.4% with only 0.23 false detections per hour. This yields a clinically satisfying performance with a positive predictive value of 87.1%. Portable EEG-recorders identifying paroxystic events in epilepsy outpatients are a promising tool for patients and physicians dealing with absence epilepsy. Albeit the small size of the EEG-device, some children still complained about the obtrusive nature of the device. We aim at developing less obtrusive though still very efficient devices e.g. hidden in the ear canal or below the skin.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Electrical Engineering, Biomedical Engineering, Copenhagen University Hospital, Nordzealand Hospital
Authors: Kjær, T. W. (Ekstern), Sørensen, H. B. D. (Intern), Groenborg, S. (Ekstern), Pedersen, C. R. (Ekstern), Duun-Henriksen, J. (Intern)
Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Journal of Translational Engineering in Health and Medicine
Volume: 5
ISSN (Print): 2168-2372
Ratings:
Scopus rating (2017): CiteScore 2.54
Scopus rating (2016): CiteScore 1.88
Scopus rating (2015): CiteScore 1.26
Original language: English

Absence Seizures, Automatic Seizure Detection, Epilepsy, Single Channel EEG, SVM

Electronic versions:
07809044.pdf
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DOIs:
10.1109/JTEHM.2017.2649491

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Publication: Research - peer-review › Journal article – Annual report year: 2017

Detection of User Independent Single Trial ERPs in Brain Computer Interfaces: An Adaptive Spatial Filtering Approach

Brain Computer Interfaces (BCIs) use brain signals to communicate with the external world. The main challenges to address are speed, accuracy and adaptability. Here, a novel algorithm for P300 based BCI spelling system is presented, specifically suited for single-trial detection of EventRelated Potentials (ERPs) by combining spatial filtering and new feature extraction methods. The adaptive spatial filtering technique, axDAWN, removes the need for calibration of the system thereby improving the overall speed of the system. Besides, axDAWN enhances the P300 response to target stimuli. The wavelet decomposition and entropy of the recorded ERPs are shown to be correlated with the presence of the P300 responses. The proposed scheme is validated thoroughly in a P300 speller and provides a solution to achieve high accuracy results for single-trial detection of ERPs, being the system user independent.
Diagnostic monitoring of drivetrain in a 5 MW spar-type floating wind turbine using Hilbert spectral analysis

The objective of this paper is to investigate the frequency-based fault detection of a 5MW spar-type floating wind turbine (WT) gearbox using measurements of the global responses. It is extremely costly to seed managed defects in a real WT gearbox to investigate different fault detection and condition monitoring approaches; using analytical tools, therefore, is one of the promising approaches in this regard. In this study, forces and moments on the main shaft are obtained from the global response analysis using an aero-hydro-servo-elastic code, SIMO-RIFLEX-AeroDyn. Then, they are utilized as inputs to a high-fidelity gearbox model developed using a multi-body simulation software (SIMPACK). The main shaft bearing is one of the critical components since it protects gearbox from axial and radial loads. Six different fault cases with different severity in this bearing are investigated using power spectral density (PSD) of relative axial acceleration of the bearing and nacelle. It is shown that in severe degradation of this bearing the first stage dynamic of the gearbox is dominant in the main shaft vibration signal. Inside the gearbox, the bearings on the high speed side are those often with high probability of failure, thus, one fault case in IMS-B bearing was also considered. Based on the earlier studies, the angular velocity error function is considered as residual for this fault. The Hilbert transform is used to determine the envelope of this residual. Information on the amplitude of this residual properly indicates damage in this bearing.
Diagnostic value of sleep stage dissociation as visualized on a 2-dimensional sleep state space in human narcolepsy

Type 1 narcolepsy (NT1) is characterized by symptoms believed to represent Rapid Eye Movement (REM) sleep stage dissociations, occurrences where features of wake and REM sleep are intermingled, resulting in a mixed state. We hypothesized that sleep stage dissociations can be objectively detected through the analysis of nocturnal Polysomnography (PSG) data, and that those affecting REM sleep can be used as a diagnostic feature for narcolepsy. A Linear Discriminant Analysis (LDA) model using 38 features extracted from EOG, EMG and EEG was used in control subjects to select features differentiating wake, stage N1, N2, N3 and REM sleep. Sleep stage differentiation was next represented in a 2D projection. Features characteristic of sleep stage differences were estimated from the residual sleep stage probability in the 2D space. Using this model we evaluated PSG data from NT1 and non-narcoleptic subjects. An LDA classifier was used to determine the best separation plane. This method replicates the specificity/sensitivity from the training set to the validation set better than many other methods. Eight prominent features could differentiate narcolepsy and controls in the validation dataset. Using a composite measure and a specificity cut off 95% in the training dataset, sensitivity was 43%. Specificity/sensitivity was 94%/38% in the validation set. Using hypersomnia subjects, specificity/sensitivity was 84%/15%. Analyzing treated narcoleptics the specificity/sensitivity was 94%/10%. Sleep stage dissociation can be used for the diagnosis of narcolepsy. However the use of some medications and presence of undiagnosed hypersomnolence patients impacts the result.
Direct electroplating of plastic for advanced electrical applications

Electrodeposition or electroplating is predominantly applied to metallic components. Electroplating of plastics is possible in some cases where an initial electroless plating layer of nickel or copper is made to provide a conductive surface on the plastic part. This paper proposes a method for direct electroplating of plastic eliminating the need for slow and expensive processes like electroless metal deposition, PVD coating, painting with conductive inks etc. The results obtained from the test demonstrate the potential of direct electroplating of plastic to enhance the electrical conductivity and the use of electroplated plastics for advanced applications like Moulded Interconnect Devices (MIDs).

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Institute for Product Development
Authors: Islam, A. (Intern), Hansen, H. N. (Intern), Tang, P. T. (Intern)
Pages: 209–212
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: C I R P Annals
Volume: 66
Directional Transverse Oscillation Vector Flow Estimation

A method for estimating vector velocities using transverse oscillation (TO) combined with directional beamforming is presented. In Directional Transverse Oscillation (DTO) a normal focused field is emitted and the received signals are beamformed in the lateral direction transverse to the ultrasound beam to increase the amount of data for vector velocity estimation. The approach is self-calibrating as the lateral oscillation period is estimated from the directional signal through a Fourier transform to yield quantitative velocity results over a large range of depths. The approach was extensively simulated using Field IIpro and implemented on the experimental SARUS scanner in connection with a BK Medical 8820e convex array transducer. Velocity estimates for DTO are found for beam-to-flow angles of 60, 75, and 90, and vessel depths from 24 to 156 mm. Using 16 emissions the Standard Deviation (SD) for angle estimation at depths ranging from 24 to 104 mm are between 6.01 and 0.93 with a mean SD of 2.8. The mean relative SD for the lateral velocity component is 9.2% and the mean relative bias -3.4% or 4 times lower than for traditional TO. The approach also works for deeper lying vessels with a slight increase in SD to 15.7%, but a maintained bias of -3.5% from 126 to 156 mm. Data for a pulsating flow has also been acquired for 15 cardiac cycles using a CompuFlow 1000 pump. The relative SD was here 7.4% for a femoral artery waveform.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering
Authors: Jensen, J. A. (Intern)
Number of pages: 11
Pages: 1194-1204
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control
Volume: 64
Issue number: 8
ISSN (Print): 0885-3010
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.73 SJR 0.986 SNIP 1.402
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.814 SNIP 1.494 CiteScore 2.43
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.088 SNIP 1.627 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.872 SNIP 1.496 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.802 SNIP 1.479 CiteScore 1.87
Direct Reuse of Rare Earth Permanent Magnets—Coating Integrity

Rare earth permanent magnets can be reused directly as an alternative to traditional recycling methods, in which scrapped magnets are reprocessed into new magnets by undergoing many of the original energy-intensive and expensive production processes. Direct reuse entails using segmented magnet assemblies built by several small standard-sized magnets that can be reused directly in a number of different applications. A central part of the direct reuse strategy is to separate and demagnetize magnets by heating them to the Curie temperature. We investigated the validity of direct reuse as a rare earth magnet recycling strategy by evaluating the extent to which the heat-driven demagnetization cycles affected magnetic properties, as well as the integrity of the protective coating of Nd–Fe–B magnets. The experimental investigation consisted of four different tests, and was applied to 300 magnets that had either been heated once, five times, or none at all. The tests included $J$ – $H$ measurements, coating pull-off test, corrosion salt spray test, and optical microscopy of the interface between coating and magnet. Magnets coated with Zn, Epoxy, Ni–Cu–Ni, and Ni–Cu+Epoxy were investigated, of which Ni–Cu+Epoxy showed no degradation after heat treatment. Direct reuse as a
recycling strategy could therefore be a valuable alternative to traditional recycling.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Torshavn College, Sintex A/S
Authors: Høgberg, S. (Intern), Holbøll, J. (Intern), Mijatovic, N. (Intern), Jensen, B. B. (Ekstern), Bendixen, F. B. (Ekstern)
Number of pages: 9
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Publication information
Journal: IEEE Transactions on Magnetics
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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Scopus rating (2017): SNIP 1.039 SJR 0.488 CiteScore 1.82
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.51 SJR 0.653 SNIP 0.949
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.575 SNIP 1.21 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.696 SNIP 1.464 CiteScore 1.68
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.587 SNIP 1.395 CiteScore 1.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.769 SNIP 1.55 CiteScore 1.89
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.818 SNIP 1.409 CiteScore 1.69
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.712 SNIP 1.134
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.735 SNIP 1.182
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.911 SNIP 1.236
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.764 SNIP 1.196
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.905 SNIP 1.231
Scopus rating (2005): SJR 1.027 SNIP 1.245
Scopus rating (2004): SJR 0.816 SNIP 1.122
Discharge characteristics in inhomogeneous fields under air flow
This research investigates the impact of high velocity air flow on Partial Discharge (PD) patterns generated in strongly inhomogeneous fields. In the laboratory, a needle plane electrode configuration was exposed to a high electrical DC-field and a laminar air flow up to 22 ms. The needle was connected to a variable DC potential of up to 100 kV over a grounded plate in order to trigger different corona modes. The impact of the air flow on the space charges created in the vicinity of the electrode is evaluated by means of PD measurements in time domain. The results indicate that the wind increases the frequency and magnitude of partial discharges in the vicinity of the electrode due to an increased rate of space charge removal around the tip of the needle and in the gap. The positive polarity shows higher dependency on air flow compared to the negative polarity. It is shown that positive breakdown streamer corona can be extinguished if wind speeds of more than 14.3 ms are applied to the electrode.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies
Authors: Vogel, S. (Intern), Holbøll, J. (Intern)
Number of pages: 6
Publication date: 2017

Distance relay performance in future converter dominated power systems
Increasing penetration of converter-based generations in power system has led to new system challenges. Short circuit power response from converter-based generations is different from that of traditional synchronous generators. Power electronic converters can be designed for over-current only up to 1.1-1.25 times of its nominal value. Low availability of short circuit power can cause many challenges such as misoperation of distance relays. The aim of this paper is to investigate the effect of converter dominated systems on performance of distance relays. Backup functionality of the distance relay is major concern as miscoordination of backup relays in case of cascading faults can lead to severe stress in system, which can develop into blackout. In this paper, response of relays in traditional system is compared with response of relays in low short-circuit-current power systems. Impact of converter controls on fault current response of converter-based generations is also investigated. Index Terms—Converter control, distance relays, power system protection, system modelling.

General information
State: Published
Organisations: Department of Wind Energy, Integration & Planning, Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Distributed Optimization based Dynamic Tariff for Congestion Management in Distribution Networks

This paper proposes a distributed optimization based dynamic tariff (DDT) method for congestion management in distribution networks with high penetration of electric vehicles (EVs) and heat pumps (HPs). The DDT method employs a decomposition based optimization method to have aggregators explicitly participate in congestion management, which gives more certainty and transparency compared to the normal DT method. With the DDT method, aggregators reveal their final aggregated plan and respect the plan during operation. By establishing an equivalent overall optimization, it is proven that the DDT method is able to minimize the overall energy consumption cost and line loss cost, which is different from previous decomposition-based methods such as multiagent system methods. In addition, a reconditioning method and an integral controller are introduced to improve convergence of the distributed optimization where challenges arise due to multiple congestion points, multiple types of flexible demands and network constraints. The case studies demonstrate the efficacy of the DDT method for congestion management in distribution networks.
Disturbance Attenuation of DC Voltage Droop Control Structures in a Multi-Terminal HVDC Grid

DC voltage droop control is seen as the preferred control structure for primary voltage control of future multiterminal HVDC systems. Different droop control structures have been proposed in literature which can be classified in eight categories. This paper contributes to an analysis of the disturbance rejection of these droop control structures. The approach is based on multi-variable frequency response analysis where both ac and dc grid dynamics are incorporated. In particular, the amplification of dc voltage oscillations due to wind power variations is analyzed using singular value analysis. Further, the impact of dc cable modeling on the results is discussed. In addition, it is shown that the maximum singular value limits, frequently used in literature for MIMO-analysis, are not sufficient to prove that the impact of certain disturbances on analyzed outputs is within a certain boundary. It is necessary to verify the results by a multiple input single output analysis of the transfer functions connecting the inputs with the highest amplified output.

General information
State: Published
Authors: Thams, F. (Intern), Chatzivasileiadis, S. (Intern), Prieto-Araujo, E. (Ekstern), Eriksson, R. (Ekstern)
Number of pages: 6
Publication date: 2017

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Publication: Research - peer-review › Journal article – Annual report year: 2017

D-NA5.1 Smart Grid configuration validation scenario description method

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Grenoble Institute of Technology, OFFIS - Institute for Information Technology, University of Strathclyde, Ricerca Sistema Energetico SpA, Delft University of Technology, The Institute of Communications and Computer System, European Distributed Energy Resources Laboratories (DERlab) e.V, Commissariat a L'Energie Atomique CEA, Austrian Institute of Technology
Number of pages: 146
Publication date: 2017
DNP NMR of carbohydrate converting enzymes

Dissolution dynamic nuclear polarization (DNP) NMR can be used to increase the sensitivity of $^{13}\text{C}NMR$ signal by up to four orders of magnitude. This allows for real-time monitoring of reactions and observation of intermediates. The biggest drawback of the method is the loss of polarization with $T_1$ relaxation, but even with this limitation, it is possible to obtain detailed reaction parameters in less than one minute. The enzyme investigated was $\beta$-galactosidase from E. coli (E.C. 3.2.1.23). It is well described and the mechanism is generally accepted to be a double displacement with a covalently bound intermediate, however, this evidence is based on mutant of X-ray crystallography and simulations. As the natural substrate lactose does not have any quaternary carbon with long $T_1$, the unnatural substrate o-nitrophenyl $\beta$-D-galactopyranoside was used (figure 1) as the quaternary positions have $T_1$ relaxations of ca. 15 s instead of $<$2 s. The DNP NMR monitoring of the hydrolysis of this substrate can be seen in figure 2, and another use of this substrate is for optimizing the conditions for a labelled substrate (figure 1), which would further increase the signal and allow monitoring of the carbohydrate instead of the aglycon. This is, however, not commercially available and had to be synthesized from doubly labelled galactose.

Door and cabinet recognition using convolutional neural nets and real-time method fusion for handle detection and grasping

In this paper, we present a new method that robustly identifies doors, cabinets, and their respective handles, with special emphasis on extracting useful features from handles to be then manipulated. The novelty of this system relies on the combination of a Convolutional Neural Net (CNN), as a form of reducing the search space, several methods to extract point cloud data and a mobile robot to interact with the objects. The framework consists of the following components: The implementation of a CNN to extract a Region of Interest (ROI) from an image corresponding to a door or cabinet. Several vision-based techniques to detect handles inside the ROI and its 3D positioning. A complementary plane segmentation method to differentiate door/cabinet from the handle. An algorithm to fuse both approaches robustly and extract essential information from the handle for robotic grasping (i.e., handle point cloud, door plane model, grasping locations, turning orientation, orthogonal vector to door). A mobile robot for grasping the handle. The system assumes no prior knowledge of the environment.
Dynamic pricing for demand response considering market price uncertainty

Retail energy providers (REPs) can employ different strategies such as offering demand response (DR) programs, participating in bilateral contracts, and employing self-generation distributed generation (DG) units to avoid financial losses in the volatile electricity markets. In this paper, the problem of setting dynamic retail sales price by a REP is addressed with a robust optimization technique. In the proposed model, the REP offers price-based DR programs while it faces uncertainties in the wholesale market price. The main contribution of this paper is using a robust optimization approach for setting the short-term dynamic retail rates for an asset-light REP. With this approach, the REP can decide how to participate in forward contracts and call options. They can also determine the optimal operation of the self-generation DG units. Several case studies have been carried out for a REP with 10,679 residential consumers. The deterministic approach and its robust counterpart are used to solve the problem. The results show that, with a slight decrease in the expected payoff, the REP can effectively protect itself against price variations. Offering time-variable retail rates also can increase the expected profit of the REPs.
Economic Assessment of Network-Constrained Transactive Energy for Managing Flexible Demand in Distribution Systems

The increasing number of distributed energy resources such as electric vehicles and heat pumps connected to power systems raises operational challenges to the network operator, for example, introducing grid congestion and voltage deviations in the distribution network level if their operations are not properly coordinated. Coordination and control of a large number of distributed energy resources requires innovative approaches. In this paper, we follow up on a recently proposed network-constrained transactive energy (NCTE) method for scheduling of electric vehicles and heat pumps within a retailer's aggregation at distribution system level. We extend this method with: (1) a new modeling technique that allows the resulting congestion price to be directly interpreted as a locational marginal pricing in the system; (2) an explicit analysis of the benefits and costs of different actors when using the NCTE method in the system, given the high penetration of distributed energy resources. This paper firstly describes the NCTE-based distribution system that introduces a new interacting scheme for actors at the distribution system level. Then, technical modeling and economic interpretation of the NCTE-based distribution system are described. Finally, we show the benefits and costs of different actors within the NCTE-based distribution system.

General information
State: Published
Authors: Hu, J. (Intern), Yang, G. (Intern), Xue, Y. (Ekstern)
Number of pages: 16
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Main Research Area: Technical/natural sciences

Publication information
Journal: Energies
Volume: 10
Issue number: 5
Article number: 711
Economic Model Predictive Control for Hot Water Based Heating Systems in Smart Buildings

This paper presents a study to optimize the heating energy costs in a residential building with varying electricity price signals based on an Economic Model Predictive Controller (EMPC). The investigated heating system consists of an air source heat pump (ASHP) incorporated with a hot water tank as active Thermal Energy Storage (TES), where two optimization problems are integrated together to optimize both the ASHP electricity consumption and the building heating consumption utilizing a heat dynamic model of the building. The results show that the proposed EMPC can save the energy cost by load shifting compared with some reference cases.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Department of Civil Engineering, University of Oldenburg
Authors: Awadelrahman, M. A. A. (Ekstern), Zong, Y. (Intern), Li, H. (Intern), Agert, C. (Ekstern)
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Main Research Area: Technical/natural sciences

Publication information
Journal: Energy and Power Engineering
Economy, Movement Dynamics, and Muscle Activity of Human Walking at Different Speeds

The complex behaviour of human walking with respect to movement variability, economy and muscle activity is speed dependent. It is well known that a U-shaped relationship between walking speed and economy exists. However, it is an open question if the movement dynamics of joint angles and centre of mass and muscle activation strategy also exhibit a U-shaped relationship with walking speed. We investigated the dynamics of joint angle trajectories and the centre of mass accelerations at five different speeds ranging from 20 to 180% of the predicted preferred speed (based on Froude speed) in twelve healthy males. The muscle activation strategy and walking economy were also assessed. The movement dynamics was investigated using a combination of the largest Lyapunov exponent and correlation dimension. We observed an intermediate stage of the movement dynamics of the knee joint angle and the anterior-posterior and mediolateral centre of mass accelerations which coincided with the most energy-efficient walking speed. Furthermore, the dynamics of the joint angle trajectories and the muscle activation strategy was closely linked to the functional role and biomechanical constraints of the joints.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Electrical Engineering, Biomedical Engineering, University of Copenhagen, Technical University of Denmark
Authors: Raffalt, P. C. (Forskerdatabase), Guul, M. K. (Ekstern), Nielsen, A. N. (Ekstern), Puthusserypady, S. (Intern), Alkjær, T. (Ekstern)
Number of pages: 14
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Main Research Area: Technical/natural sciences

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Scopus rating (2017): CiteScore 4.36 SJR 1.533 SNIP 1.245
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.63 SJR 1.692 SNIP 1.354
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.034 SNIP 1.597 CiteScore 5.3
Web of Science (2015): Indexed yes
Effect of a treat-to-target strategy based on methotrexate and intra-articular betamethasone with or without additional cyclosporin on MRI-assessed synovitis, ostelitis, tenosynovitis, bone erosion, and joint space narrowing in early rheumatoid arthritis: results from a 2-year randomized double-blind placebo-controlled trial (CIMESTRA)

Objectives: To investigate whether a treat-to-target strategy based on methotrexate (MTX) and intra-articular (IA) betamethasone suppresses magnetic resonance imaging (MRI)-determined measures of disease activity and reduces joint destruction in early rheumatoid arthritis (eRA) patients, and to investigate whether concomitant cyclosporin A (CyA) provides an additional effect.

Method: In the 2-year randomized, double-blind, treat-to-target trial CIMESTRA, 160 patients with eRA (<6months) were randomized to MTX, intra-articular betamethasone and CyA, or placebo CyA. A total of 129 patients participated in the MRI substudy, and had contrast-enhanced MR images of the non-dominant hand at months 0, 6, 12, and 24. MR images were evaluated for osteitis, synovitis, tenosynovitis, bone erosion, and joint space narrowing (JSN), using validated scoring methods.

Results: Significant reductions were seen at 6 months in all inflammatory parameters [synovitis, mean change -1.6 (p = .0001); osteitis, mean change -1.2 (p < .0001); tenosynovitis, mean change -1.9 (p < .0001); bone erosion, mean change -0.9 (p = .01); and joint space narrowing, mean change -0.7 (p = .0003)].

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Rigshospitalet, Slagelse Hospital, Sheba Medical Center at Tel Hashomer, King Christian X Hospital for Rheumatic Diseases, Aarhus University Hospital, Odense University Hospital, University Hospital Herlev, Zitelab ApS, Vejle Hospital, University of Southern Denmark, Hvidovre University Hospital, Copenhagen University Hospital
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Scopus rating (2017): SNIP 0.928 SJR 1.34 CiteScore 1.97
Web of Science (2017): Indexed Yes
Effect of musical training on pitch discrimination performance in older normal-hearing and hearing-impaired listeners

Hearing-impaired (HI) listeners, as well as elderly listeners, typically have a reduced ability to discriminate the fundamental frequency (F0) of complex tones compared to young normal-hearing (NH) listeners. Several studies have shown that musical training, on the other hand, leads to improved F0-discrimination performance for NH listeners. It is unclear whether a comparable effect of musical training occurs for listeners whose sensory encoding of F0 is degraded. To address this question, F0 discrimination was investigated for three groups of listeners (14 young NH, 9 older NH and 10 HI listeners), each including musicians and non-musicians, using complex tones that differed in harmonic content. Musical training significantly improved F0 discrimination for all groups of listeners, especially for complex tones containing low-numbered harmonics. In a second experiment, the sensitivity to temporal fine structure cues (TFS) was estimated in the same listeners. Although TFS cues were degraded for the two older groups of listeners, musicians showed better performance than non-musicians. Additionally, a significant correlation was obtained between F0-discrimination performance and sensitivity to TFS cues for complex tones with low and intermediate harmonic numbers. These findings suggest that musical training may enhance both sensory encoding of TFS cues and F0 discrimination in young and older listeners with or without hearing loss.

General information
Effects of hearing-aid dynamic range compression on spatial perception in a reverberant environment

This study investigated the effects of fast-acting hearing-aid compression on normal-hearing and hearing-impaired listeners’ spatial perception in a reverberant environment. Three compression schemes— independent compression at each ear, linked compression between the two ears, and “spatially ideal” compression operating solely on the dry source signal— were considered using virtualized speech and noise bursts. Listeners indicated the location and extent of their perceived sound images on the horizontal plane. Linear processing was considered as the reference condition. The results showed that both independent and linked compression resulted in more diffuse and broader sound images as well as internalization and image splits, whereby more image splits were reported for the noise bursts than for speech. Only the spatially ideal compression provided the listeners with a spatial percept similar to that obtained with linear processing. The same general pattern was observed for both listener groups. An analysis of the interaural coherence and direct-to-reverberant ratio suggested that the spatial distortions associated with independent and linked compression resulted from enhanced reverberant energy. Thus, modifications of the relation between the direct and the reverberant sound should be avoided in amplification strategies that attempt to preserve the natural sound scene while restoring loudness cues.
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
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Effects of slow- and fast-acting compression on hearing impaired listeners’ consonant-vowel identification in interrupted noise

There is conflicting evidence about the relative benefit of slow- and fast-acting compression for speech intelligibility. It has been hypothesized that fast-acting compression improves audibility at low signal-to-noise ratios (SNRs) but may distort the speech envelope at higher SNRs. The present study investigated the effects of compression with nearly instantaneous attack time but either fast (10 ms) or slow (500 ms) release times on consonant identification in hearing-impaired listeners. Consonant-vowel speech tokens were presented at several presentation levels in two conditions: in the presence of interrupted noise and in quiet (with the compressor “shadow controlled” by the corresponding mixture of speech and noise). These conditions were chosen to disentangle the effects of consonant audibility and noise-induced forward masking on speech intelligibility. A small but systematic intelligibility benefit of fast-acting compression was found in both the quiet and the noisy conditions for the lower speech levels. No negative effects of fast-acting compression were observed when the speech level exceeded the level of the noise. These findings suggest that fast-acting compression provides an audibility benefit in fluctuating interferers as compared to slow-acting compression, while not substantially affecting the perception of consonants at higher SNRs.

Effects of visco-thermal losses in metamaterials slabs based on rigid building units

Potential applications of negative-index acoustic metamaterials are strongly limited by absorptive effects of different origin. In this context, we present an investigation of the visco-thermal effects on the acoustic properties of double-negative metamaterials based on specifically designed rigid units with subwavelength dimensions. It is shown that visco-thermal losses dissipate about 70% of the acoustic energy associated to the excitation of monopolar and dipolar resonances, leading to the suppression of negative refractive index. Our numerical simulations based on the Boundary Element Method (BEM) are in excellent agreement with recent experimental data showing the quenching of the double-negative transmission peak. The BEM numerical model, which has been specifically adapted to this purpose, has also been validated against an equivalent Finite Element Method model. We also present the results and discuss the differences of visco-thermal effects on monopolar resonances leading to negative bulk modulus metamaterials, and Fabry-Perot resonances in metamaterial slabs.
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.56 SNIP 1.306
Original language: English

Bibliographical note
Invited Paper.
Efficiency Investigation of Subwoofer Driven Around Resonance Frequency
The need for efficient portable speaker systems has increased tremendously over the past 10 years. The batteries, amplifiers and filtering has all seen great improvements in efficiency leaving the speakers units as the most inefficient part of the system, mainly due to the large amounts of current drawn that ends up being dissipated as heat in the voice coil. This paper will look at how you can design a speaker system to take advantage of the resonance of a speaker unit, since that is where the unit is most efficient and draws the least current. A subwoofer speaker system will be designed with focus on only driving the speaker units near their resonance frequency. The tests found that with modern DSP it was rather simple to design a speaker system that operate in a very narrow frequency band around the speaker units’ resonance frequencies, which in turn ensured a very small current draw. This greatest drawback of this method is the increase in components needed, which drives up cost and complexity.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Thydal, T. (Ekstern), Iversen, N. E. (Intern), Knott, A. (Intern)
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Publication date: 2017

Electrophysiological dynamics of covert and overt visual attention.
Attention is a key neural function for choosing certain information to receive more processing than others. Attention is allocated either by directly looking at the target (overt) or without eye movement towards the target (covert). The current study was designed to extract relevant features by using steady-state visual evoked potentials (SSVEP) task. SSVEP task was presented to subjects at the same time that the electroencephalography (EEG) signals were recorded by the scalp electrodes. Subjects were instructed to respond to a certain stimulus by pressing a button. This way attention was measure in continuous manner. Results showed that the amplitude of SSVEP frequencies is higher in overt than covert attention. This indicates that by overt attention events are registered with larger power. However, exploring the harmonics of frequencies showed that covert attention generates larger 2nd harmonic (e.g. 12Hz) than the 1st harmonic (e.g. 6Hz). This pattern was not observed in overt attention. We suggest that covert attention increases the non-linearity in the visual system. Results from the source analysis showed that SSVEP signals are extracted from the primary visual cortex in overt attention. However, when covert attention is allocated to SSVEPs, frequencies are extracted from parietal and frontal areas. This shows that covert attention recruits higher cognitive function. To test how SSVEPs are represented in higher brain areas, we conducted an invasive multi-unit recording from rhesus monkeys. Monkeys were trained to perform similar SSVEP task. Recording was done from somatosensory (S1) and motor (M1) cortices. Results showed that the neuronal ring rates in S1 and M1 not only increased selectively to attended icker stimulus, but also they were highly synchronized. Moreover, some SSVEP frequencies was enhanced in single neurons. These results showed, for the rst time, that visual attention to repetitive stimuli is able to regulate neuronal activities in S1 and M1 regions.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Copenhagen Center for Health Technology, Copenhagen University Hospital
Authors: Ordikhani-Seyedlar, M. (Intern), Puthusserypady, S. (Intern), Kjaer, T. W. (Ekstern), Siebner, H. R. (Ekstern), Sørensen, H. B. D. (Intern)
Number of pages: 141
Publication date: 2017
Relations
Projects:
Electrophysiological dynamics of covert and overt visual attention.
Publication: Research › Ph.D. thesis – Annual report year: 2017

EM simulation assisted parameter extraction for the modeling of transferred-substrate InP HBTs
In this paper an electromagnetic (EM) simulation assisted parameters extraction procedure is demonstrated for accurate modeling of down-scaled transferred-substrate InP HBTs. The external parasitic network associated with via transitions and device electrodes is carefully extracted from calibrated 3D EM simulations up to 325 GHz. Following an on-wafer multi-line Through-Reflect-Line (TRL) calibration procedure, the external parasitic network is de-embedded from the transistor measurements and the active device parameters are extracted in a reliable way. The small-signal model structure augmented with the distributed parasitic network is verified against measured S-parameters up to 110 GHz.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Leibniz-Institut für Höchstfrequenztechnik
Authors: Johansen, T. K. (Intern), Weimann, N. (Ekstern), Doerner, R. (Ekstern), Hossain, M. (Ekstern), Krozer, V. (Ekstern), Heinrich, W. (Ekstern)
Number of pages: 4
Pages: 240-243
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 12th European Microwave Integrated Circuits Conference
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 12th European Microwave Integrated Circuits Conference (EuMIC), Nuremberg, Germany, 08/10/2017 - 08/10/2017
DOIs: 10.23919/EuMIC.2017.8230704
Source: FindIt
Source-ID: 2394348829
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Enabling Technologies for Smart Grid Integration and Interoperability of Electric Vehicles
Conventional, centralized power plants are being replaced by intermittent, distributed renewable energy sources, thus raising the concern about the stability of the power grid in its current state. All the while, electrification of all forms of transportation is increasing the load on the transforming power grid and potentially only contributing to the problem. However, an intelligent integration of EVs into the grid, could not only alleviate potential self induced problems, but also make EVs a vital resource for providing grid services. This thesis investigates the technical requirements for successful EV integration into the smart grid, as a smart, mobile distributed energy resource. The work is split into three key topics: enabling technologies, grid service applications and interoperability issues. The current state of e-mobility technologies is surveyed. Technologies and protocols in the full e-mobility architecture, enabling the synthesis between EVs and smart grid, are analyzed for potential gaps. A test system, inspired by the core of the e-mobility architecture, is implemented to enable testing of EVs providing grid services. The grid services identified in the NIKOLA project, as potentially viable to be provided using EVs, are tested in laboratory- and field experiments. The work shows that EVs can provide a variety of grid services on the distribution- and transmission level, such as improving voltage quality, preventing transformer overloading and frequency regulation. The issue of interoperability in the field of e-mobility, investigated in the COTEVOS project, is explored. It is concluded, that collective testing of the OEM equipment in testing symposiums, is the best way to ensure interoperability between different OEMs, and to discuss as well as fix the issues in the standard itself. Altogether, it is demonstrated that the provision of different grid services, using EVs, is technically feasible. While some gaps in standards/protocols still exist, standardization committees are actively listening to inputs from e-mobility research projects to cover them in the new versions. This enables EVs to not only mitigate their own effects on the grid, but also provide value to grid operators, locally as well as system wide. Finally, it is shown that active integration of EVs into the smart grid, is not only achievable, but is well on its way to becoming a reality.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Martinenas, S. (Intern), Træholt, C. (Intern), Andersen, P. B. (Intern), Marinelli, M. (Intern)
Number of pages: 190
Publication date: 2017

Publication information
Encoding of inductively measured k-space trajectories in MR raw data

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Chinese Academy of Sciences
Authors: Pedersen, J. O. (Intern), Hanson, C. G. (Ekstern), Xue, R. (Ekstern), Hanson, L. G. (Intern)
Number of pages: 7
Publication date: 2017
Event: Abstract from ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.
Main Research Area: Technical/natural sciences
Electronic versions: abstract_001.pdf

Relations
Activities:
Encoding of Inductively Measured k-Space Trajectories in MR Raw Data
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Energy and Reserve under Distributed Energy Resources Management-Day-Ahead, Hour-Ahead and Real-Time
The increasing penetration of distributed energy resources based on renewable energy sources in distribution systems leads to a more complex management of power systems. Consequently, ancillary services become even more important to maintain the system security and reliability. This paper proposes and evaluates a generic model for day-ahead, intraday (hour-ahead) and real-time scheduling, considering the joint optimization of energy and reserve in the scope of the virtual power player concept. The model aims to minimize the operation costs in the point of view of one aggregator agent taking into account the balance of the distribution system. For each scheduling stage, previous scheduling results and updated forecasts are considered. An illustrative test case of a distribution network with 33 buses, considering a large penetration of distribution energy resources allows demonstrating the benefits of the proposed model.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, INESC Technology and Science, Polytechnic Institute of Porto
Authors: Soares, T. (Ekstern), Silva, M. (Ekstern), Sousa, T. (Intern), Morais, H. (Ekstern), Vale, Z. (Ekstern)
Number of pages: 18
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Energies
Volume: 10
Issue number: 11
Article number: 1778
ISSN (Print): 1996-1073
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.11 SJR 0.67 SNIP 1.34
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
To obtain accurate blood flow velocity estimates it is important to remove the clutter signal originating from tissue. Conventionally, the clutter signal has been separated from the blood signal based on the difference of their spectral frequencies. However, this approach is not enough for obtaining vector flow measurements, since the spectra overlap at high beam-to-flow angles. In this work a distinct approach is proposed, where the energy of the velocity spectrum is used to differentiate among the two signals. The energy based method is applied by limiting the amplitude of the velocity spectrum function to a predetermined threshold. The effect of the clutter filtering is evaluated on a plane wave (PW) scan sequence in combination with transverse oscillation (TO) and directional beamforming (DB) for velocity estimation. The performance of the filter is assessed by comparison of the velocity estimates of the proposed filter against a conventional moving average clutter filter. The effect of tissue motion is investigated using a Field II simulation of a straight vessel with moving wall, while the direct effect of the filter on the velocity estimates is evaluated on a CFD model of a carotid bifurcation with a fixed vessel wall. The results show that the proposed filter outperformed the moving average during moving vessel wall conditions, where standard deviations from the velocity magnitudes and angles were kept consistently below 6% and 6° compared to 63% and 48° on the moving average filter. The results on the CFD showed that on non-moving conditions the velocity estimates had minor statistical differences with errors on the magnitude of -7.95±10.1% and angles of 0.15±6.65° for the proposed filter compared to -5.83±9.08% and -0.12±4.48°.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Energylab Nordhavn: An integrated community energy system towards green heating and e-mobility

This paper analyzes the green potential of a newly developed urban community, i.e., Nordhavn, in Copenhagen, Denmark from a planning perspective, wherein the energy sector of power, heat and transportation will be developed as an integrated energy system solution. Based on an hour-by-hour analysis wherein the generation and demand in each energy sector are balanced, the analysis explains how different levels of penetration of centralized heat pumps (HPs) and electric vehicles (EVs) would influence the energy performance of this integrated community energy system. The performance of the integrated energy system is evaluated from the perspectives of annual fuel consumption, electricity import, system cost and CO2 emission, etc.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management
Authors: Wang, J. (Intern), You, S. (Intern), Zong, Y. (Intern), Træholt, C. (Intern)
Number of pages: 6
Publication date: 2017

Energylab Nordhavn – Physical Implementation and perspectives

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy
Authors: Greisen, C. (Intern)
Number of pages: 1
Publication date: 2017
Enhancing damping of gas bearings using linear parameter-varying control

Journal bearings can be lubricated through controllable injectors using pressurised fluids, whose viscosity highly determines the dynamic responses of the rotating machine. The use of fluids with low viscosity is attracting a growing interest due to the reduced friction forces and consequent losses when the machine is in operation. However low viscosity also entails poor damping properties, which may lead to degraded performance or even instability when the rotating machine operates at or near one of the modal frequencies. This issue can be properly addressed by employing active feedback control systems to regulate the injection pressure of the fluid. Due to the strong dependencies of system performance on system parameters, the sought controller should be robust over a large range of operational conditions. This paper addresses the damping enhancement of controllable gas bearings through robust control approaches. Through an extensive experimental campaign the paper evaluates two robust controllers, a linear parameter-varying (LPV) controller and \( \infty \) controller, on their capability to guarantee stability and performance of a gas bearing across the large operational envelopes in rotational speed and injection pressure. The control systems are designed applying state-of-the-art methods in the respective areas. The experimental results clearly demonstrate the feasibility of enhancing the damping properties of a gas bearing by means of robust control methods.

General information

State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Mechanical Engineering, Solid Mechanics
Authors: Theisen, L. R. S. (Intern), Niemann, H. H. (Intern), Galeazzi, R. (Intern), Santos, I. (Intern)
Pages: 48–64
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Sound and Vibration
Volume: 365
ISSN (Print): 0022-460X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.2 SJR 1.36 SNIP 2.037
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.09 SJR 1.459 SNIP 2.236
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.31 SNIP 2.15 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.41 SNIP 2.308 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.32 SNIP 2.553 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.441 SNIP 2.939 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.383 SNIP 2.661 CiteScore 2.05
Enhancing demand side flexibility in Nordhavn buildings for integrated multi-energy systems

General information
State: Published
Organisations: Department of Civil Engineering, Section for Indoor Climate and Building Physics, Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Li, R. (Intern), Wang, J. (Intern), Zong, Y. (Intern), Foteinaki, K. (Intern), Rode, C. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts, Sustain 2017
Publisher: Technical University of Denmark (DTU)
Article number: L-9
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
SustainAbstracts2017c.compressed_105.pdf
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2017
Enhancing Wind Power Integration through Optimal Use of Flexibility in Multi-Carrier Energy Systems from the Danish Perspective

Denmark's goal of being independent of fossil energy sources in 2050 puts forward great demands on all energy subsystems (electricity, heat, gas and transport, etc.) to be operated in a holistic manner. The Danish experience and challenges of wind power integration and the development of district heating systems are summarized in this paper. How to optimally use the cross-sectoral flexibility by intelligent control (model predictive control-based) of the key coupling components in an integrated heat and power system including electrical heat pumps in the demand side, and thermal storage applications in buildings is investigated.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management, University of Zaragoza, Sichuan University
Authors: Zong, Y. (Intern), Awadelrahman, M. A. A. (Ekstern), Wang, J. (Intern), You, S. (Intern), Traeholt, C. (Intern), Xiao, X. (Ekstern)
Pages: 78-88
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: World Journal of Engineering and Technology
Volume: 5
Issue number: 4
ISSN (Print): 2331-4249
Original language: English
Cross-Sectoral Flexibility, District Heating Systems, Multi-Carrier Energy Systems, Power to Heat, Wind Power Integration
Electronic versions:
WJET_2017101016173894.pdf
DOIs: 10.4236/wjet.2017.54B009

Relations
Projects:
Enhancing Wind Power Integration through Optimal Use of Flexibility in Multi-Carrier Energy Systems from the Danish Perspective
Source: PublicationPreSubmission
Source-ID: 138685617
Publication: Research - peer-review › Journal article – Annual report year: 2017

Environmental coefficients of the free-field sensitivity of measurement microphones

The sensitivity of measurement microphones, both pressure and free field, is affected by changes in the environmental conditions, mainly temperature and static pressure. Static pressure and temperature coefficients for the pressure sensitivity have been the object of previous studies focused on Laboratory Standard microphones and few working standard microphones. The literature describes frequency dependent values for these coefficients which are used for calibration purposes. However, there is no description of the environmental coefficients of the free-field sensitivity though there have been some implementations that attempt to take care of the differences between the coefficients for the two types of sensitivities. Measuring the coefficients in a free field poses some challenge; it is not so easy to change neither the static pressure nor the temperature inside anechoic room within the range usually needed for a robust determination of the coefficients. Analysis of data gathered through a sufficiently large number of measurements has been suggested. This paper proposes an experimental procedure for the determination of the free-field sensitivity coefficients which makes use of the existing facilities used for the determination of the pressure sensitivity coefficients. Results are compared, whenever possible with numerical calculations of the microphones involved, and with alternative procedures based on the knowledge of the pressure sensitivity coefficients, diffraction of the microphone, and the load of the microphone impedance due to the radiation impedance.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, DPA Microphones A/S, Danish Fundamental Metrology
Authors: Barrera Figueroa, S. (Ekstern), Cutanda Henriquez, V. (Intern), Torras-Rosell, A. (Ekstern)
Number of pages: 9
Publication date: 2017

Host publication information
Title of host publication: Proceedings of Internoise 2017
Equivalent to Represent Inertial and Primary Frequency Control Effects of an External System

This paper presents a novel equivalent, which is suitable for simulation of inertial and primary frequency control effects. In the model reduction procedure, dynamic power injectors are used to replace the external system and to mimic its dynamic behavior. The parameters of the equivalents are tuned with a simple approach presented in this paper. The effectiveness of the proposed method is demonstrated on a modified version of the ENTSO-E Dynamic Study Model. The results show that the system frequency response of the unreduced system is retained and a speedup of the simulations of around 4.0 is achieved.
Estimating the diffuseness of sound fields: A wavenumber analysis method

The concept of a diffuse sound field is widely used in the analysis of sound in enclosures. The diffuse sound field is generally described as composed of plane waves with random phases, which wave number vectors are uniformly distributed over all angles of incidence. In this study, an interpretation in the spatial frequency domain is discussed, with the prospect of evaluating the diffuse field conditions in non-anechoic enclosures. This work examines how theoretical considerations compare with experimental results obtained in rooms with various diffuse field conditions. In addition, the paper investigates how the results relate to the modal theory of room acoustics, based on the conception that any mode, also in non-rectangular rooms, can be expanded into a number of propagating waves.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Royal Melbourne Institute of Technology
Authors: Nolan, M. (Intern), Davy, J. L. (Ekstern), Brunskog, J. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 5
Article number: 3784
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
Estimating the Sabine absorption coefficient of fibrous materials for various backing conditions

Since absorber manufacturers cannot provide the absorption coefficients for all possible mounting conditions, acousticians have difficulties knowing the absorption characteristics of their own configurations. This paper aims to predict the Sabine absorption coefficient for various mounting conditions by extracting the air flow resistivity of the test specimen and the frequency-dependent effect of the chamber on the measured absorption coefficients. Two homogeneous fibrous absorbers are measured for experimental validation, showing good agreements between the predictions and measurements.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Jeong, C. (Intern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 24th International Congress on Sound and Vibration
Main Research Area: Technical/natural sciences
Conference: The 24th International Congress on Sound and Vibration, London, United Kingdom, 23/07/2017 - 23/07/2017
Fibrous absorbers, Sabine absorption coefficient, Flow resistivity extraction
Source: PublicationPreSubmission
Source-ID: 134381159
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Estimation of surface impedance at oblique incidence based on sparse array processing

A method is proposed to estimate the surface impedance of a large absorptive panel from free-field measurements with a spherical microphone array. The method relies on the reconstruction of the pressure and the particle velocity on the studied surface using an equivalent source method based on spherical array measurements. The sound field measured by the array is mainly composed of an incident and a reflected wave, so it can be represented as a spatially sparse problem. This makes it possible to use compressive sensing in order to enhance the resolution and the quality of the estimation. The results indicate an accurate reconstruction for angles of incidence between 0° and 60°, and between approximately 200 and 4000 Hz. Additionally, experimental challenges are discussed, such as the sample's finiteness at low frequencies and the estimation of the background noise.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Richard, A. P. A. (Intern), Fernandez Grande, E. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern)
Pages: 4115–4125
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 6
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
Estimation of surface impedance using different types of microphone arrays

This study investigates microphone array methods to measure the angle dependent surface impedance of acoustic materials. The methods are based on the reconstruction of the sound field on the surface of the material, using a wave expansion formulation. The reconstruction of both the pressure and the particle velocity leads to an estimation of the...
surface impedance for a given angle of incidence. A porous type absorber sample is tested experimentally in anechoic conditions for different array geometries, sample sizes, incidence angles, and distances between the array and sample. In particular, the performances of a rigid spherical array and a double layer planar array are examined. The use of sparse array processing methods and conventional regularization approaches are studied. In addition, the influence of the size of the sample on the surface impedance estimation is investigated using both experimental data and numerical simulations with a boundary element model. Results indicate that the small distance between the planar array and the sample favors a more robust estimation.

**General information**

State: Published
Pages: 3842
Publication date: 2017
Conference: 173rd Meeting of the Acoustical Society of America and the 8th Forum Acusticum, Boston, United States, 25/06/2017 - 25/06/2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 5
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
Evaluating a Loudspeaker-Based Virtual Sound Environment using Speech-on-Speech Masking

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Ahrens, A. (Intern), Marschall, M. (Intern), Dau, T. (Intern)
Pages: 1138-1141
Publication date: 2017

Host publication information
Title of host publication: Proceedings of DAGA 2017
Publisher: Deutsche Gesellschaft für Akustik e.V.
Main Research Area: Technical/natural sciences
Conference: 43. Jahrestagung für Akustik, Kiel, Germany, 06/03/2017 - 06/03/2017
Source: PublicationPreSubmission
Source-ID: 134009143
Publication: Research - peer-review › Conference abstract in journal – Annual report year: 2017

Evaluating the Cost of Line Capacity Limitations in Aggregations of Commercial Buildings
The trend towards electrification of the heating sector in many cases leads to the replacement of fossil-fueled heating systems with electric heat pumps. This may result to significantly higher consumption and potentially violations of the distribution grid operational limits. We propose a day-ahead optimization strategy to assess the cost of imposing capacity limitations in the total consumption of individual buildings, as well as aggregations of buildings. We show that such capacity limitations lead to an increase for the buildings operational costs, which can be interpreted as the value of these limitations. Based on such calculations, the aggregator can value capacity-limitation services to the distribution system operator. Moreover, the value of aggregation is also highlighted, since it leads to lower costs than imposing the same total capacity limitation on individual buildings.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Energy Analytics and Markets
Evaluation of a Loudspeaker-Based Virtual Acoustic Environment for Investigating sound-field auditory steady-state responses

Measuring sound-field auditory steady-state responses (ASSR) is a promising new objective clinical procedure for hearing aid fitting validation, particularly for infants who cannot respond to behavioral tests. In practice, room acoustics of non-anechoic test rooms can heavily influence the auditory stimulus used for eliciting the ASSR. To systematically investigate the effect of the room acoustics conditions on sound-field ASSR, a loudspeaker-based auralization system was implemented using a mixed order Ambisonics approach. The present study investigates the performance of the auralization system in terms of objective room acoustic measurements and sound-field ASSR measurements, both in the actual room and in the simulated and auralized room. The evaluation is conducted for a small room with well-defined acoustic properties. The room is carefully modeled using the novel room acoustic simulation tool PARISM (Phased Acoustical Radiosity and Image Source Method) and validated through measurements. This study discusses the limitations of the system and the potential improvements needed for a more realistic sound-field ASSR simulation.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Interacoustics A/S
Authors: Zapata-Rodriguez, V. (Ekstern), Marbjerg, G. H. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern), Laugesen, S. (Ekstern), M. Harte, J. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 5
Article number: 3997
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Evaluation of New Ultrasound Techniques for Clinical Imaging in selected Liver and Vascular Applications

This Ph.D. project is based on a longstanding collaboration between physicists and engineers from the Center of Fast Ultrasound Imaging (CFU) at the Technical University of Denmark and medical doctors from the department of Radiology at Rigshospitalet. The intent of this cooperation is to validate new ultrasonic methods for future clinical use. Study I compares two B-mode ultrasound methods: the new experimental technique Synthetic Aperture Sequential Beamforming combined with Tissue Harmonic Imaging (SASB-THI), and a conventional technique combined with THI. While SASB reduces the amount of data transformation, thus enabling wireless transmission, THI can improve resolution and image contrast, and creates fewer artifacts. Thirty-one patients with verified liver tumors were scanned and recordings with and without visible pathology were performed. Subsequently, eight radiologists evaluated blinded to information about the
technique, which B-mode images they preferred, as well as detection of pathology. Evaluation showed that the techniques were preferred equally and tumor could be detected equally well.

Study II deals with the ability of vector flow imaging (VFI) to monitor patients with arteriovenous fistulas for hemodialysis for upcoming stenosis. VFI is an angle-independent method for determining blood flow direction and velocity. Volume can be determined by integrating the velocity profile multiplied by the cross-sectional area. Nineteen patients were monitored monthly over a period of six months, and VFI estimates were compared with the reference ultrasound dilution technique (UDT). VFI volume flow values were not significantly different from UDT and had a better precision. Concordance between VFI and UDT was high when large volume flow changes (greater than 25%) occurred between dialysis sessions. However, the methods could not be regarded as interchangeable. Study III deals with VFI's ability to determine peak velocity in the portal vein. The commonly used ultrasound method for this is spectral Doppler, which is known to overestimate peak velocity when the angle between the blood vessel and the beam is more than 70 degrees; this overestimation becomes even larger when the angle becomes larger. VFI can determine the peak velocity angle independently. Thirty-two healthy volunteers were scanned with spectral Doppler and VFI with two portal vein scan positions (intercostal and subcostal). The study showed that VFI estimates the same peak velocity as spectral Doppler. Furthermore, VFI has better precision and can estimate the same peak velocity with a scan position, where spectral Doppler cannot. Finally, inter- and intraobserver agreement is higher for VFI. All three studies indicate that the techniques can be used in the clinic and probably will be part of everyday practice in the near future.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Authors: Brandt, A. H. (Ekstern), Nielsen, M. B. (Ekstern), Jensen, J. A. (Intern), Hansen, K. L. (Ekstern), Hemmsen, M. C. (Intern)
Number of pages: 102
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Evaluation of respiratory motion correction in PET/CT using a 3D printed phantom

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Experimental analysis of flexibility change with different levels of power reduction by demand response activation on thermostat controlled loads
This paper studies the flexibility available with thermostatically controlled loads (TCLs) to provide power system services by demand response (DR) activation. Although the DR activation on TCLs can provide power system ancillary services, it is important to know how long such services can be provided for when different levels of power reduction are imposed. The flexibility change with different levels of power reduction is tested experimentally with domestic fridges used by real customers with unknown user interaction. The investigation quantifies the flexibility of household
fridges and the impact of DR activation in terms of deviation in the average temperature. The maximum possible power reduction with the cluster of refrigerators is 67% and the available flexibility with the cluster of refrigerators is 10%. The resulting deviation in the average temperature is 14%.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management
Authors: Lakshmanan, V. (Intern), Marinelli, M. (Intern), Hu, J. (Intern), Bindner, H. W. (Intern)
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BFI (2017): BFI-level 1
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.53 SJR 0.384 SNIP 0.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.339 SNIP 0.693 CiteScore 1.27
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.549 SNIP 1.168 CiteScore 2.15
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.386 SNIP 0.828 CiteScore 1.07
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.335 SNIP 0.827 CiteScore 1.04
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.323 SNIP 0.814 CiteScore 1.09
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.277 SNIP 0.452
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.311 SNIP 0.581
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.319 SNIP 0.572
Scopus rating (2007): SJR 0.237 SNIP 0.55
Scopus rating (2006): SJR 0.237 SNIP 0.548
Scopus rating (2005): SJR 0.3 SNIP 0.479
Scopus rating (2004): SJR 0.201 SNIP 0.4
Scopus rating (2003): SJR 0.306 SNIP 0.5
Scopus rating (2002): SJR 0.357 SNIP 0.444
Scopus rating (2001): SJR 0.26 SNIP 0.311
Scopus rating (2000): SJR 0.184 SNIP 0.828
Scopus rating (1999): SJR 0.204 SNIP 0.545
Experimental characterization of the Green's function in a room using sparse reconstruction principles

Measuring the Green's function over the entire volume of a room would typically require an unfeasible number of measurements, due to requirements on spatial sampling. To alleviate the need for excessive measurements, sparse reconstruction methods can be employed, as they make it possible to reconstruct a seemingly undersampled signal. The present study proposes a method for acquiring experimentally the Green’s function in a room by measuring directly the mode shapes of the room, based on the conception that any mode can be expanded into a number of propagating waves. If the modes are described in the wavenumber domain (as a plane-wave expansion), sparse reconstruction methods can be employed, under the implicit assumption that each mode shape is represented as the superposition of a small number of plane waves. In addition, it is assumed that the medium is source-free and homogeneous. The methodology is examined numerically and verified experimentally, based on measurements in a lightly damped rectangular room.
Experimental performance assessment of the sub-band minimum variance beamformer for ultrasound imaging

Recent progress in adaptive beamforming techniques for medical ultrasound has shown that current resolution limits can be surpassed. One method of obtaining improved lateral resolution is the Minimum Variance (MV) beamformer. The frequency domain implementation of this method effectively divides the broadband ultrasound signals into sub-bands (MVS) to conform with the narrow-band assumption of the original MV theory. This approach is investigated here using experimental Synthetic Aperture (SA) data from wire and cyst phantoms. A 7 MHz linear array transducer is used with the SARUS experimental ultrasound scanner for the data acquisition. The lateral resolution and the contrast obtained, are evaluated and compared with those from the conventional Delay-and-Sum (DAS) beamformer and the MV temporal implementation (MVT). From the wire phantom the Full-Width-at-Half-Maximum (FWHM) measured at a depth of 52 mm, is 16.7 μm (0.08λ) for both MV methods, while the corresponding values for the DAS case are at least 24 times higher. The measured Peak-Side-lobe-Level (PSL) may reach −41 dB using the MVS approach, while the values from the DAS and MVT beamforming are above −24 dB and −33 dB, respectively. From the cyst phantom, the power ratio (PR), the contrast-to-noise ratio (CNR), and the speckle signal-to-noise ratio (sSNR) measured at a depth of 30 mm are at best similar for MVS and DAS, with values ranging between −29 dB and −30 dB, 1.94 and 2.05, and 2.16 and 2.27 respectively. In conclusion the MVS beamformer is not suitable for imaging continuous targets, and significant resolution gains were obtained only for isolated targets.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Heriot-Watt University, University of Edinburgh
Experimental Validation of BDI Agents for Distributed Control of Electric Power Grids
This paper presents initial laboratory experiments designed to test belief-desire-intention agent reasoning in a webof-cell context. The work introduces the application of the bridge between JASON and the Common Artifact Infrastructure for Agents Open Environments to agent and environment modeling, respectively. Belief-desire-intention reasoning is achieved through JASON’s engine while artifacts monitor and control grid devices using dedicated JAVA objects. Experiments have been conducted in SYSLAB, a testbed for distributed power system control and distributed solutions, located at the Risø campus of the Technical University of Denmark. Experimental results show the feasibility of applying belief-desire-intention reasoning to WoC control using a test case where tie-line power flow setpoints must be followed.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Federal University of Santa Catarina
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Experimental Verification of Optimal Frequency Range for Microwave Head Imaging
This work presents the experimental verification of the power transmission of a radiating field into the human head for Microwave Imaging (MWI) applications. We aim at finding the range of frequencies that optimize the power scattered by any anomalies from inside to outside of the brain when excited by an incoming radiating field and hence improve the quality of microwave imaging. For this purpose, a 3D printed head phantom composed of liquids emulating dispersive biological head tissues in the range of [0.5-4] GHz has been built. Measurement results show that the wave penetrates well up to 1.3GHz as there is a strong attenuation around 2GHz, and low levels of transmitted power above 3GHz.

General information
State: Published
Authors: Bjelogrlic, M. (Ekstern), Fuchs, B. (Ekstern), Thiran, J. (Ekstern), Mosig, J. R. (Ekstern), Mattes, M. (Intern)
Number of pages: 4
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Host publication information
Exploiting Deep Neural Networks and Head Movements for Robust Binaural Localization of Multiple Sources in Reverberant Environments

This paper presents a novel machine-hearing system that exploits deep neural networks (DNNs) and head movements for robust binaural localization of multiple sources in reverberant environments. DNNs are used to learn the relationship between the source azimuth and binaural cues, consisting of the complete cross-correlation function (CCF) and interaural level differences (ILDs). In contrast to many previous binaural hearing systems, the proposed approach is not restricted to localization of sound sources in the frontal hemifield. Due to the similarity of binaural cues in the frontal and rear hemifields, front–back confusions often occur. To address this, a head movement strategy is incorporated in the localization model to help reduce the front–back errors. The proposed DNN system is compared to a Gaussian-mixture-model-based system that employs interaural time differences (ITDs) and ILDs as localization features. Our experiments show that the DNN is able to exploit information in the CCF that is not available in the ITD cue, which together with head movements substantially improves localization accuracies under challenging acoustic scenarios, in which multiple talkers and room reverberation are present.

General information
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Organisations: Department of Electrical Engineering, Hearing Systems, University of Sheffield
Authors: Ma, N. (Ekstern), May, T. (Intern), Brown, G. J. (Ekstern)
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BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 4.2 SJR 0.867 CiteScore 4.4
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 3.5 SJR 0.762 SNIP 3.429
Scopus rating (2015): SJR 1.247 SNIP 2.4 CiteScore 2.4
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.468 SNIP 2.936 CiteScore 4.58
Scopus rating (2013): SJR 1.021 SNIP 3.242 CiteScore 4.03
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 0.918 SNIP 2.672 CiteScore 3.05
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 0.892 SNIP 2.743 CiteScore 2.56
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Scopus rating (2010): SJR 1.127 SNIP 2.502
Exploiting Flexibility in Coupled Electricity and Natural Gas Markets: A Price-Based Approach

Natural gas-fired power plants (NGFPPs) are considered a highly flexible component of the energy system and can facilitate the large-scale integration of intermittent renewable generation. Therefore, it is necessary to improve the coordination between electric power and natural gas systems. Considering a market-based coupling of these systems, we introduce a decision support tool that increases market efficiency in the current setup where day-ahead and balancing markets are cleared sequentially. The proposed approach relies on the optimal adjustment of natural gas price to modify the scheduling of power plants and reveals the necessary flexibility to handle stochastic renewable production. An essential property of this price-based approach is that it guarantees no financial imbalance (deficit or surplus) for the system operator at the day-ahead stage. Our analysis shows that the proposed mechanism reduces the expected system cost and efficiently accommodates high shares of renewables.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Ordoudis, C. (Intern), Delikaraoglou, S. (Intern), Pinson, P. (Intern), Kazempour, J. (Intern)
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Fast Plane Wave 2-D Vector Flow Imaging Using Transverse Oscillation and Directional Beamforming
Several techniques can estimate the 2-D velocity vector in ultrasound. Directional beamforming (DB) estimates blood flow velocities with a higher precision and accuracy than transverse oscillation (TO), but at the cost of a high beamforming load when estimating the flow angle. In this paper, it is proposed to use TO to estimate an initial flow angle, which is then
refined in a DB step. Velocity magnitude is estimated along the flow direction using cross-correlation. It is shown that the suggested TO-DB method can improve the performance of velocity estimates compared to TO, and with a beamforming load, which is 4.6 times larger than for TO and seven times smaller than for conventional DB. Steered plane wave transmissions are employed for high frame rate imaging, and parabolic flow with a peak velocity of 0.5 m/s is simulated in straight vessels at beamto-flow angles from 45 to 90. The TO-DB method estimates the angle with a bias and standard deviation (SD) less than 2, and the SD of the velocity magnitude is less than 2%. When using only TO, the SD of the angle ranges from 2 to 17 and for the velocity magnitude up to 7%. Bias of the velocity magnitude is within 2% for TO and slightly larger but within 4% for TO-DB. The same trends are observed in measurements although with a slightly larger bias. Simulations of realistic flow in a carotid bifurcation model provide visualization of complex flow, and the spread of velocity magnitude estimates is 7.1 cm/s for TO-DB, while it is 11.8 cm/s using only TO. However, velocities for TO-DB are underestimated at peak systole as indicated by a regression value of 0.97 for TO and 0.85 for TO-DB. An in vivo scanning of the carotid bifurcation is used for vector velocity estimations using TO and TO-DB. The SD of the velocity profile over a cardiac cycle is 4.2% for TO and 3.2% for TO-DB.

General information
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Organisations: Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Department of Electrical Engineering, Biomedical Engineering, Department of Information Technology, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Authors: Jensen, J. (Intern), Villagómez Hoyos, C. A. (Intern), Stuart, M. B. (Intern), Ewertsen, C. (Ekstern), Nielsen, M. B. (Ekstern), Jensen, J. A. (Intern)
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BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.94 SJR 1.183 SNIP 1.447
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.73 SJR 0.986 SNIP 1.402
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.814 SNIP 1.494 CiteScore 2.43
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.088 SNIP 1.627 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.872 SNIP 1.496 CiteScore 2.18
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.802 SNIP 1.479 CiteScore 1.87
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.733 SNIP 1.325 CiteScore 1.95
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.928 SNIP 1.562
Fast Plane Wave Imaging
This PhD project investigates and further develops methods for ultrasound plane wave imaging and blood flow estimation with the objective of overcoming some of the major limitations in conventional ultrasound systems, which are related to low frame rates and only estimation of velocities along the ultrasound beam. The first part of the contribution investigates the compromise between frame rate and plane wave image quality including the influence of grating lobes from a λ-pitch transducer. A method for optimizing the image quality is suggested, and it is shown that the frame rate can be increased by a factor of three without loss of image quality for a particular λ/2-pitch transducer, when compared to a λ-pitch transducer. The second part presents a method for high frame rate 2-D vector flow imaging. The method was validated in simulations and measurements, and it is shown that angles can be estimated with a bias and standard deviation less than 2°, and the velocity magnitude can be estimated with a bias and standard deviation less than 4 % over a large range of beam-to-flow angles. The vector flow method was also investigated under laminar and complex flow conditions in the carotid arteries in ten healthy volunteers. Complex flow patterns were measured in an anthropomorphic flow phantom and showed good agreement with the velocity field simulated using computational fluid dynamics. The last part of the contribution investigates two clinical applications. Plane wave imaging was used for slow velocity flow estimation in the human placenta, which made it possible to map the vessel resistance in several fetal arteries. Finally, vector flow imaging was used for volume flow estimation in patients undergoing dialysis. The sources of error related to the volume flow estimation were investigated, making it possible to compensate for the errors. The developed techniques for plane wave imaging using high frame rates and/or estimation of 2-D vector flow may give the clinicians new tools for assessing the health of blood vessels and aid while examining patients with cardiovascular and organ diseases.
Fatigue Load Sensitivity Based Optimal Active Power Dispatch For Wind Farms

This paper proposes an optimal active power dispatch algorithm for wind farms based on Wind Turbine (WT) load sensitivity. The control objectives include tracking power references from the system operator and minimizing fatigue loads experienced by WTs. The sensitivity of WT fatigue loads to power references is defined which simplifies the formulation of the optimal power dispatch problem. Since the sensitivity value is calculated at the local WT controller, the computation burden of the central wind farm controller is largely reduced. Moreover, explicit analytical equations of the fatigue load sensitivity are derived, which significantly improves the computation efficiency of the local WT controller. The proposed algorithm can be implemented in different active power control schemes. Case studies were conducted with a wind farm under balance control for both low and high wind conditions. By comparing the rainflow cycles and Damage Equivalent Load (DEL), the efficacy of the proposed algorithm is verified.
Fault diagnosis and condition monitoring of wind turbines

This paper describes a model-free method for the fault diagnosis and condition monitoring of rotor systems in wind turbines. Both fault diagnosis and monitoring can be achieved without using a model for the wind turbine, applied controller, or wind profiles. The method is based on measurements from standard sensors on modern wind turbines, including moment sensors and rotor angle sensors. This approach will allow the method to be applied to existing wind turbines without any modifications. The method is based on the detection of asymmetries in the rotor system caused by changes or faults in the rotor system. A multiblade coordinate transformation is used directly on the measured flap-wise and edge-wise moments followed by signal modulation. Changes or faults in the rotor system will result in unique signatures in the set of modulation signals. These signatures are described through the amplitudes and phase information of the modulation signals. It is possible to detect and isolate which blade is faulty or has been changed based on these signatures. Furthermore, the faulty component can be isolated, i.e., the actuator, sensor or blade, and the type of fault can be determined. The method can be used both on- and off-line.
FDG at 7.8 MeV
I here report the fundamental performance of a new generation of compact medical cyclotrons for hospital-based PET tracer manufacture, exemplified with the FDG production numbers achieved by the first prototype of the GE GenTrace cyclotron. The proton energy is 7.8 MeV. After 3 years of extensive testing in a "physics lab" setting, which is door-to-door with our normal GMP production suite, I can now conclude that this cyclotron in conjunction with a standard GE Fastlab chemistry box easily achieves significant, reliable and compliant FDG output surpassing 15 GBq per batch at EOS, after 2 hours bombardment time. The details are reported below.

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Organisations: Department of Electrical Engineering, Department of Transport, Transport optimisation and technique
Authors: Jensen, M. (Intern)
Number of pages: 7
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Publication information
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Volume: 1845
Article number: 020011
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.26 SJR 0.165 SNIP 0.3
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.21 SJR 0.165 SNIP 0.246
BFI (2015): BFI-level 1
Installed wind capacity in Africa has grown rapidly the last few years, and by late 2016 had reached about 4.8 GW. However, so far few investments have been made in inland localities due to the generally lower wind potential. This paper therefore explores if and to what extent it is possible to establish economically feasible wind-power plants in countries with lower wind potential. To address this question, the paper provides a combined wind resource mapping and a pre-feasibility study for grid integration of wind power at four specific sites in Mali. The study finds that Mali has generally poor wind conditions, with average wind speeds of below 5 m/s at 50 m above ground level in the south, while there are larger areas in the northern part with average wind speeds of above 7 m/s at 50 m above ground level. Overall the research shows that in countries with generally poor wind conditions, such as in the southern part of Mali, it is possible to identify a limited number of sites with local speed-up effects situated close to the existing grid, at which there are options for undertaking medium-size wind-power projects that would be economically feasible at current crude oil prices of 50 USD/barrel.

Feasibility of wind power integration in weak grids in non-coastal areas of Sub-Saharan Africa: the case of Mali

Installed wind capacity in Africa has grown rapidly the last few years, and by late 2016 had reached about 4.8 GW. However, so far few investments have been made in inland localities due to the generally lower wind potential. This paper therefore explores if and to what extent it is possible to establish economically feasible wind-power plants in countries with lower wind potential. To address this question, the paper provides a combined wind resource mapping and a pre-feasibility study for grid integration of wind power at four specific sites in Mali. The study finds that Mali has generally poor wind conditions, with average wind speeds of below 5 m/s at 50 m above ground level in the south, while there are larger areas in the northern part with average wind speeds of above 7 m/s at 50 m above ground level. Overall the research shows that in countries with generally poor wind conditions, such as in the southern part of Mali, it is possible to identify a limited number of sites with local speed-up effects situated close to the existing grid, at which there are options for undertaking medium-size wind-power projects that would be economically feasible at current crude oil prices of 50 USD/barrel.

General information
State: Published
Organisations: Department of Management Engineering, UNEP DTU Partnership, Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Department of Wind Energy, Resource Assessment Modelling, Agence d’Energie Renouvelable, 3E
Authors: Nygaard, I. (Intern), Kamissoko, F. (Ekstern), Nørgård, P. B. (Intern), Badger, J. (Intern), Dewilde, L. (Ekstern)
Pages: 557-584
Publication date: 2017
Fine-Tuning Nonhomogeneous Regression for Probabilistic Precipitation Forecasts: Unanimous Predictions, Heavy Tails, and Link Functions

Raw ensemble forecasts of precipitation amounts and their forecast uncertainty have large errors, especially in mountainous regions where the modeled topography in the numerical weather prediction model and real topography differ most. Therefore, statistical postprocessing is typically applied to obtain automatically corrected weather forecasts. This study applies the nonhomogenous regression framework as a state-of-the-art ensemble postprocessing technique to predict a full forecast distribution and improves its forecast performance with three statistical refinements. First of all, a novel split-type approach effectively accounts for unanimous zero precipitation predictions of the global ensemble model of the ECMWF. Additionally, the statistical model uses a censored logistic distribution to deal with the heavy tails of precipitation amounts. Finally, it is investigated which are the most suitable link functions for the optimization of regression coefficients for the scale parameter. These three refinements are tested for 10 stations in a small area of the European Alps for lead times from +24 to +144 h and accumulation periods of 24 and 6 h. Together, they improve probabilistic forecasts for precipitation amounts as well as the probability of precipitation events over the default postprocessing method. The improvements are largest for the shorter accumulation periods and shorter lead times, where the information of unanimous ensemble predictions is more important.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, University of Innsbruck
Authors: Gebetsberger, M. (Ekstern), Messner, J. W. (Intern), Mayr, G. J. (Ekstern), Zeileis, A. (Ekstern)
Pages: 4693-4708
Publication date: 2017
Main Research Area: Technical/natural sciences
Finite volume method room acoustic simulations integrated into the architectural design process

In many cases, room acoustics are neglected during the early stage of building design. This can result in serious acoustical problems that could have been easily avoided and can be difficult or expensive to remedy at later stages. Ideally, the room acoustic design should interact with the architectural design from the earliest design stage, as a part of a holistic design process. A new procedure to integrate room acoustics into architectural design is being developed in a Ph.D. project, with the aim of promoting this early stage holistic design process. This project aims to develop a new hybrid simulation tool combining wave-based and geometrical acoustics methods. One of the important aspects is the flexibility to represent realistic geometric shapes, for which the finite volume method (FVM) is chosen for the wave-based part of the tool. As a starting point, the computational efficiency of high-order two-dimensional FVM for defining an efficient wave-based simulation tool is investigated. Preliminary two-dimensional FVM simulation results are presented, which illuminate the suitability for handling complex geometries compared to other wave-based simulation methods.

Bibliographical note

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Finite volume method room acoustic simulations integrated into the architectural design process

In many cases, room acoustics are neglected during the early stage of building design. This can result in serious acoustical problems that could have been easily avoided and can be difficult or expensive to remedy at later stages. Ideally, the room acoustic design should interact with the architectural design from the earliest design stage, as a part of a holistic design process. A new procedure to integrate room acoustics into architectural design is being developed in a Ph.D. project, with the aim of promoting this early stage holistic design process. This project aims to develop a new hybrid simulation tool combining wave-based and geometrical acoustics methods. One of the important aspects is the flexibility to represent realistic geometric shapes, for which the finite volume method (FVM) is chosen for the wave-based part of the tool. As a starting point, the computational efficiency of high-order two-dimensional FVM for defining an efficient wave-based simulation tool is investigated. Preliminary two-dimensional FVM simulation results are presented, which illuminate the suitability for handling complex geometries compared to other wave-based simulation methods.

General information

State: Published
Authors: Pind Jörgensson, F. K. (Intern), Jeong, C. (Intern), Engsig-Karup, A. P. (Intern), Strømann-Andersen, J. (Ekstern)
Pages: 3783
Publication date: 2017
Conference: 173rd Meeting of the Acoustical Society of America and the 8th Forum Acusticum, Boston, United States, 25/06/2017 - 25/06/2017
Main Research Area: Technical/natural sciences
Flexible Method for the Automated Offline-Detection of Artifacts in Multi-Channel Electroencephalogram Recordings

Electroencephalogram (EEG) signal quality is often compromised by artifacts that corrupt quantitative EEG measurements used in clinical applications and EEG-related studies. Techniques such as filtering, regression analysis and blind source separation are often used to remove these artifacts. However, these preprocessing steps do not allow for complete artifact correction. We propose a method for the automated offline-detection of remaining artifacts after preprocessing in multi-channel EEG recordings. In contrast to existing methods it requires neither adaptive parameters varying between recordings nor a topography template. It is suited for short EEG segments and is flexible with regard to target applications. The algorithm was developed and tested on 60 clinical EEG samples of 20 seconds each that were recorded both in resting state and during cognitive activation to gain a realistic artifact set. Five EEG features were used to quantify temporal and spatial signal variations. Two distance measures for the single-channel and multi-channel variations of these features were defined. The global thresholds were determined by three-fold cross-validation and Youden's J statistic in conjunction with receiver operating characteristics (ROC curves). We observed high sensitivity of 95.5%±4.8 and specificity of 88.8%±2.1. The method has thus shown great potential and is promising as a possible tool for both EEG-based clinical applications and EEG-related research.

Flexible prototype of modular multilevel converters for experimental verification of DC transmission and multiterminal systems

Testing and verification of high-level and low-level control, modulation, fault handling and converter co-ordination for modular multilevel converters (MMCs) requires development of experimental prototype converters. In this paper, we provide a a complete overview of the MMC-based experimental prototype at UNSW Sydney (The University of New South Wales) including the structure of the sub-modules, communication, control and protection functions as well as the possible configurations of the system. The prototype, rated at a dc voltage of up to 800 V and power of 20 kVA and can be used to study the operation of a single converter, back-to-back and point-to-point connections as well as multi-terminal systems.
Forming of space charge wave with broad frequency spectrum in helical relativistic two-stream electron beams: Paper

We elaborate a quadratic nonlinear theory of plural interactions of growing space charge wave (SCW) harmonics during the development of the two-stream instability in helical relativistic electron beams. It is found that in helical two-stream electron beams the growth rate of the two-stream instability increases with the beam entrance angle. An SCW with the broad frequency spectrum, in which higher harmonics have higher amplitudes, forms when the frequency of the first SCW harmonic is much less than the critical frequency of the two-stream instability. For helical electron beams the spectrum expands with the increase of the beam entrance angle. Moreover, we obtain that utilizing helical electron beams in multiharmonic two-stream superheterodyne free-electron lasers leads to the improvement of their amplification characteristics, the frequency spectrum broadening in multiharmonic signal generation mode, and the reduction of the overall system dimensions.
Frequency Stability Enhancement for Low Inertia Systems using Synthetic Inertia of Wind Power

High-level integration of renewable energy sources in power system leads to the displacement of conventional generators and consequently challenges in power system frequency stability are introduced. To mitigate the negative impact of significant wind power penetration in the grid on the frequency stability, this paper proposes supplementary control methods to implement synthetic inertia for doubly-fed induction generator (DFIG) based wind energy system during frequency excursions. Different control strategies and activation schemes are analyzed and implemented on the Western Danish renewable-based system using real-time digital simulator (RTDS) to propose the best one for the synthetic inertia controller. From the comparative simulation results, it can be concluded that the method using a combination of both the frequency deviation and derivative as input signals, and the under-frequency trigger provides the best dynamic response in term of the system frequency stability improvement.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Siemens A/S
Authors: Nguyen, H. T. (Intern), Yang, G. (Intern), Nielsen, A. H. (Intern), Jensen, P. H. (Ekstern)
Number of pages: 5
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 IEEE PES General Meeting
Fully Integrated, Low Drop-Out Linear Voltage Regulator in 180 nm CMOS
This paper presents a capacitor-free low dropout (LDO) linear regulator based on a dual loop topology. The regulator utilizes two feedback loops to satisfy the challenges of hearing aid devices, which include fast transient performance and small voltage spikes under rapid load-current changes. The proposed design works without the need of a decoupling capacitor connected at the output and operates with a 0-100 pF capacitive load. The design has been taped out in a 0.18 μm CMOS process. The proposed regulator has a low component count, area of 0.012 mm² and is suitable for system-on-chip integration. It regulates the output voltage at 0.9 V from a 1.0 V - 1.4 V supply. The measured results for a current step load from 250-500 µA with a rise and fall time of 1.5 µs are an overshoot of 26 mV and undershoot of 26 mV with a settling time of 3.5 µs when CL between 0-100 pF. The proposed LDO regulator consumes a quiescent current of only 10.5 µA. The design is suitable for application with a current step edge time of 1 ns while maintaining ∆Vout of 64 mV.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Yosef-Hay, Y. (Ekstern), Larsen, D. Ø. (Intern), Llimos Muntal, P. (Intern), Jørgensen, I. H. H. (Intern)
Number of pages: 10
Pages: 427-436
Publication date: 2017
Main Research Area: Technical/natural sciences

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Volume: 92
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.9 SJR 0.211 SNIP 0.6
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.74 SJR 0.216 SNIP 0.604
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.197 SNIP 0.397 CiteScore 0.58
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.223 SNIP 0.61 CiteScore 0.64
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.243 SNIP 0.572 CiteScore 0.72
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.252 SNIP 0.583 CiteScore 0.72
ISI indexed (2012): ISI indexed yes

Renal ischemia/reperfusion injury (IRI) is a leading cause of acute kidney injury (AKI), and at present, there is a lack of reliable biomarkers that can diagnose AKI and measure early progression because the commonly used methods cannot evaluate single-kidney IRI. Hyperpolarized \([1,4-C-13(2)]\) fumarate conversion to \([1,4-C-13(2)]\) malate by fumarase has been proposed as a measure of necrosis in rat tumor models and in chemically induced AKI rats. Here we show that the degradation of cell membranes in connection with necrosis leads to elevated fumarase activity in plasma and urine and secondly that hyperpolarized \([1,4-C-13(2)]\) malate production 24 h after reperfusion correlates with renal necrosis in a 40-min unilateral ischemic rat model. Fumarase activity screening on bio-fluids can detect injury severity, in bilateral as well as unilateral AKI models, differentiating moderate and severe AKI as well as short-and long-term AKI. Furthermore after verification of renal injury by bio-fluid analysis the precise injury location can be monitored by in vivo measurements of the fumarase activity non-invasively by hyperpolarized \([1,4-C-13]\) fumarate MR imaging. The combined in vitro and in vivo biomarker of AKI responds to the essential requirements for a new reliable biomarker of AKI.

General information

State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Technical University of Denmark, Aarhus University, GE Healthcare, GE Healthcare, Brondby, Denmark
Authors: Nielsen, P. M. (Ekstern), Eldirdiri, A. (Intern), Bertelsen, L. B. (Ekstern), Jorgensen, H. S. (Ekstern), Ardenkjær-Larsen, J. H. (Intern), Laustsen, C. (Ekstern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences
Functional description of the monitoring and observability detailed concepts for the Pan-European Control Schemes: ELECTRA Deliverable D5.4. WP5: Increased Observability

Deliverable D5.4 outlines the methodology and the topics analysed in T5.4 for deriving PanEuropean observables within the Web-of-Cells (WoC) concept. Observables are derived by analysing traditional instability events typical of large power systems.

General information

State: Published
Number of pages: 122
Publication date: 2017
GABA-edited echo-planar spectroscopic imaging (EPSI) with MEGA-sLASER at 7T

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Copenhagen University Hospital
Authors: Magnusson, P. O. (Ekstern), Boer, V. O. (Ekstern), Marsman, A. (Ekstern), Lundell, H. (Ekstern), Hanson, L. G. (Intern), Petersen, E. T. (Intern)
Number of pages: 2
Publication date: 2017
Event: Poster session presented at ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Magnusson_ISMRM2017_1255.pdf
Source: PublicationPreSubmission
Source-ID: 143288980
Publication: Research - peer-review › Poster – Annual report year: 2018

GaN-based High Efficiency Bidirectional DC-DC Converter with 10 MHz Switching Frequency

Wide bandgap (WBG) semiconductor devices allow power electronic converters to achieve higher efficiency, higher power density and potentially higher reliability. However, the design challenges accompanied by applying the new WBG devices have risen accordingly. In this paper, a non-isolated bidirectional DC-DC converter equipped with Gallium Nitride (GaN) semiconductor transistors is presented. The converter's operation principles, zero-voltage switching (ZVS) constraints and dead-time effects are studied. Moreover, the optimization and tradeoffs on the adopted high-frequency inductor are investigated. Based on the theoretical analysis and calculation, a laboratory prototype with a switching frequency up to 10 MHz and the maximum output power of 100 W is constructed and tested. Switching at 10 MHz, a power density of approximately 6.25W/cm³ and an efficiency of 94.4% in the Buck mode are achieved. Moreover, the measured losses can match the theoretically calculated counterparts well, therefore the design and analysis are verified. However, from the experimental test carried out, it can also be seen, that making a compact converter, even for a GaN-based one, operate at 10 MHz and 100 W is still very challenging due to complex ZVS control, lacks of feasible magnetic materials, and limited thermal dissipation area.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Kruse, K. (Ekstern), Zhang, Z. (Intern), Elbo, M. (Ekstern)
Number of pages: 6
Publication date: 2017

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Title of host publication: Proceedings of 2017 IEEE Applied Power Electronics Conference and Exposition
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE Applied Power Electronics Conference and Exposition, Tampa, United States, 26/03/2017 - 28/03/2017
Bidirecional, Converer, DC-DC, Dead-time, Gallium Nitride, High switching frequency, Soft-switching
Electronic versions:
PID4586343.pdf
Source: PublicationPreSubmission
Source-ID: 131436832
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Generalized framework for the parallel semantic segmentation of multiple objects and posterior manipulation

The end-to-end approach presented in this paper deals with the recognition, detection, segmentation and grasping of objects, assuming no prior knowledge of the environment nor objects. The proposed pipeline is as follows: 1) Usage of a trained Convolutional Neural Net (CNN) that recognizes up to 80 different classes of objects in real time and generates bounding boxes around them. 2) An algorithm to derive in parallel the pointclouds of said regions of interest (ROI). 3) Eight different segmentation methods to remove background data and noise from the pointclouds and obtain a precise result of the semantically segmented objects. 4) Registration of the object's pointclouds over time to generate the best possible model. 5) Utilization of an algorithm to detect an array of grasping positions and orientations based mainly on the geometry of the object's model. 6) Implementation of the system on the humanoid robot MyBot, developed in the RIT Lab at KAIST. 7) An algorithm to find the bounding box of the object's model in 3D to then create a collision object and add it to the octomap. The collision checking between robot's hand and the object is removed to allow grasping using the MoveIt libraries. 8) Selection of the best grasping pose for a certain object, plus execution of the grasping movement. 9) Retrieval of the object and moving it to a desired final position.

Giga-voxel computational morphogenesis for structural design

In the design of industrial products ranging from hearing aids to automobiles and aeroplanes, material is distributed so as to maximize the performance and minimize the cost. Historically, human intuition and insight have driven the evolution of mechanical design, recently assisted by computer-aided design approaches. The computer-aided approach known as topology optimization enables unrestricted design freedom and shows great promise with regard to weight savings, but its applicability has so far been limited to the design of single components or simple structures, owing to the resolution limits of current optimization methods. Here we report a computational morphogenesis tool, implemented on a supercomputer, that produces designs with giga-voxel resolution—more than two orders of magnitude higher than previously reported. Such resolution provides insights into the optimal distribution of material within a structure that were hitherto unachievable owing to the challenges of scaling up existing modeling and optimization frameworks. As an example, we apply the tool to the design of the internal structure of a full-scale aeroplane wing. The optimized full-wing design has unprecedented structural detail at length scales ranging from tens of metres to millimetres and, intriguingly, shows remarkable similarity to naturally occurring bone structures in, for example, bird beaks. We estimate that our optimized design corresponds to a reduction in mass of 2–5 per cent compared to currently used aeroplane wing designs, which translates into a reduction in fuel consumption of about 40–200 tonnes per year per aeroplane. Our morphogenesis process is generally applicable, not only to mechanical design, but also to flow systems, antennas, nano-optics and micro-systems.

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General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Korea Advanced Institute of Science & Technology
Authors: Llopart, A. (Intern), Ravn, O. (Intern), Andersen, N. A. (Intern), Kim, J. (Ekstern)
Pages: 561-8
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 IEEE International Conference on Robotics and Biomimetics
Publisher: IEEE
ISBN (Print): 9781538637425
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE International Conference on Robotics and Biomimetics, Macao, China, 05/12/2017 - 05/12/2017
Object detection, Convolutional neural nets, Semantic segmentation, Pointcloud processing, Grasping, Humanoid robot
DOIs: 10.1109/ROBIO.2017.8324476
Source: FindIt
Source-ID: 2397784715
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Giga-voxel computational morphogenesis for structural design

In the design of industrial products ranging from hearing aids to automobiles and aeroplanes, material is distributed so as to maximize the performance and minimize the cost. Historically, human intuition and insight have driven the evolution of mechanical design, recently assisted by computer-aided design approaches. The computer-aided approach known as topology optimization enables unrestricted design freedom and shows great promise with regard to weight savings, but its applicability has so far been limited to the design of single components or simple structures, owing to the resolution limits of current optimization methods. Here we report a computational morphogenesis tool, implemented on a supercomputer, that produces designs with giga-voxel resolution—more than two orders of magnitude higher than previously reported. Such resolution provides insights into the optimal distribution of material within a structure that were hitherto unachievable owing to the challenges of scaling up existing modelling and optimization frameworks. As an example, we apply the tool to the design of the internal structure of a full-scale aeroplane wing. The optimized full-wing design has unprecedented structural detail at length scales ranging from tens of metres to millimetres and, intriguingly, shows remarkable similarity to naturally occurring bone structures in, for example, bird beaks. We estimate that our optimized design corresponds to a reduction in mass of 2–5 per cent compared to currently used aeroplane wing designs, which translates into a reduction in fuel consumption of about 40–200 tonnes per year per aeroplane. Our morphogenesis process is generally applicable, not only to mechanical design, but also to flow systems, antennas, nano-optics and micro-systems.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology
Authors: Aage, N. (Intern), Andreassen, E. (Intern), Lazarov, B. S. (Intern), Sigmund, O. (Intern)
Pages: 84-86
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature
Volume: 550
Giga-Voxel Structural Optimization

The optimal topology of large structural systems has until now been concerned with the design of individual parts and not that of complete assemblies. However, due to recent advances in numerical algorithms tailored for large scale structural optimization this limitation can now be circumvented. In this work we present several examples displaying how high
resolution topology optimization can be used to obtain new, as well as already known, insight within the field of structural optimization. To demonstrate the capabilities of the developed framework we apply it to the design of the supporting structure of an entire wing from a Boeing 777 type aircraft. In order to obtain a design that allows for details in the order of those found in existing wing structures, we discretize the wing with approximately 1.1 billion tri-linear hexahedral finite elements, yielding a maximum element size of $h = 0.8\, \text{cm}$. The design problem is solved using mathematical programming methods, filters from image processing and a multiple load case problem formulation. The results show how the topology of the wing structure has obvious similarities to nature's own light weight aviation design, i.e. bird bones, and how very fine resolution topology optimization provides new insight and possible weight savings for future aircraft designs.

**General information**

**State:** Published  
**Organisations:** Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology  
**Authors:** Aage, N. (Intern), Andreassen, E. (Intern), Lazarov, B. S. (Intern), Sigmund, O. (Intern)  
**Number of pages:** 1  
**Pages:** 220  
**Publication date:** 2017

**Host publication information**

**Title of host publication:** Proceedings of the 30th Nordic Seminar on Computational Mechanics (NSCM-30)  
**Editors:** Høsberg, J., Pedersen, N.  
**BFI conference series:** Nordic Seminar on Computational Mechanics (5010906)  
**Main Research Area:** Technical/natural sciences  
**Conference:** 30th Nordic Seminar on Computational Mechanics (NSCM-30), Copenhagen, 25/10/2017 - 25/10/2017  
**Topology optimization, Giga resolution, High performance computing, Finite element methods**  
**Electronic versions:**  
GIGA_VOXEL_Structural_Optimization.pdf  
**Publication:** Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

**Gradient distortions in EEG provide motion tracking during simultaneous EEG-fMRI**

Conference abstract, selected for oral presentation by Malte Laustsen.

**General information**

**State:** Published  
**Organisations:** Department of Electrical Engineering, Center for Magnetic Resonance, Department of Applied Mathematics and Computer Science, Cognitive Systems, Center for Hyperpolarization in Magnetic Resonance, Copenhagen University Hospital  
**Authors:** Laustsen, M. (Intern), Andersen, M. (Ekstern), Madsen, K. H. (Intern), Hanson, L. G. (Intern)  
**Number of pages:** 2  
**Publication date:** 2017  
**Event:** Abstract from ISMRM Workshop on Motion Correction in MRI & MRS, Cape Town, South Africa.  
**Main Research Area:** Technical/natural sciences  
**Electronic versions:**  
Laustsen_Andersen_Madsen_Hanson_Gradient_distortions_in_EEG_provide_motion_tracking_during_simultaneous_EEG_fMRI.pdf  
**Source:** PublicationPreSubmission  
**Source-ID:** 137246663  
**Publication:** Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Grid architecture for future distribution system — A cyber-physical system perspective**

Increasing power electronics controlled distributed generation resources and active loads provide a future distributed system with more controllability as well as challenges to synthesize heterogeneous devices. From system engineering's perspective, control and operation of the future distribution system need more insight into the system architecture of the grid. In this paper, in light of the start-of-the-art control strategies for microgrids which rely on power electronics systems, a grid architecture model for future distribution system is proposed based on microgrid clusters. Both the physical and cyber structures for this architecture are described. Two illustrative examples are presented to explain different control methods that can be adopted in this model to harmonize different devices. This architecture can be used to guide the system design for the smart distribution system.

**General information**

**State:** Published  
**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Aalborg University, Universidad Distrital Francisco Jose de Caldas  
**Authors:** Li, C. (Ekstern), Dragicevic, T. (Ekstern), Leonardo Diaz Aldana, N. (Ekstern), Hernandez, A. C. L. (Ekstern), Guan, Y. (Ekstern), Rasmussen, T. B. (Intern), Beheshtaein, S. (Ekstern)
Guest Editorial: Special issue: Selected papers from NorCAS 2016, the 2nd Nordic
This Special Issue includes selected papers from the 2nd NorCAS conference held in Copenhagen, Denmark, November 2016. The NorCAS conference is the result of a merger between the former International Symposium on Systems-on-Chip and the Norchip conference which has been held annually since 1983. A Special Issue from this conference has been published by Springer (initially Kluwer) since the Norchip 1992 conference in Helsinki, so this issue covering the 2016 NorCAS conference marks the 25th anniversary of Norchip/NorCAS Special Issues. The conference covers all fields of electronics, spanning from complex digital systems to advanced analog and mixed-mode circuits. For this Special Issue, the papers are selected among those dealing with analog and mixed-mode circuits and systems. More than 25 papers were presented in this field, and from these, 8 papers have been selected for the Special Issue, covering topics in energy harvesting, data conversion, voltage regulators and sensor interfaces. Hopefully, you will find interesting reading in some of these papers.
Guest Editorial: Special Issue: Smart Grid Voltage Control

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Tsinghua University, Carnegie Mellon University, University of Tennessee, Knoxville, Pacific Northwest National Laboratory
Authors: Sun, H. (Ekstern), Guo, Q. (Ekstern), Ilic, M. D. (Ekstern), Wu, Q. (Intern), Sun, K. (Ekstern), Du, P. (Ekstern)
Number of pages: 2
Pages: 3655-3656
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: I E T Generation, Transmission and Distribution
Volume: 11
Issue number: 15
ISSN (Print): 1751-8687
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
The development of smart grids worldwide aims at tackling various challenges facing power system operation and planning due to increased penetration of many new technologies of diversified properties. On the one hand, system operators and many other participants have to deal with increased uncertainties and risks involved in daily operation and planning activities. On the other hand, applications of many new metering and measurement devices, capable of closely monitoring and sensing grid operation in real time, result in overwhelming amount of measurement data of high precision and resolution. By far, how to make the best use of the massive data remains quite a challenging task facing power system researchers and practitioners [1].
Guidelines for Distribution System Operators on Reactive Power Provision by Electric Vehicles in Low Voltage Grids

The increasing success of electric vehicles is bringing new technical challenges to power system operators. This work intends to provide guidelines for distribution system operators in terms of reactive power requirements when evaluating and authorizing electric vehicles supply equipment with fast charging capability in existing low voltage distribution feeders. The aim is to prevent the voltage to exceed the permitted values when charging at high power, by exploiting the effect of the reactive power. The proposed guidelines for distribution system operators are reported in a matrix, which indicates the amount of reactive power that an individual electric vehicle is expected to provide when connected to a low voltage feeder, in order to benefit of the desired voltage rise effect in comparison to the case of unitary power factor.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Nanjing University of Information Science and Technology
Authors: Zecchino, A. (Intern), Marinelli, M. (Intern), Træholt, C. (Intern), Korpås, M. (Ekstern)
Pages: 1787 – 1791
Publication date: 2017
Conference: 24th International Conference on Electricity Distribution, Glasgow, United Kingdom, 12/06/2017 - 12/06/2017
Main Research Area: Technical/natural sciences

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Volume: 2017
Issue number: 1
ISSN (Print): 2515-0855
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DOIs:
10.1049/oap-cired.2017.0377
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Source-ID: 130890355
Publication: Research › peer-review › Conference article – Annual report year: 2017

Harmonic Active Filtering and Impedance-based Stability Analysis in Offshore Wind Power Plants

Nowadays, to eliminate harmonics injected by the wind turbines in offshore wind power plants there is a need to install passive filters. Moreover, the passive filters are not adaptive to harmonic profile changes due to topology changes, grid loading etc. Therefore, active filters in wind turbines are proposed as a flexible harmonic mitigation measure. The motivation of this study is to explore the possibility of embedding active filtering in wind turbine grid-side converters without having to change the system electrical infrastructure. The active filtering method can prevent additional equipment installation and provides effectively similar functionality as passive filters. This work is focused on harmonic propagation studies in wind power plants, power quality evaluation at the point of connection and harmonic mitigation by active filtering. Finally, an impedance-based stability analysis of the grid-connected converter system is performed.

General information
State: Published
Authors: Dhua, D. (Ekstern), Yang, G. (Intern), Zhang, Z. (Intern), Kocewiak, Ł. H. (Ekstern), Timofejevs, A. (Forskerdatabase)
Number of pages: 8
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 16th Wind Integration Workshop
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 16th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power Plants, Berlin, Germany, 25/10/2017 - 25/10/2017
Active Filtering, Impedance-based Stability, Notch Filter, Offshore Wind Power Plant
Electronic versions:
Paper_WIW_17_ID_WIW17_162_Harmonic_Active_Filtering_and_Impedance_based_Stability_Analysis_in_Large_Offshore_Wind_Farm_Final_.pdf
Helbredstjek af dansk sundhedsteknologi: Sektorudviklingsrapport
Sådan kan samarbejde mellem industrien, universiteterne og sundhedsvæsenet skabe gode løsninger til forebyggelse, diagnostik, patientbehandling og rehabilitering

General information
State: Published
Organisations: Office for Innovation & Sector Services, Copenhagen Center for Health Technology, Department of Applied Mathematics and Computer Science, Embedded Systems Engineering, Center for Energy Resources Engineering, Scientific Computing, Department of Management Engineering, Technology and Innovation Management, Department of Electrical Engineering, Biomedical Engineering, Department of Micro- and Nanotechnology, Nano Bio Integrated Systems, Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Energy Conversion and Storage, Electrofunctional materials, IT Service, National Space Institute, Innovation and Research-based consultancy, Department of Chemical and Biochemical Engineering, The Danish Polymer Centre, Office for Research and Relations, It-branchen, manjourn.dk
Number of pages: 72
Publication date: 2017

Hidden hearing loss with envelope following responses (EFRs): The off-frequency problem
Recent animal studies have shown that noise over-exposure can cause the loss of auditory nerve (AN) fiber synapses without causing hair cell loss (see Kujawa and Liberman (2015) for a review). This AN fiber synapses loss has been termed "hidden hearing loss" or "synaptopathy", since it is not reflected in the traditional puretone threshold. The envelope following response (EFR) has been proposed as a potential objective method to assess synaptopathy in humans (i.e., Bharadwaj et al., 2015). Encina-Llamas et al., (2016) reported different trends in EFR level-growth functions recorded using two modulation depths in normal-hearing (NH) and mild hearing-impaired (HI) listeners. The EFR is a gross encephalographic potential that represents the encoding of the envelope of the stimulus, arising from synchronized neural activity from all excited frequencies and fibers. In this study, an computational model of the AN was used to investigate the effects of off-frequency contributions (i.e. away from the characteristic place of the stimulus) and the differential loss of different AN fiber types on EFR level-growth functions.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Harvard Medical School, Interacoustics A/S, Boston University
Authors: Encina-Llamas, G. (Intern), Parthasarathy, A. (Ekstern), Harte, J. M. (Ekstern), Dau, T. (Intern), Kujawa, S. G. (Ekstern), Shinn-Cunningham, B. (Ekstern), Epp, B. (Intern)
Publication date: 2017
Event: Poster session presented at 40th MidWinter Meeting of the Association for Research in Otolaryngology, Baltimore, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
encina_llamas_ARO_2017_poster.pdf
Source: PublicationPreSubmission
Source-ID: 150210779
Publication: Research - peer-review › Poster – Annual report year: 2017

High Accuracy Nonlinear Control and Estimation for Machine Tool Systems
Component mass production has been the backbone of industry since the second industrial revolution, and machine tools are producing parts of widely varying
size and design complexity. The ever-increasing level of automation in modern manufacturing processes necessitates the use of more sophisticated machine tool systems that are adaptable to different workspace conditions, while at the same time being able to maintain very narrow workpiece tolerances. The main topic of this thesis is to suggest control methods that can maintain required manufacturing tolerances, despite moderate wear and tear. The purpose is to ensure that full accuracy is maintained between service intervals and to advice when overhaul is needed. The thesis argues that quality of manufactured components is directly related to the positioning accuracy of the machine tool axes, and it shows which low level control architectures are used to position the machining tool relatively to the material being processed. While existing algorithms provide sufficient accuracy after commissioning of the machine by experts, the thesis shows how they fall short in keeping required tolerances in the presence of equipment wear, unless they are re-tuned by experts. The goal of this research has therefore been investigation and development of advanced control and estimation algorithms, which facilitate high-accuracy machine tool axis positioning, and are robust to equipment degradation and wear. This thesis presents the findings of the research conducted during the three years of the PhD program at the Technical University of Denmark. The research has been carried out in close collaboration with Siemens AG in Nuremberg, who sponsored the research. Siemens also provided state-of-the-art industrial equipment to facilitate experimental testing and validation. DTU added mechanical components to test the development of friction and backlash. The scientific-technical contributions of the research fall into three parts, which also constitute the structure of the thesis. The first part concerns the development of an efficient description of a generic machine-tool axis system. A detailed mathematical model is derived that captures the most important axis dynamics. Positioning degrading phenomena, such as friction and backlash, are expressed as nonlinear axis torques. Identification of the test rig parameters and sensitivity analysis is carried out, to highlight the significance of individual model parameters. The second contribution of this research pertains to the investigation of different nonlinear control strategies and architectures for the positioning of the axis. Eight position controllers based on sliding-mode and adaptive principles are designed, implemented and tested on the experimental setup. A set of quantitative and qualitative criteria is used for the systematic comparison of the methods. The evaluation results show that four out of the eight designs provide superior positioning accuracy and resilience to unknown and varying friction, in comparison to the state-of-the-art proportional-integral control solutions. The third part of the research relates to the development of online backlash estimation algorithms for machine-tools. The proposed method utilizes position and velocity measurements in a cascaded scheme consisting of a sliding-mode velocity observer and an adaptive deadzone angle estimator. A series of experiments is conducted for testing the algorithm in various operation scenarios under different levels of uncertainty. The results show that the estimator identifies the unknown deadzone angle and changes in it with sufficient accuracy and can, therefore, facilitate backlash compensation, as well as equipment wear assessment and prognosis. The scientific results of this research have been summarized in three journal articles, which have been submitted, and an article presented at the IFAC World Congress 2017 that has been published.
Achieving high measurement accuracy; these include the measurement technique per se, its implementation in terms of proper measurement procedures, the use of uncertainty estimates, as well as facility inter-comparison and validation.

**High-frame-rate Imaging of a Carotid Bifurcation using a Low-complexity Velocity Estimation Approach**

In this paper, a 2-D vector flow imaging (VFI) method developed by combining synthetic aperture sequential beamforming and directional transverse oscillation is used to image a carotid bifurcation. Ninety-six beamformed lines are sent from the probe to the host system for each VFI frame, enabling the possibility of wireless transmission. The velocity is estimated using a relatively inexpensive 2-D phase-shift approach, and real-time performance can be achieved in mobile devices. However, high-frame-rate velocities can be obtained by sending the data to a cluster of computers. The objective of this study is to demonstrate the scalability of the method’s performance according to the needs of the user and the processing capabilities of the host system. In vivo measurements of a carotid bifurcation of a 54-year-old volunteer were conducted using a linear array transducer connected to the SARUS scanner. The velocities were estimated at a rate of 134 independent frames per second (FPS) to reveal complex flow patterns. A peak frame rate of 2140 FPS can be obtained by generating the images recursively. VFI images are shown during the systolic phase revealing the formation of a vortex in the internal carotid artery. The peak systolic velocity from a range gate in the common tract was 0.76 m s⁻¹ with a standard deviation (SD) of 6.1%. The mean velocity profile was calculated from the same range gate with an average SD of 7.86%.

**High frequency Soft Switching Half Bridge Series-Resonant DC-DC Converter Utilizing Gallium Nitride FETs**

The need for efficient, smaller, lighter and cheaper power supply units drive the investigation of using high switching frequency soft switching resonant converters. This work presents an 88% efficient 48V nominal input converter switching at 6 MHz and output power of 21 Watts achieving power density of 7 W/cm³ for Power-over-Ethernet LED lighting applications. The switching frequency is used to control the output current delivered.
to the load resistance. The converter was tested using a constant resistance load. The performance and thermal behavior were investigated and reported in this work.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electronics, ICEPOWER A/S
Authors: Nour, Y. (Intern), Knott, A. (Intern), Petersen, L. P. (Ekstern)
Number of pages: 7
Publication date: 2017

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Title of host publication: Proceedings of the 19th European Conference on Power Electronics and Applications
Publisher: IEEE
Main Research Area: Technical/natural sciences

**High performance control strategy for single-phase three-level neutral-point-clamped traction four-quadrant converters**

Operational data from Chinese railways indicate a number of challenges for traction four-quadrant converter (4QC) control including low-order voltage and current harmonics and reference tracking. A control strategy for a single-phase three-level neutral-point-clamped 4QC employed in the electric multiple unit traction system is proposed in this study. The strategy is based on a multiple frequency tuned quasi-proportional resonant controller in the ac-side current loop and a multiple frequency tuned notch filter in the dc-link voltage loop. Under the typical supply voltage distortion present in the network, the proposed control strategy improves the current tracking performance and reduces the line current harmonics, when compared with conventional control strategies. Experimental results, both under purely sinusoidal and distorted supply voltages, validate the effectiveness of the proposed control strategy.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Beijing Jiaotong University, University of New South Wales
Authors: Kejian, S. (Ekstern), Konstantinou, G. (Ekstern), Jing, L. (Ekstern), Mingli, W. (Ekstern), Agelidis, V. (Intern)
Pages: 884-93
Publication date: 2017
Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.196 SJR 0.803 CiteScore 3.34
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.31 SJR 0.958 SNIP 1.543
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.834 SNIP 1.308 CiteScore 3.28
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.685 SNIP 1.418 CiteScore 2.62
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.691 SNIP 1.366 CiteScore 2.37
ISI indexed (2013): ISI indexed yes
High-voltage integrated linear regulator with current sinking capabilities for portable ultrasound scanners

This paper presents a high-voltage integrated regulator capable of sinking current for driving pulse-triggered level shifters in drivers for ultrasound applications. The regulator utilizes a new topology with a feedback loop and a current sinking circuit to satisfy the requirements of the portable ultrasound scanner: a great driving strength in the scanner’s transducer and a low undershoot voltage in the output node. The design regulates an output voltage of 45 V from an input voltage of 50 V, and it can sink currents up to 100 mA using no external components with only 340 mV of undershoot voltage. The proposed design has been implemented in high-voltage 0.18 μm process within an area of 0.11 mm² and it is suitable for system-on-chip integration due to its low component count and the fully integrated design.

How fast is a collective bacterial state established?

Bacteria in a biofilm colony have the capacity to monitor the size and growth conditions for the colony and modify their phenotypical behaviour to optimise attacks, defence, migration, etc. The quorum sensing systems controlling this involve production and sensing of diffusive signal molecules. Frequently, quorum sensing systems carry a positive feedback loop which produces a switch at a threshold size of the colony. This all-or-none switch can be beneficial to create a sudden attack, leaving a host little time to establish a defence. The reaction-diffusion system describing a basal quorum sensing loop involves production of signal molecules, diffusion of signal molecules, and detection of signal molecules. We study the ignition process in a numerical solution for a basal quorum sensor and demonstrate that even in a large colony the ignition travels through the whole colony in less than a minute. The ignition of the positive feedback loop was examined in different approximations. As expected, in the exact calculation the ignition was found to be delayed compared to a calculation where the binding of signal molecules was quasistatic. The buffering of signal molecules is found to have little effect on the ignition process. Contrary to expectation, we find that the ignition does not start when the threshold is reached at the center-instead it allows for the threshold to be approached in the whole colony followed by an almost simultaneous ignition of the whole biofilm aggregate.
Human in-vivo brain magnetic resonance current density imaging (MRCDI)

Magnetic resonance current density imaging (MRCDI) and MR electrical impedance tomography (MREIT) are two emerging modalities, which combine weak time-varying currents injected via surface electrodes with magnetic resonance imaging (MRI) to acquire information about the current flow and ohmic conductivity distribution at high spatial resolution. The injected current flow creates a magnetic field in the head, and the component of the induced magnetic field $\Delta B_{z,c}$ parallel to the main scanner field causes small shifts in the precession frequency of the magnetization. The measured MRI signal is modulated by these shifts, allowing to determine $\Delta B_{z,c}$ for the reconstruction of the current flow and ohmic conductivity. Here, we demonstrate reliable $\Delta B_{z,c}$ measurements in-vivo in the human brain based on multi-echo spin echo (MESE) and steady-state free precession free induction decay (SSFP-FID) sequences. In a series of experiments, we optimize their robustness for in-vivo measurements while maintaining a good sensitivity to the current-induced fields. We validate both methods by assessing the linearity of the measured $\Delta B_{z,c}$ with respect to the current strength. For the more efficient SSFP-FID measurements, we demonstrate a strong influence of magnetic stray fields on the $\Delta B_{z,c}$ images, caused by non-ideal paths of the electrode cables, and validate a correction method. Finally, we perform measurements with two different current injection profiles in five subjects. We demonstrate reliable recordings of $\Delta B_{z,c}$ fields as weak as 1nT, caused by currents of 1mA strength. Comparison of the $\Delta B_{z,c}$ measurements with simulated $\Delta B_{z,c}$ images based on FEM calculations and individualized head models reveals significant linear correlations in all subjects, but only for the stray field-corrected data. As final step, we reconstruct current density distributions from the measured and simulated $\Delta B_{z,c}$ data. Reconstructions from non-corrected $\Delta B_{z,c}$ measurements systematically overestimate the current densities. Comparing the current densities reconstructed from corrected $\Delta B_{z,c}$ measurements and from simulated $\Delta B_{z,c}$ images reveals an average coefficient of determination $R^2$ of 71%. In addition, it shows that the simulations underestimated the current strength on average by 24%. Our results open up the possibility of using MRI to systematically validate and optimize numerical field simulations that play an important role in several neuroscience applications, such as transcranial brain stimulation, and electro- and magnetoencephalography.
Human In-vivo MR Current Density Imaging (MRCDI) Based on Optimized Multi-echo Spin Echo (MESE)

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, University of Tubingen
Authors: Göksu, C. (Intern), Hanson, L. G. (Intern), Ehses, P. (Ekstern), Scheffler, K. (Ekstern), Thielscher, A. (Intern)
Number of pages: 2
Publication date: 2017
Event: Poster session presented at ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
Hyperbaric oxygen sensitizes anoxic Pseudomonas aeruginosa biofilm to ciprofloxacin

Chronic Pseudomonas aeruginosa lung infection is characterized by the presence of endobronchial antibiotic-tolerant biofilm subject to strong oxygen (O2) depletion due to the activity of surrounding polymorphonuclear leukocytes. The exact mechanisms affecting the antibiotic susceptibility of biofilms remain unclear, but accumulating evidence suggests that the efficacy of several bactericidal antibiotics is enhanced by stimulation of aerobic respiration of pathogens, while lack of O2 increases their tolerance. In fact, the bactericidal effect of several antibiotics depends on active aerobic metabolism activity and the endogenous formation of reactive O2 radicals (ROS). In this study we aimed to apply hyperbaric oxygen treatment (HBOT) in order to sensitize anoxic P. aeruginosa agarose-biofilms established to mimic situations with intense O2 consumption by the host response in the cystic fibrosis (CF) lung. Application of HBOT resulted in enhanced bactericidal activity of ciprofloxacin at clinically relevant durations and was accompanied by indications of restored aerobic respiration, involvement of endogenous lethal oxidative stress and increased bacterial growth. The findings highlight that oxygenation by HBOT improves the bactericidal activity of ciprofloxacin on P. aeruginosa biofilm and suggest that bacterial biofilms is sensitized to antibiotics by supplying hyperbaric O2.
Hyperpolarized $^{133}$Cs is a sensitive probe for real-time monitoring of biophysical environments

$^{133}$Cs NMR is a valuable tool for non-invasive analysis of biological systems, where chemical shift and relaxation properties report on changes in the physical environment. Hyperpolarization can increase the liquid-state $^{133}$Cs NMR signal by several orders of magnitude and allow real-time monitoring of physical changes in cell based systems.

General information

State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance
Authors: Karlsson, M. (Intern), Ardenkjær-Larsen, J. H. (Intern), Lerche, M. H. (Intern)
Number of pages: 4
Pages: 6625-6628
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Hyperpolarized Water Perfusion in the Porcine Brain – a Pilot Study

Dynamic Contrast-Enhanced MR (DCE-MR) perfusion assessment with gadolinium contrast agents is currently the most widely used cerebral perfusion MR method. Hyperpolarized water has recently been shown to succeed 13C probes as angiography probe. In this study, we demonstrate the feasibility of hyperpolarized water for visualizing the brain vasculature of a large animal in a clinically relevant setting. In detail, reference perfusion values were obtained and large to small arteries could be identified.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Aarhus University
Authors: Søvsø Szocska Hansen, E. (Ekstern), Lipsø, H. K. W. (Intern), Tougaard, R. S. (Ekstern), Laustsen, C. (Ekstern), Ardenkjær-Larsen, J. H. (Intern)
Publication date: 2017
Event: Abstract from ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.
Main Research Area: Technical/natural sciences
Links:
http://dev.ismrm.org/2017/4093.html

Hyperpolarized xenon by d-DNP using the clinical GE SpinLab polarizer system

Hyperpolarized (HP) 129Xe have been demonstrated as a useful probe for magnetic resonance (MR) lung imaging and show promise for in vivo perfusion imaging and brown adipose tissue characterization. Reports of large polarization enhancements for 129Xe using dynamic nuclearpolarization (DNP) have raised expectations that DNP can be an alternative to the standard spin exchange optical pumping (SEOP) method. We show that it is possible to produce HP 129Xe gas using the clinical GE SpinLab polarizer, thus extending the practical use of the system beyond the primary purpose of hyperpolarizing liquid biomolecules.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Aarhus University
Authors: Mariager, C. Ø. (Ekstern), Ringgaard, S. (Ekstern), Ardenkjær-Larsen, J. H. (Intern), Laustsen, C. (Ekstern)
Publication date: 2017

Identification of Conflicts between Transmission and Distribution System Operators when Acquiring Ancillary Services from Electric Vehicles

Distributed energy resources are able to provide services to grid operators, possibly with competing objectives. With the development of active distribution grid management, various market designs arise. Here, a reference market framework is considered, which allocates the available flexibility products according to requests coming from both distribution and transmission system operators. The goal of this paper is to provide an identification procedure that is able to detect,
identify and catalogue possible conflicts among the involved stakeholders that take place when requesting and/or acquiring ancillary services from flexible units. The investigation is carried out considering a 3-area power system which allows to take into account local constraints as well as system-wide needs. As outcome, this paper identifies the conflicts from both a theoretical and a practical point of view, by means of descriptions/identification procedure and by visual examples, respectively.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Zecchino, A. (Intern), Knezovic, K. (Intern), Marinelli, M. (Intern)
Number of pages: 6
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Ancillary services, Distribution system operator, Electric vehicles, Transmission system operator
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DSO_TSO_conflicts_when_aquiring_Flexibility_from_EVs_revised.pdf
DOI:
10.1109/ISGTEurope.2017.8260127
Source: PublicationPreSubmission
Source-ID: 133555831
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Identifying Causality from Alarm Observations**
The complexity of modern industrial plants poses significant challenges for the design of effective alarm systems. Rigorous alarm management is recommended to ensure that the operators get useful information from the alarm system, rather than being overloaded with irrelevant state information. Alarm management practices have been shown to significantly reduce the frequency of alarms in industrial process plants. These practices help focusing the operators’ attention on actually critical situations. However, they cannot resolve the cascades of critical situations frequently occurring during emergency situations. Multilevel flow modelling (MFM) has been proposed as a way of representing knowledge about the industrial process and infer causes and consequences of deviations throughout the system. The method enables the identification of causes and consequences of alarm situations based on an abstracted model of the mass and energy flows in the system. The application of MFM for root cause analysis based alarm grouping has been demonstrated and can be extended to reason about the direction of causality considering the entirety of the alarms present in the system for more comprehensive decision support. This contribution presents the foundation for combining the cause and consequence propagation of multiple observations from the system based on an MFM model. The proposed logical reasoning matches actually observed alarms to the propagation analysis in MFM to distinguish plausible causes and consequences. This extended analysis results in causal paths from likely root causes to tentative consequences, providing the operator with a comprehensive tool to not only identify but also rank the criticality of a large number of concurrent alarms in the system.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Automation and Control
Authors: Kirchhübel, D. (Intern), Zhang, X. (Intern), Lind, M. (Intern), Ravn, O. (Intern)
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Main Research Area: Technical/natural sciences
Decision support, Causality, Multilevel flow modelling
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Activities:
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Source: PublicationPreSubmission
Source-ID: 140922788
Publication: Research - peer-review › Paper – Annual report year: 2017
Imaging regional metabolic changes in the ischemic rat heart in vivo using hyperpolarized(1-13C)Pyruvate

We evaluated the use of hyperpolarized 13C magnetic resonance imaging (MRI) in an open-chest rat model of myocardial infarction to image regional changes in myocardial metabolism. In total, 10 rats were examined before and after 30 minutes of occlusion of the left anterior descending coronary artery using hyperpolarized [1-13C]pyruvate. Cardiac metabolic images of [1-13C]pyruvate and its metabolites [1-13C]lactate, [1-13C]alanine, and [13C]bicarbonate were obtained before and after ischemia. Significant reduction in the [1-13C]alanine and [1-13C]lactate signals were observed after ischemia. The severity of the ischemic insult was verified by increased blood levels of troponin I and by using late contrast-enhanced MRI that showed enhanced signal in the ischemic region. This study shows that hyperpolarized MRI can be used to image regional metabolic changes in the in vivo rat heart in an open-chest model of ischemia reperfusion. Hyperpolarized MRI enables new possibilities for evaluating changes in cardiac metabolism noninvasively and in real time, which potentially could be used for research to evaluate new treatments and metabolic interventions for myocardial ischemia and to apply knowledge to future application of the technique in humans.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, Copenhagen University Hospital, Aarhus University, University of Copenhagen
Pages: 123-130
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Main Research Area: Technical/natural sciences

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Impact of Noise and Noise Reduction on Processing Effort: A Pupillometry Study

Speech perception in adverse listening situations can be exhausting. Hearing loss particularly affects processing demands, as it requires increased effort for successful speech perception in background noise. Signal processing in hearing aids and noise reduction (NR) schemes aim to counteract the effect of noise and reduce the effort required for speech recognition in adverse listening situations. The present study examined the benefit of NR schemes, applying a combination of a digital NR and directional microphones, for reducing the processing effort during speech recognition. The effect of noise (intelligibility level) and different NR schemes on effort were evaluated by measuring the pupil dilation (PPD) of listeners. In 2 different experiments, performance accuracy and peak pupil dilation (PPD) were measured in 24 listeners with hearing impairment while they performed a speech recognition task. The listeners were tested at 2 different signal to noise ratios corresponding to either the individual 50% correct (L50) or the 95% correct (L95) performance level in a 4-talker babble condition with and without the use of a NR scheme. In experiment 1, the PPD differed in response to both changes in the speech intelligibility level (L50 versus L95) and NR scheme. The PPD increased with decreasing intelligibility, indicating higher processing effort under the L50 condition compared with the L95 condition. Moreover, the PPD decreased when the NR scheme was applied, suggesting that the processing effort was reduced. In experiment 2, 2 hearing aids using different NR schemes (fast-acting and slow-acting) were compared. Processing effort changed as indicated by the PPD depending on the hearing aids and therefore on the NR scheme. Larger PPDs were measured for the slow-acting NR scheme. The benefit of applying an NR scheme was demonstrated for both L50 and L95, that is, a situation at which the performance level was at a ceiling. This opens the opportunity for new means of evaluating hearing aids in situations in which traditional speech reception measures are shown not to be sensitive. This is an open access
Impact of Public Aggregate Wind Forecasts on Electricity Market Outcomes

Following a call to foster a transparent and more competitive market, member states of the European transmission system operator are required to publish, among other information, aggregate wind power forecasts. The publication of the latter information is expected to benefit market participants by offering better knowledge of the market operation, leading subsequently to a more competitive energy market. Driven by the above regulation, we consider an equilibrium study to address how public information of aggregate wind power forecasts can potentially affect market results, social welfare as well as the profits of participating power producers. We investigate, therefore, a joint day-ahead energy and reserve auction, where producers offer their conventional power strategically based on a complementarity approach and their wind power at generation cost based on a forecast. In parallel, an iterative game-theoretic approach (diagonalization) is incorporated in order to investigate the existence of an equilibrium for various values of aggregate forecast. As anticipated, variations in public forecasts will affect market results and, more precisely, under-forecasts can mislead power producers to make decisions that favor social welfare, while over-forecasts will cause the opposite effect. Furthermore, energy and reserve market prices can also be affected by deviations in aggregate wind forecasts altering, inevitably, the profits of all power producers.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, University of Mons
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Number of pages: 11
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: IEEE Transactions on Sustainable Energy
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Scopus rating (2017): CiteScore 7.42 SJR 2.318 SNIP 2.452
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 7.8 SJR 2.368 SNIP 2.967
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.717 SNIP 3.22 CiteScore 7.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.554 SNIP 3.898 CiteScore 7.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.043 SNIP 3.712 CiteScore 7.03
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 1.243 SNIP 3.744 CiteScore 6.58
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.73 SNIP 3.01 CiteScore 5.13
ISI indexed (2011): ISI indexed no
Original language: English
Wind power, Aggregate forecasts, Public data, Equilibrium, Game theory
Impact of realistic communications for fast-acting demand side management

The rising penetration of intermittent energy resources is increasing the need for more diverse electrical energy resources that are able to support ancillary services. Demand side management (DSM) has a significant potential to fulfill this role, but several challenges are still impeding the wide-scale integration of DSM. One of the major challenges is ensuring the performance of the networks that enable communications between control centres and the end DSM resources. This study presents an analysis of all communications networks that typically participate in the activation of DSM, and provides an estimate for the overall latency that these networks incur. The most significant sources of delay from each of the components of the communications network are identified which allows the most critical aspects to be determined. This analysis, therefore, offers a detailed evaluation of the performance of DSM resources in the scope of providing real-time ancillary services. It is shown that, using available communications technologies, DSM can be used to provide primary frequency support services. In some cases, neighbourhood area networks may add significant delay, requiring careful choice of the technologies deployed.

Impact of stimulus-related factors and hearing impairment on listening effort as indicated by pupil dilation

Previous research has reported effects of masker type and signal-to-noise ratio (SNR) on listening effort, as indicated by the peak pupil dilation (PPD) relative to baseline during speech recognition. At about 50% correct sentence recognition performance, increasing SNRs generally results in declining PPDs, indicating reduced effort. However, the decline in PPD over SNRs has been observed to be less pronounced for hearing-impaired (HI) compared to normal-hearing (NH) listeners. The presence of a competing talker during speech recognition generally resulted in larger PPDs as compared to the presence of a fluctuating or stationary background noise. The aim of the present study was to examine the interplay between hearing-status, a broad range of SNRs corresponding to sentence recognition performance varying from 0 to 100% correct, and different masker types (stationary noise and single-talker masker) on the PPD during speech perception. Twenty-five HI and 32 age-matched NH participants listened to sentences across a broad range of SNRs, masked with speech from a single talker (-25 dB to +15 dB SNR) or with stationary noise (-12 dB to +16 dB). Correct
sentence recognition scores and pupil responses were recorded during stimulus presentation. With a stationary masker, NH listeners show maximum PPD across a relatively narrow range of low SNRs, while HI listeners show relatively large PPD across a wide range of ecological SNRs. With the single-talker masker, maximum PPD was observed in the mid-range of SNRs around 50% correct sentence recognition performance, while smaller PPDs were observed at lower and higher SNRs. Mixed-model ANOVAs revealed significant interactions between hearing-status and SNR on the PPD for both masker types. Our data show a different pattern of PPDs across SNRs between groups, which indicates that listening and the allocation of effort during listening in daily life environments may be different for NH and HI listeners.
Impact of tumor position, conductivity distribution and tissue homogeneity on the distribution of tumor treating fields in a human brain: A computer modeling study

Background: Tumor treating fields (TTFields) are increasingly used in the treatment of glioblastoma. TTFields inhibit cancer growth through induction of alternating electrical fields. To optimize TTFields efficacy, it is necessary to understand the factors determining the strength and distribution of TTFields. In this study, we provide simple guiding principles for clinicians to assess the distribution and the local efficacy of TTFields in various clinical scenarios.

Methods: We calculated the TTFields distribution using finite element methods applied to a realistic head model. Dielectric property estimates were taken from the literature. Twenty-four tumors were virtually introduced at locations systematically varied relative to the applied field. In addition, we investigated the impact of central tumor necrosis on the induced field.

Results: Local field 'hot spots' occurred at the sulcal fundi and in deep tumors embedded in white matter. The field strength was not higher for tumors close to the active electrode. Left/right field directions were generally superior to anterior/posterior directions. Central necrosis focally enhanced the field near tumor boundaries perpendicular to the applied field and introduced significant field non-uniformity within the tumor.

Conclusions: The TTFields distribution is largely determined by local conductivity differences. The well conducting tumor tissue creates a preferred pathway for current flow, which increases the field intensity in the tumor boundaries and surrounding regions perpendicular to the applied field. The cerebrospinal fluid plays a significant role in shaping the current pathways and funnels currents through the ventricles and sulci towards deeper regions, which thereby experience higher fields. Clinicians may apply these principles to better understand how TTFields will affect individual patients and possibly predict where local recurrence may occur. Accurate predictions should, however, be based on patient specific models. Future work is needed to assess the robustness of the presented results towards variations in conductivity.

General information
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Implementation and validation of synthetic inertia support employing series produced electric vehicles

The high integration of renewable energy resources (inverter connected) replacing conventional generation reduces the available rotational inertia in the power system. This introduces the need for faster regulation services including synthetic inertia services. These services could potentially be provided by electric vehicles due to their fast response capability. This work evaluates and experimentally shows the capability and limits of EVs in providing synthetic inertia services. Three series produced EVs are used during the experiment. The results show the performance of the EVs in providing synthetic inertia. It shows also that, on the contrary of synchronous inertia, synthetic inertia might lead to unstable frequency behavior.
Implementation of a Simplified State Estimator for Wind Turbine Monitoring on an Embedded System

The transition towards a cyber-physical energy system (CPES) entails an increased dependency on valid data. Simultaneously, an increasing implementation of renewable generation leads to possible control actions at individual distributed energy resources (DERs). A state estimation covering the whole system, including individual DER, is time consuming and numerically challenging. This paper presents the approach and results of implementing a simplified state estimator onto an embedded system for improving DER monitoring. The implemented state estimator is based on numerically robust orthogonal factorization and used on a set of state equations of a generic wind turbine generator (WTG). The simplified state estimator is tested by simulating a generic WTG model and evaluated based on its execution time and estimation accuracy. Results show its fast execution time, its accuracy in handling normal measurement error and its ability to provide reliable data in the case of gross errors in the set of measurements.

Implementation of fuzzy logic for mitigating conflicts of frequency containment control

Ever increasing shares of intermittent renewable energy sources (RES) in present and future power systems pose new challenges with regard to operation, particularly balance, frequency and voltage stability. Towards effective solutions, the ELECTRA IRP project has developed a novel structure for future power systems operation, by dividing them in a few cells, constituting so a web-of-cells, and equipped with controllers addressing operation objectives. This study deals with the frequency containment control use case and, in particular, its implementation in the context of operation constraints imposed by different system conditions. To this end, a design method based on fuzzy logic for avoiding conflicts caused from these conditions or multiple control loops implemented on the same resource is proposed. Simulation results for various selected scenarios and controllers show the effectiveness of the proposed approach.
Improved Decoupling for 13C coil Arrays Using Non-Conventional Matching and Preamplifier Impedance
In this study, we describe a method to obtain improved preamplifier decoupling for receive-only coils. The method relies on the better decoupling obtained when coils are matched to an impedance higher than 50. Preamplifiers with inductive imaginary impedance and low real impedance, increase the effectiveness of the decoupling. A 2-channel 13C array of 50 mm loop coils show an increase of Q-factor of the coils from 247 to 365. The measured SNR, using two small phantoms, demonstrated a similar improvement.

Improved Focusing Method for 3-D Imaging using Row–Column-Addressed 2-D Arrays
A row–column-addressed (RCA) 2-D array can be interpreted as two orthogonal 1-D arrays. By transmitting with row elements and receiving the echoes through column elements or vice versa, a rectilinear volume in front of the array can be beamformed. Since the transmit and receive 1-D arrays are orthogonal to each other, only one-way focusing is possible in each transmit or receive plane. For applications, where the scatterers are sparse, e.g., in micro-bubble tracking, this study suggests to multiply the envelope data received by the row elements when transmitting with columns as well as the data received by the column elements when transmitting with rows, to improve the focusing. In this way, at each point a two-way focused profile in both transmit and receive directions can be produced. This paper investigates the performance of the new focusing scheme based on simulations and phantom measurements with a PZT λ/2-pitch 3 MHz 62+62 RCA 2-D
transducer probe. A synthetic aperture imaging sequence with single element transmissions at a time, is designed for imaging down to 14 cm at a volume rate of 44 Hz.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Center for Fast Ultrasound Imaging
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**Improved reconstruction for IDEAL spiral CSI**

In this study we demonstrate how reconstruction for IDEAL spiral CSI (spectroscopic imaging scheme developed for hyperpolarized dynamic metabolic MR imaging) can be improved by using regularization with a sparsity constraint. By exploiting sparsity of the spectral domain, IDEAL spiral CSI can achieve chemical shift encoding by acquisition of only few time-shifted echoes. The minimum number of echoes required to avoid noise amplification can be decreased by means of regularization enforcing spectral sparsity, thereby reducing scan time. Improvements achieved by using regularized reconstruction are demonstrated for in vivo data from a hyperpolarized cardiac study of a pig.

**General information**

State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Aarhus University, GE Global Research
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**Incorporating evanescent modes and flow losses into reference impedances in acoustic Thévenin calibration**

This paper proposes an alternative approach to acoustic Thévenin calibration of an ear probe. An existing methodology derives the Thévenin-equivalent source parameters from the measured probe pressures in a number of short waveguides by solving an overdetermined system of equations. This existing methodology is affected by errors caused by evanescent modes when the waveguide model lengths are estimated. These errors introduce a parallel acoustic compliance into the source parameters. The proposed methodology takes into account evanescent modes and flow losses in the transition between the probe tube and waveguides during calibration. This is achieved by positioning the probe tube, without an ear tip, flush with the input plane in waveguides of well-defined dimensions and utilizing the physical rather than estimated lengths to calculate the analytical waveguide models. Terms that model evanescent modes and flow losses are added to the plane-wave impedance and adjusted to minimize the calibration error. It is shown that this method can reduce the calibration error across a wide frequency range and remove the parallel compliance from the source parameters. This approach leads to an independence of the source parameters on the calibration waveguide radius, though subsequent impedance measurements are still affected by evanescent modes.

**General information**
Increased Observability in Electric Distribution Grids: Emerging Applications Promoting the Active Role of Distribution System Operators

This thesis addresses supervision and control of horizontally integrated electric power systems, in which Distribution System Operators (DSOs) assume an active role. Focus lies on the technical possibilities emerging from the expanding Information and Communication Technology (ICT) and monitoring infrastructure in distribution grids. Strong emphasis is placed on experimental verifications of the investigated concepts wherever applicable. Electric grids are changing, and so are the roles of system operators. The interest in sustainable energy and the rapidly increasing number of Distributed Energy Resources (DERs) throughout the grid entail a range of challenges: vertical integration schemes, with a few bulk generators supplying mostly passive customers, are toppled; renewables are highly volatile; and the grid’s resilience to load changes is weakened due to fewer direct-coupled synchronous machines. The DSO is in a central position to all these developments. Their awareness of generation and consumption flexibility of customers and DERs brings DSOs in the position to be more actively involved in grid management. Several technical applications, emerging from the premise of increased observability in distribution grids, that promote this active role are explored in this work. Grid models are fundamental to power grid planning and operations, but quality and coverage of distribution grid models are typically less pronounced compared to transmission networks. The expanding monitoring and ICT infrastructure across the Low and Medium Voltage levels provides new, non-invasive opportunities to enhance topological knowledge, which is demonstrated on two different approaches. First, available measurements are used for estimating the parameters of lines and cables. The methodology handles noisy, unsynchronized data compromised by systematic measurement errors, and has been validated on generated and real data obtained from SYSLAB. Second, ICT allows for extending the model scope without a central topology storage. The presented binary connectivity extension approach preserves details of the local neighbourhood, which is augmented with information from remote areas that is gradually reduced in detail. Reduction performance is evaluated numerically as well as on the IEEE 906-bus European Low Voltage test feeder. Supervisory Control And Data Acquisition (SCADA) systems monitor and control the power grid, and enable human operators in control centres to interact with it. The rising number of data sources and faster grid dynamics are a challenge to static SCADA architectures, which is tackled by modern ICT means of distributed data acquisition, processing, and exchange. For that purpose, a Multi Agent System (MAS)-based framework for prototyping distributed applications was developed. Software agents represent power system elements, offering high-level application interfaces and flexible low-level data acquisition mechanisms, and a Common Information Model (CIM)-like abstraction layer in between. A distributed Situational Awareness (SA) concept is subsequently designed and tested on models of SYSLAB and the Power Networks Demonstration Centre (PNDC), focusing on two features. Related to topology reduction covered earlier, the first is dynamic gathering and representation of topological information distributed throughout the grid. The second feature is live data visualisation on top of the topologies, in which power balances and other data are queried on demand. Improved models and SA benefit the operation of interconnected power systems as a whole, exemplified on Load Frequency Control (LFC). While LFC will likely remain the Transmission System Operator (TSO)’s responsibility, DSOs play a major role due to their local awareness. The presented LFC approach consequently uses direct state observations to determine area imbalances, and actively involves primary devices in frequency control to achieve tuning-free secondary control. Stability proofs and performance studies with Automatic Generation Control (AGC) are conducted analytically, in simulations, and in SYSLAB, on a three-area power system. Considering the option of DSOs performing balancing tasks, a consecutive load mobility approach accounts for the fact that DSO areas are not necessarily self-sufficient. Missing power is covered by neighbouring areas to confine problems in a small region, which is demonstrated in SYSLAB on a two-area, grid-connected setup. The results highlight the advantages of harnessing the information obtained directly from the distribution grid for real-time supervision and control. Better models contribute to improved SA of DSOs, and distributed data exchange mechanisms allow the coordination of a multitude of DERs. Together, the proposed solutions will strengthen the DSO’s position to cope with current and future challenges. Regulatory issues concerning data ownership and privacy, as well as questions on the hierarchies between TSOs, DSOs, and third-parties like aggregators, are yet to be settled by the corresponding authorities, and are therefore not covered in the frame of this work. Nevertheless, with the current speed of development of technical solutions and regulations, near-complete observability of the electric grid will be achieved in the foreseeable future. Harnessing the increased observability already benefits the
unbundling of electricity markets, and is imperative to ensure security of the grid.

General information
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Influence of a remote microphone on localization with hearing aids
When used with hearing aids (HA), the addition of a remote microphone (RM) may alter the spatial perception of the listener. First, the RM signal is presented diotically from the HAs. Second, the processing in the HA often delays the RM signal relative to the HA microphone signals. Finally, the level of the RM signal is independent of the distance from the RM to HA. The present study investigated localization performance of 15 normal-hearing and 9 hearing-impaired listeners under conditions simulating the use of an RM with a behind the ear (BTE) HA. Minimum audible angle discrimination around an average angle of 45° was measured for three sets of relative gains and seven sets of relative delays for a total of 21 conditions. In addition, a condition with just the simulated BTE HA signals was tested. Overall, for both groups, minimum audible angle discrimination was best when the relative RM gain was small (−3 and −6 dB) and the delay was approximately 10-20 ms. Under these conditions, localization performance approached the level obtained in the BTE HA only condition.

General information
State: Published
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Influence of binary mask estimation errors on robust speaker identification
Missing-data strategies have been developed to improve the noise-robustness of automatic speech recognition systems in adverse acoustic conditions. This is achieved by classifying time-frequency (T-F) units into reliable and unreliable components, as indicated by a so-called binary mask. Different approaches have been proposed to handle unreliable feature components, each with distinct advantages. The direct masking (DM) approach attenuates unreliable T-F units in the spectral domain, which allows the extraction of conventionally used mel-frequency cepstral coefficients (MFCCs). Instead of attenuating unreliable components in the feature extraction front-end, full marginalization (FM) discards unreliable feature components in the classification back-end. Finally, bounded marginalization (BM) can be used to
combine the evidence from both reliable and unreliable feature components during classification. Since each of these approaches utilizes the knowledge about reliable and unreliable feature components in a different way, they will respond differently to estimation errors in the binary mask. The goal of this study was to identify the most effective strategy to exploit knowledge about reliable and unreliable feature components in the context of automatic speaker identification (SID). A systematic evaluation under ideal and non-ideal conditions demonstrated that the robustness to errors in the binary mask varied substantially across the different missing-data strategies. Moreover, full and bounded marginalization showed complementary performances in stationary and non-stationary background noises and were subsequently combined using a simple score fusion. This approach consistently outperformed individual SID systems in all considered experimental conditions.

General information
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Organisations: Department of Electrical Engineering, Hearing Systems
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Scopus rating (2013): SJR 0.566 SNIP 2.091 CiteScore 2.71
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.726 SNIP 2.41 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 0.537 SNIP 1.824
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Scopus rating (2005): SJR 0.455 SNIP 1.736
Scopus rating (2004): SJR 0.396 SNIP 1.616
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Influence of Processing Conditions on the Mechanical Behavior of MWCNT Reinforced Thermoplastic Nanocomposites

The influence of the processing conditions and MWCNT content on the mechanical properties of PA6,6-based nanocomposites were investigated. In addition to the composition of the composites, the impact of manufacturing conditions such as dilution mechanism, twin-screw extruder mixing specifications, and injection molding parameters on the behavior of the nanocomposites are evaluated. Results show that while the increase in the content of MWCNTs can lead to 40.0% enhancement in the mechanical properties, changing the processing parameters varies the values by 30.0% in the same content. The mechanisms involved in the modulation of the nanocomposites properties are also discussed.

General information
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Injection Moulding Simulation and Experimental Validation of Hearing Aid Shells

This paper presents the validation results of the Moldex3D simulations and experiments carried on a complex 3D part, it critically analyzes the capability of Moldex3D and provides the guideline for more accurate simulation with the commercial software. Moldex3D with Boundary Layer Meshing (BLM) mode was adopted in this work to simulate the injection molding
process of a hearing aid shell made of Polybutylene Terephthalate (PBT) filled with 30% glass fiber. The typical hearing aid shells are complex thin-walled structures made by injection molding. Highly sophisticated molds and lots of process optimizations by trial and errors are needed to make successful shells for hearing aids. In this context, a dedicated simulation tool can be very useful to reduce the time and cost for developing the new hearing aids. In this work, the injection molding experimental validation of the Moldex3D simulation was conducted for the upper shell of a hearing aid. With the pressure sensors integrated in the molding tool, real cavity pressure data was collected and the real filling time was estimated to replicate the processing conditions in the simulation. Injection time, injection pressure, pressure loss and warpage were taken as the main comparison criteria. Different parameter settings in Moldex3D were investigated to find their influence on the accuracy of the simulation. Results showed that the injection molding process prediction from the simulation was relatively precise when the nozzle geometry, the pressure effect on the viscosity and the determination of a proper heat transfer coefficient (HTC), etc. were considered. The agreement observed between the warpage of the experimental molded parts and simulated parts was not good. Warpage were dominated by the fiber orientation which was extremely dependent on the filling HTC and the RPR (Retarding Principal Rate Model) used in Moldex3D for the fiber orientation model.

InP DHBT technology for power amplifiers at mm-wave frequencies
An InP Double Heterojunction Bipolar Transistor (DHBT) technology is presented for millimeter-wave power amplifiers at E-band and higher frequencies. Single- and multi-finger transistors with 0.7 μm emitter width and emitter lengths of 5, 7, 10 μm are designed for high frequency and high power applications. The static and AC performances of the fabricated devices are discussed. Reported cutoff frequency and maximum oscillation frequency are ft=267 GHz and fmax=450 GHz for a 0.7×5 μmP2 single-finger device, respectively. Results from large-signal measurements at 30 GHz are reported for single and 4-finger devices. Ballasted devices are introduced to improve thermal behaviour and to increase the limits of the safe operating area (SOA). The SOA is improved approximately by 75% for 4-finger devices with 0.7×10 μm2 emitter. A fabricated monolithic microwave integrated circuit (MMIC) at E-band based on stacked InP DHBTs is presented and its performances reported to demonstrate the power capabilities of the technology. [All rights reserved Elsevier].

General information
State: Published
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Pages: 111-19
Publication date: 2017
Main Research Area: Technical/natural sciences
This paper presents a power supply using an increased switching frequency to minimize the size of energy storing components, thereby addressing the demands for increased power densities in power supplies. 100 MHz and higher switching frequencies have been used in resonant power converters, which along with the possible integration of passive components on silicon wafer, present a beneficial solution in applications such as mobile phones. This paper presents a design for a 9 W class E resonant power converter in an 0.18 µm CMOS process. The converter is driven by a self oscillating gate drive, which is presented in an in-depth mathematical analysis. The gate resistance of the designed transistors is of critical importance in order to achieve the correct phase shift required for zero-voltageswitching. The Z-parameter method is used to characterize the transistors which is verified through simulations. The required spiral inductors was modeled, and simulations show Q values of as high as 14 at a switching frequency of 250 MHz. Simulations of the converter show an efficiency of 55 % with a self oscillating gate drive. However the modeled inductor was not adequate for operating with the self oscillating gate drive, presenting a future challenge for power supplies on chip.

Integrated Very High Frequency Switch Mode Power Supplies: Design Considerations
This paper presents a power supply using an increased switching frequency to minimize the size of energy storing components, thereby addressing the demands for increased power densities in power supplies. 100 MHz and higher switching frequencies have been used in resonant power converters, which along with the possible integration of passive components on silicon wafer, present a beneficial solution in applications such as mobile phones. This paper presents a design for a 9 W class E resonant power converter in an 0.18 µm CMOS process. The converter is driven by a self oscillating gate drive, which is presented in an in-depth mathematical analysis. The gate resistance of the designed transistors is of critical importance in order to achieve the correct phase shift required for zero-voltageswitching. The Z-parameter method is used to characterize the transistors which is verified through simulations. The required spiral inductors was modeled, and simulations show Q values of as high as 14 at a switching frequency of 250 MHz. Simulations of the converter show an efficiency of 55 % with a self oscillating gate drive. However the modeled inductor was not adequate for operating with the self oscillating gate drive, presenting a future challenge for power supplies on chip.

General information
State: Published
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BFI (2018): BFI-level 1
The growing penetration of electric vehicles (EVs) represents an operational challenge to system operators, mainly at the distribution level by introducing congestion and voltage drop problems. To solve these potential problems, a two-level coordination approach is proposed in this study. An aggregation entity, i.e., an EV virtual power plant (EV-VPP), is used to facilitate the interaction between the distribution system operator (DSO) and EV owners considering the decentralized electricity market structure. In level I, to prevent the line congestion and voltage drop problems, the EV-VPP internally respects the line and voltage constraints when making optimal charging schedules. In level II, to avoid power transformer congestion problems, this paper investigates three different coordination mechanisms, or power transformer capacity allocation mechanisms, between the DSO and the EV-VPPs, considering the case of EVs charging and discharging. The three mechanisms include: (1) a market-based approach; (2) a pro-rata approach; and (3) a newly-proposed constrained market-based approach. A case study considering a 37-bus distribution network and high penetration of electric vehicles is presented to demonstrate the effectiveness of the proposed coordination mechanism, comparing with the existing ones.
Interaction of droop control structures and its inherent effect on the power transfer limits in multi-terminal VSC-HVDC

Future multi-terminal HVDC systems are expected to utilize dc voltage droop controllers and several control structures have been proposed in literature. This paper proposes a methodology to analyse the impact of various types of droop control structures using small-signal stability analysis considering all possible combinations of droop gains. The different control structures are evaluated by the active power transfer capability as a function of the droop gains, considering various possible stability margins. This reveals the flexibility and robustness against active power flow variations, due to disturbances for all the implementations. A case study analyzing a three terminal HVDC VSC-based grid with eight different kinds of droop control schemes points out that three control structures outperform the remaining ones. Additionally, a multi-vendor case is considered where the most beneficial combinations of control structures has been combined in order to find the best performing combination.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Svenska Kraftnat, Norwegian University of Science and Technology
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Investigating the effects of noise-estimation errors in simulated cochlear implant speech intelligibility

A recent study suggested that the most important factor for obtaining high speech intelligibility in noise with cochlear implant recipients is to preserve the low-frequency amplitude modulations of speech across time and frequency by, for example, minimizing the amount of noise in speech gaps. In contrast, other studies have argued that the transients provide the most information. Thus, the present study investigates the relative impact of these two factors in the framework of noise reduction by systematically correcting noise-estimation errors within speech segments, speech gaps, and the transitions between them. Speech intelligibility in noise was measured using a cochlear implant simulation tested on normal-hearing listeners. The results suggest that minimizing noise in the speech gaps can substantially improve intelligibility, especially in modulated noise. However, significantly larger improvements were obtained when both the noise in the gaps was minimized and the speech transients were preserved. These results imply that the correct identification of the boundaries between speech segments and speech gaps is the most important factor in maintaining high intelligibility in cochlear implants. Knowing the boundaries will make it possible for algorithms to both minimize the noise in the gaps and enhance the low frequency amplitude modulations.

Investigating time-efficiency of forward masking paradigms for estimating basilar membrane input-output characteristics

It is well known that pure-tone audiometry does not sufficiently describe individual hearing loss (HL) and that additional measures beyond pure-tone sensitivity might improve the diagnostics of hearing deficits. Specifically, forward masking experiments to estimate basilar membrane (BM) input-output (I/O) function have been proposed. However, such measures are very time consuming. The present study investigated possible modifications of the temporal masking curve (TMC) paradigm to improve time and measurement efficiency. In experiment 1, estimates of knee point (KP) and compression ratio (CR) of individual BM I/Os were derived without considering the corresponding individual “off-frequency” TMC. While accurate estimation of KPs was possible, it is difficult to ensure that the tested dynamic range is sufficient. Therefore, in experiment 2, a TMC-based paradigm, referred to as the “gap method”, was tested. In contrast to the standard TMC paradigm, the maker level was kept fixed and the “gap threshold” was obtained, such that the masker just masks a low-level (12 dB sensation level) signal. It is argued that this modification allows for better control of the tested stimulus level range, which appears to be the main drawback of the conventional TMC method. The results from the present study were consistent with the literature when estimating KP levels, but showed some limitations regarding the estimation of the CR values. Perspectives and limitations of both approaches are discussed.
Investigation of echogenic surface enhancements for improved needle visualization in ultrasonography: A PRISMA systematic review.

Background: Visualization of standard needles at steep angles in clinical Ultrasound (US) images is a problematic and important concern. This systematic review evaluates published studies that investigate echogenic needles and how surface enhancements can improve needle visualization. Method: A systematic search was performed in five databases: Cochrane Library, Embase (through Ovid), MEDLINE (through PubMed), Scopus, and Web of Science from inception to April 12th, 2017. Each search was based on the search terms: ultrasound, needle, visualization, and comparison, with related synonyms and spelling matters. Results: 29 studies were identified and included in the qualitative synthesis. Conclusion: Overall, studies agree, that echogenic surface enhancements improve needle visualization in US images at steep angles regardless of target, applied US device and probe, operators, assessors, and methods of assessment.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark, Københavns Universitet
Authors: Hovgesen, C. H. (Ekstern), Wilhjelm, J. E. (Intern), Vilmann, P. (Ekstern)
Number of pages: 1
Publication date: 2017
Event: Abstract from DMTS Annual meeting, Vingsted, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions: foredragsoversigt_2017_1.pdf

Investigation of the mechanical properties of GNP/MWCNT reinforced PA66 hybrid nanocomposites

The multifunctional characteristics of nanocomposites have introduced novel possibilities for different industrial sectors. However, the stable and optimized production of polymeric nanocomposite components is challenging. This research investigates the mechanical behavior of thermoplastic based nanocomposites reinforced with two prominent nanofillers namely Multi Walled Carbon Nanotubes (MWCNT) and Graphene NanoPlatelets (GNP) manufactured through industrially viable methods. Three main groups of Polyamide (PA 66) based nano- and hybrid composite specimens namely PA 66/MWCNT, PA 66/GNP, and PA 66/MWCNT/GNP are prepared. Different contents and mixture ratios of the nanofillers are incorporated in the polymeric matrix through the dilution process using a twin-screw extruder. The influence of the manufacturing parameters and content of the nanofillers on the mechanical properties of the nanocomposite specimens are investigated. Results show that the inclusion of either of the nanomaterials improves the elastic modulus and tensile strength of the nanocomposites significantly. Moreover, the combination of the two nanofillers in the nanocomposites is resulting into completely novel material properties which do not follow the linear combinations of the observed behaviors. In fact, the interaction between the two different nanofillers influences both dispersion state and mechanical properties. The mechanisms of modulation in the properties and dispersion states are also discussed using scanning electron microscopy and rheological investigations. The research provides an insight to manufacture tailored hybrid nanocomposites with the optimized mechanical properties.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Technical University of Denmark
Authors: Doagou Rad, S. (Intern), Islam, A. (Intern), Søndergaard Jensen, J. (Ekstern)
Number of pages: 5
Publication date: 2017
Event: Paper presented at 33rd International Conference of the Polymer Processing Society (PPS-33), Cancun, Mexico.
Main Research Area: Technical/natural sciences
Electronic versions: pps_article_sadora_1.pdf
Source: PublicationPreSubmission
Source-ID: 143330710
Publication: Research - peer-review » Paper – Annual report year: 2018

Laboratory infrastructure driven key performance indicator development using the smart grid architecture model

This study presents a methodology for collaboratively designing laboratory experiments and developing key performance indicators for the testing and validation of novel power system control architectures in multiple laboratory environments.
The contribution makes use of the smart grid architecture model as it facilitates the integration of individually developed control functions into a consolidated solution for laboratory validation and testing. The experimental results obtained across multiple laboratories can be efficiently compared, when the proposed methodology is adopted and thus the study offers means of support for improved cooperation in smart grid validation and round robin testing.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, University of Strathclyde, Austrian Institute of Technology, TECNALIA Research & Innovation
Authors: Syed, M. H. (Ekstern), Guillo-Sansano, E. (Ekstern), Blair, S. M. (Ekstern), Burt, G. M. (Ekstern), Strasser, T. I. (Ekstern), Brunner, H. (Ekstern), Gehrke, O. (Intern), Rodríguez-Seco, J. E. (Ekstern)
Pages: 1866-70
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Conference: 24th International Conference on Electricity Distribution, Glasgow, United Kingdom, 12/06/2017 - 12/06/2017
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Source: Findit
Source-ID: 2392853001
Publication: Research - peer-review › Conference article – Annual report year: 2017

Large-signal modeling of multi-finger InP DHBT devices at millimeter-wave frequencies
A large-signal modeling approach has been developed for multi-finger devices fabricated in an Indium Phosphide (InP) Double Heterojunction Bipolar Transistor (DHBT) process. The approach utilizes unit-finger device models embedded in a multi-port parasitic network. The unit-finger model is based on an improved UCSD HBT model formulation avoiding an erroneous RciCbci transit-time contribution from the intrinsic collector region as found in other III-V based HBT models. The mutual heating between fingers is modeled by a thermal coupling network with parameters extracted from electro-thermal simulations. The multi-finger modeling approach is verified against measurements on an 84 GHz power amplifier utilizing four finger InP DHBTs in a stacked configuration.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Center for Magnetic Resonance, III-V Lab
Authors: Johansen, T. K. (Intern), Midili, V. (Intern), Squartecchia, M. (Intern), Zhurbenko, V. (Intern), Nodjiadjim, V. (Ekstern), Dupuy, J. (Ekstern), Riet, M. (Ekstern), Konczykowska, A. (Ekstern)
Number of pages: 3
Publication date: 2017

Host publication information
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Publisher: IEEE
ISBN (Print): 978-1-5090-5862-4
Main Research Area: Technical/natural sciences
Conference: 2017 International Workshop on Integrated Nonlinear Microwave and Millimetre-Wave Circuits, Graz, Austria, 20/04/2017 - 20/04/2017
Electro-thermal simulation, Heterojunction bipolar transistor (HBT), Indium phosphide, Millimeter-wave monolithic integrated circuits, Modeling
DOIs:
10.1109/INMMIC.2017.7927301
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Lateralized speech perception with small interaural time differences in normal-hearing and hearing-impaired listeners

Spatial release from masking (SRM) elicited by interaural timing differences (ITDs) only can be almost normal for listeners with symmetrical hearing loss. This study investigated whether elderly hearing-impaired (HI) listeners still achieve similar SRMs as young normal-hearing (NH) listeners, when SRMs are elicited by small ITDs. Speech reception thresholds (SRTs) and SRM due to ITDs were measured over headphones for 10 young NH and 10 older HI listeners, who had normal or close-to-normal hearing below 1.5 kHz. Diotic target sentences were presented in diotic or dichotic speech-shaped noise or two-talker babble maskers. In the dichotic conditions, maskers were lateralized by delaying the masker waveforms in the left headphone channel. Multiple magnitudes of masker ITDs were tested in both noise conditions. Although deficits were observed in speech perception abilities in speechshaped noise and two-talker babble in terms of SRTs, HI listeners could utilize ITDs to a similar degree as NH listeners to facilitate the binaural unmasking of speech. A slight difference was observed between the group means when target and maskers were separated from each other by large ITDs, but not when separated by small ITDs. Thus, HI listeners do not appear to require larger ITDs than NH listeners do in order to receive a benefit from binaural unmasking.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Locsei, G. (Intern), Santurette, S. (Intern), Dau, T. (Intern), MacDonald, E. (Intern)
Pages: 311-318
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the International Symposium on Auditory and Audiological Research
Volume: 6: Adaptive Processes in Hearing
Publisher: The Danavox Jubilee Foundation
Editors: Santurette, S., Dau, T., C.-Dalsgaard, J., Tranebjærg, L., Andersen, T., Poulsen, T.
ISBN (Electronic): 978-87-990013-6-1
Main Research Area: Technical/natural sciences
Conference: International Symposium on Auditory and Audiological Research, Nyborg, Denmark, 23/08/2017 - 23/08/2017
Electronic versions:
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Links:
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Linear combination of auditory steady-state responses evoked by co-modulated tones

Up to medium intensities and in the 80–100-Hz region, the auditory steady-state response (ASSR) to a multi-tone carrier is commonly considered to be a linear sum of the dipoles from each tone specific ASSR generator. Here, this hypothesis was investigated when a unique modulation frequency is used for all carrier components. Listeners were presented with a co-modulated dual-frequency carrier (1 and 4 kHz), from which the modulator starting phase $\phi$ of the 1-kHz component was systematically varied. The results support the hypothesis of a linear superposition of the dipoles originating from different frequency specific ASSR generators.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Guérit, F. (Intern), Marozeau, J. (Intern), Epp, B. (Intern)
Pages: EL395-EL400
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
Volume: 142
Issue number: 4
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Load Flow Analysis of Hybrid AC-DC Power System with Offshore Wind Power

The offshore wind power has received immense attention because of higher wind speed and lower opposition for construction. A wide range of combinations of high-voltage ACDC transmission have been proposed for integrating offshore wind farms and long-distance power transmission. This paper is to model such hybrid AC-DC systems including the interfacing converters, which have several control parameters that can change the load flow of the hybrid systems. Then, the paper proposes a Load Flow algorithm based on the Newton-Raphson method, which covers three different section types of the transmission system: the AC parts, the DC parts and the interfacing converters. Finally, this paper validates this algorithm through a detailed case study with a typical hybrid network.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark
Authors: Dhua, D. (Ekstern), Huang, S. (Intern), Wu, Q. (Intern)
Number of pages: 5
Publication date: 2017

Load Situation Awareness Design for Integration in Multi-Energy System

Renewable Energy Sources (RESS) have been penetrating in power system at a staggering pace in recent years. Their intermittent nature is, however, posing great threat to system operation. Recently, active load management has been suggested as a tool to counteract these side effects. In multi-energy system, thermal load management will benefit not only electric network but also district heating network. Electric heater will be the main focus of this paper as a common thermal load. A situation awareness framework for its integration into electric and district heating network will be proposed in this paper.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Cai, H. (Intern), You, S. (Intern), Bindner, H. W. (Intern), Klyapovskiy, S. (Intern)
Number of pages: 6
Publication date: 2017

Load Flow Analysis of Hybrid AC-DC Power System with Offshore Wind Power

The offshore wind power has received immense attention because of higher wind speed and lower opposition for construction. A wide range of combinations of high-voltage ACDC transmission have been proposed for integrating offshore wind farms and long-distance power transmission. This paper is to model such hybrid AC-DC systems including the interfacing converters, which have several control parameters that can change the load flow of the hybrid systems. Then, the paper proposes a Load Flow algorithm based on the Newton-Raphson method, which covers three different section types of the transmission system: the AC parts, the DC parts and the interfacing converters. Finally, this paper validates this algorithm through a detailed case study with a typical hybrid network.
Local Identification of Voltage Instability from Load Tap Changer Response
This paper presents a local long-term voltage instability monitoring method, which is suitable for on-line applications. The proposed extended-time Local Identification of Voltage Emergency Situations (eLIVES) method is a significantly modified version of the previously presented LIVES method. The new method is not bound to assessing system response over a predefined LTC tapping period. This allows handling LTCs with variable delays, as well as events taking place during the tapping sequence impacting the distribution voltages. For that purpose, eLIVES applies recursive least square fitting to acquired distribution voltage measurements and a new set of rules to detect a voltage emergency situation. The effectiveness of the eLIVES method is presented on the IEEE Nordic test system for voltage stability and security assessment.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of Liege, National Technical University of Athens
Authors: Weckesser, J. T. G. (Intern), Papangelis, L. (Ekstern), Vournas, C. D. (Ekstern), Van Cutsem, T. (Ekstern)
Pages: 95-103
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: Sustainable Energy, Grids and Networks
Volume: 9
ISSN (Print): 2352-4677
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Scopus rating (2017): CiteScore 2.76 SJR 0.769 SNIP 0.841
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.33 SJR 0.604 SNIP 1.394
Web of Science (2016): Indexed yes
Original language: English
Power system dynamics, Voltage stability, On-line stability monitoring
DOIs:
10.1016/j.segan.2017.01.001
Source: PublicationPreSubmission
Source-ID: 136854831
Publication: Research - peer-review › Journal article – Annual report year: 2017

Low-complexity Behavioral Model for Predictive Maintenance of Railway Turnouts
Maintenance of railway infrastructures represents a major cost driver for any infrastructure manager since reliability and dependability must be guaranteed at all times. Implementation of predictive maintenance policies relies on the availability of condition monitoring systems able to assess the infrastructure health state. The core of any condition monitoring system is the a-priori knowledge about the process to be monitored, in the form of either mathematical models of different complexity or signal features characterizing the healthy/faulty behavior. This study investigates the identification of a low-complexity behavioral model of a railway turnout capable of capturing the dominant dynamics due to the ballast and railpad components. Measured rail accelerations, acquired through a receptance test carried out on the switch panel of a turnout of the Danish railway network, have been utilized together with the Eigensystem Realization Algorithm – a type of subspace identification – to identify a fourth order model of the infrastructure. The robustness and predictive capability of the low-complexity behavioral model to reproduce track responses under different types of train excitations have been successfully validated. It is anticipated that the identified model will be instrumental for the development of methods for diagnosis and prognosis of faults and degradation process in switches and crossings.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Mechanical Engineering, Solid Mechanics
Authors: Barkhordari, P. (Intern), Galeazzi, R. (Intern), Tejada, A. D. M. (Intern), Santos, I. (Intern)
Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 8th Annual Conference of the Prognostics and Health Management Society
Publisher: Prognostics and Health Management Society
Editors: Bregon, A., J. Daigle, M.
ISBN (Electronic): 978-1-936263-26-4
Low conversion loss 94 GHz and 188 GHz doublers in InP DHBT technology
An Indium Phosphide (InP) Double Heterojunction Bipolar Transistor (DHBT) process has been utilized to design two doublers to cover the 94 GHz and 188 GHz bands. The 94 GHz doubler employs 4-finger DHBTs and provides conversion loss of 2 dB. A maximum output power of nearly 3 dBm is measured while the doubler is not entirely saturated. The DC power consumption is 132 mW. The 188 GHz doubler utilizes a 1-finger DHBT. Conversion loss of 2 dB and a maximum output power of ~1 dBm are achieved at 188 GHz with on-wafer measurements. The DC power consumption is 24 mW under saturated conditions. Both doublers operate over a broad bandwidth. The total circuit area of each chip is 1.41 mm2.

Low cost, compact, two-channel NMR spectrometer for CP-DNP
Low-Noise Active Decoupling Circuit and its Application to 13C Cryogenic RF Coils at 3T

We analyze the loss contributions in a small, 50-mm-diameter receive-only coil for carbon-13 (13C) magnetic resonance imaging at 3 T for 3 different circuits, which, including active decoupling, are compared in terms of their Q-factors and...
signal-to-noise ratio (SNR). The results show that a circuit using unsegmented tuning and split matching capacitors can provide 20% SNR enhancement at room temperature compared with that using more traditional designs. The performance of the proposed circuit was also measured when cryogenically cooled to 105 K, and an additional 1.6-fold SNR enhancement was achieved on a phantom. The enhanced circuit performance is based on the low capacitance needed to match to 50 when coil losses are low, which significantly reduces the proportion of the current flowing through the matching network and therefore minimizes this loss contribution. This effect makes this circuit particularly suitable for receive-only cryogenic coils and/or small coils for low-gamma nuclei.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, Center for Magnetic Resonance, Electromagnetic Systems, Aarhus University  
Authors: Sanchez, J. D. (Intern), Søvsø Szocska Hansen, E. (Ekstern), Laustsen, C. (Ekstern), Zhurbenko, V. (Intern), Ardenkjær-Larsen, J. H. (Intern)  
Pages: 60-66  
Publication date: 2017  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Tomography  
Volume: 3  
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Web of Science (2018): Indexed yes  
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Original language: English  
RF coil, SNR, Cryogenic, 13C MRI  
Electronic versions:  
tomo_03_060_1_.pdf  
DOIs:  
10.18383/j.tom.2016.00280

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Source: PublicationPreSubmission  
Source-ID: 130397290  
Publication: Research - peer-review › Journal article – Annual report year: 2017

**Low RF-field strength cross polarization combined with photo-induced non-persistent radicals for clinically applicable dDNP**

**General information**

State: Published  
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering  
Authors: Møllesæe Vinther, J. (Intern), Capozzi, A. (Intern), Albannay, M. (Intern), Ardenkjær-Larsen, J. H. (Intern)  
Number of pages: 1  
Publication date: 2017  
Event: Poster session presented at EUROMAR 2017, Warsaw, Poland.  
Main Research Area: Technical/natural sciences  
Electronic versions:  
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**Relations**

Activities:  
Low RF-field strength cross polarization combined with photo-induced non-persistent radicals for clinically applicable dDNP  
Publication: Research - peer-review › Poster – Annual report year: 2017

**Management of Power Quality Issues in Low Voltage Networks using Electric Vehicles: Experimental Validation**

As Electric Vehicles (EVs) are becoming more widespread, their high power consumption presents challenges for the residential low voltage networks, especially when connected to long feeders with unevenly distributed loads. However, if intelligently integrated, EVs can also partially solve the existing
and future power quality problems. One of the main aspects of the power quality relates to voltage quality. The aim of this work is to experimentally analyse whether series-produced EVs, adhering to contemporary standard and without relying on any V2G capability, can mitigate line voltage drops and voltage unbalances by a local smart charging algorithm based on a droop controller. In order to validate this capability, a low-voltage grid with a share of renewable resources is recreated in SYSLAB PowerLabDK. The experimental results demonstrate the advantages of the intelligent EV charging in improving the power quality of a highly unbalanced grid

**General information**

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Martinenas, S. (Intern), Knezovic, K. (Intern), Marinelli, M. (Intern)
Pages: 971 - 979
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: IEEE Transactions on Power Delivery
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 2.211 SJR 1.814 CiteScore 4.52
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.47 SJR 1.634 SNIP 2.536
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.788 SNIP 2.587 CiteScore 3.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.508 SNIP 2.631 CiteScore 3.4
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.412 SNIP 2.769 CiteScore 3.51
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.222 SNIP 2.577 CiteScore 3.28
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.99 SNIP 2.242 CiteScore 2.89
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.999 SNIP 2.012
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.862 SNIP 1.999
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.975 SNIP 2.155
Scopus rating (2007): SJR 0.85 SNIP 1.979
Scopus rating (2006): SJR 0.876 SNIP 1.752
Scopus rating (2005): SJR 0.874 SNIP 1.891
Scopus rating (2004): SJR 0.696 SNIP 1.905
Scopus rating (2003): SJR 1.354 SNIP 1.832
Measurement-Based Transmission Line Parameter Estimation with Adaptive Data Selection Scheme

Accurate parameters of transmission lines are critical for power system operation and control decision making. Transmission line parameter estimation based on measured data is an effective way to enhance the validity of the parameters. This paper proposes a multi-point transmission line parameter estimation model with an adaptive data selection scheme based on measured data. Data selection scheme, defined with time window and number of data points, is introduced in the estimation model as additional variables to optimize. The data selection scheme is adaptively adjusted to minimize the relative standard deviation (RSD) of estimated parameters. An iterative technique derived from the Newton method is adopted to solve the proposed model by fitting the relationship between the RSD and data selection scheme with exponential functions. Simulated data are applied to illustrate the performance of the proposed model. Some 500kV transmission lines from a provincial power system of China are estimated to demonstrate the applicability of the presented model. The superiority of the proposed model over fixed data selection schemes is also verified.

General information
State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, University of Manchester, Shandong University
Authors: Li, C. (Ekstern), Zhang, Y. (Forskerdatabase), Zhang, H. (Ekstern), Wu, Q. (Intern), Terzija, V. (Ekstern)
Number of pages: 9
Publication date: 2017
Measuring glucose cerebral metabolism in the healthy mouse using hyperpolarized C-13 magnetic resonance

The mammalian brain relies primarily on glucose as a fuel to meet its high metabolic demand. Among the various techniques used to study cerebral metabolism, C-13 magnetic resonance spectroscopy (MRS) allows following the fate of C-13-enriched substrates through metabolic pathways. We herein demonstrate that it is possible to measure cerebral glucose metabolism in vivo with sub-second time resolution using hyperpolarized C-13 MRS. In particular, the dynamic C-13-labeling of pyruvate and lactate formed from C-13-glucose was observed in real time. An ad-hoc synthesis to produce [2,3,4,6,6-H-2(5), 3,4-C-13(2)]-D-glucose was developed to improve the 13C signal-to-noise ratio as compared to experiments performed following [U-H-2(7), U-C-13]-D-glucose injections. The main advantage of only labeling C3 and C4 positions is the absence of C-13-C-13 coupling in all downstream metabolic products after glucose is split into 3-carbon intermediates by aldolase. This unique method allows direct detection of glycolysis in vivo in the healthy brain in a noninvasive manner.
Metasurface Waveguides Applied to Matched Feeds for Reflector Antennas

Waveguides with anisotropic surface impedance boundaries have been investigated for the purpose of matched feeds for offset reflectors. Matched feeds employ higher order waveguide modes to cancel out cross polarization introduced by the offset geometry. Since the higher order modes propagate at different speeds than the fundamental mode in conventional waveguides, it is challenging to meet phase relationship requirements over a large band. We have found that traditional corrugated waveguides are poorly suited for matched feed applications. However, other surfaces that satisfy the balanced hybrid condition, but have a small capacitive longitudinal reactance and large inductive azimuthal reactance show very promising properties: In a large band, HE11 and HE21 have similar propagation characteristics.

General information
Microstrip Resonator for High Field MRI with Capacitor-Segmented Strip and Ground Plane
High field MRI coils are often based on transmission line resonators. Due to relatively short wavelength of RF fields, such coils produce uneven field patterns. Here we show, that it is possible to manipulate magnetic field patterns of microstrip resonators in both planes (sagittal and transverse) segmenting stripe and ground plane of the resonator with series capacitors. The design equations for capacitors providing symmetric current distribution are derived. The performance of two types of segmented resonators are investigated experimentally. To authors' knowledge, a microstrip resonator, where both, strip and ground plane are capacitor-segmented, is shown here for the first time.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Electromagnetic Systems, Copenhagen University Hospital
Authors: Zhurbenko, V. (Intern), Boer, V. (Ekstern), Petersen, E. T. (Intern)
Number of pages: 4
Publication date: 2017
Host publication information
Title of host publication: Proceedings of the 25th Annual Meeting & Exhibition, Honolulu, United States, 22/04/2017 - 22/04/2017
BFI conference series: The International Society for Magnetic Resonance in Medicine (5030404)
Main Research Area: Technical/natural sciences
Conference: ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States, 22/04/2017 - 22/04/2017
DOIs: 10.1002/978-0-89585-018-7.000001
Source: PublicationPreSubmission
Source-ID: 132343034
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Modal interaction and higher harmonic generation in a weakly nonlinear, periodic mass–spring chain

Wave propagation in a nonlinear periodic material is investigated, by considering an infinite chain of two-mass unit cells with cubic stiffness nonlinearity. The chain is analysed using the method of multiple scales, predicting the dispersion shift in the band structure due to nonlinear self-interaction. The solution further reveals modest higher harmonic generation within the limits of the solution approach, proportional to the strength of nonlinearity and energy level in the chain. The possibility for controlling the higher harmonic generation by changing the distribution of the cubic nonlinearity is investigated. The predictions based on the analytical model are verified by numerical simulations, which also explores the limits of the infinite, analytical model.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Acoustic Technology
Authors: Frandsen, N. M. M. (Intern), Jensen, J. S. (Intern)
Pages: 149-161
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Wave Motion
Volume: 68
ISSN (Print): 0165-2125
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  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 1
  Scopus rating (2017): SNIP 1.239 SJR 0.676 CiteScore 1.84
  Web of Science (2017): Indexed yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 1.83 SJR 0.792 SNIP 1.353
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 0.678 SNIP 1.296 CiteScore 1.5
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 0.904 SNIP 1.653 CiteScore 1.74
  BFI (2013): BFI-level 1
  Scopus rating (2013): SJR 0.661 SNIP 1.383 CiteScore 1.37
  ISI indexed (2013): ISI indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): SJR 0.919 SNIP 1.622 CiteScore 1.67
  ISI indexed (2012): ISI indexed yes
  BFI (2011): BFI-level 1
  Scopus rating (2011): SJR 0.682 SNIP 1.423 CiteScore 1.49
  ISI indexed (2011): ISI indexed yes
  BFI (2010): BFI-level 1
  Scopus rating (2010): SJR 0.844 SNIP 1.724
  BFI (2009): BFI-level 1
  Scopus rating (2009): SJR 0.762 SNIP 1.599
  BFI (2008): BFI-level 1
Model-based plant-wide optimization of large-scale lignocellulosic bioethanol plants.

Second generation biorefineries transform lignocellulosic biomass into chemicals with higher added value following a conversion mechanism that consists of: pretreatment, enzymatic hydrolysis, fermentation and purification. The objective of this study is to identify the optimal operational point with respect to maximum economic profit of a large scale biorefinery plant using a systematic model-based plantwide optimization methodology. The following key process parameters are identified as decision variables: pretreatment temperature, enzyme dosage in enzymatic hydrolysis, and yeast loading per batch in fermentation. The plant is treated in an integrated manner taking into account the interactions and trade-offs between the conversion steps. A sensitivity and uncertainty analysis follows at the optimal solution considering both model and feed parameters. It is found that the optimal point is more sensitive to feedstock composition than to model parameters, and that the optimization supervisory layer as part of a plantwide automation system has the following benefits: (1) increases the economical profit, (2) flattens the objective function allowing a wider range of operation without negative impact on profit, and (3) reduces considerably the uncertainty on profit.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, DONG Energy Thermal Power A/S
Authors: Prunescu, R. M. (Intern), Blanke, M. (Intern), Jakobsen, J. G. (Ekstern), Sin, G. (Intern)
Number of pages: 13
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Biochemical Engineering Journal
Volume: 124
ISSN (Print): 1369-703X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.18
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.16
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 2.75
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
In the design of mobile sound systems an estimation of power consumption must be made in order to choose a battery of appropriate size and cost. However poor methods for power estimation tend to result in large and costly batteries. This paper aims to present a more precise method for estimating power consumption for a vented box sound system. Instead of simplifying a loudspeaker system as a purely ohmic resistance, its mechanical and acoustic parameters are used to create a state space model. Despite deviations at high frequencies, the state space model is at least twice as accurate at estimating the power consumption than simplifying the speaker as a resistor.

**Model for evaluating power consumption of vented box loudspeakers**

In the design of mobile sound systems an estimation of power consumption must be made in order to choose a battery of appropriate size and cost. However poor methods for power estimation tend to result in large and costly batteries. This paper aims to present a more precise method for estimating power consumption for a vented box sound system. Instead of simplifying a loudspeaker system as a purely ohmic resistance, its mechanical and acoustic parameters are used to create a state space model. Despite deviations at high frequencies, the state space model is at least twice as accurate at estimating the power consumption than simplifying the speaker as a resistor.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Madsen, F. S. (Ekstern), Thorsen, S. (Ekstern), Iversen, N. E. (Intern), Knott, A. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Source: FindIt
Source-ID: 2392932525
Publication: Research - peer-review › Paper – Annual report year: 2017
of simplifying a loudspeaker system as a purely ohmic resistance, its mechanical and acoustic parameters are used to
create a state space model. Despite deviations at high frequencies, the state space model is at least twice as accurate at
estimating the power consumption than simplifying the speaker as a resistor.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Madsen, F. S. (Ekstern), Thorsen, S. (Ekstern), Iversen, N. E. (Intern), Knott, A. (Intern)
Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 142nd Audio Engineering Convention
Publisher: Audio Engineering Society
Main Research Area: Technical/natural sciences
Conference: 142nd Audio Engineering Society Convention, Berlin, Germany, 20/05/2017 - 20/05/2017
Source: PublicationPreSubmission
Source-ID: 132790768
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Modeling Speech Level as a Function of Background Noise Level and Talker-to-Listener Distance for Talkers Wearing
Hearing Protection Devices
Purpose: Studying the variations in speech levels with changing background noise level and talker-to-listener distance for
talkers wearing hearing protection devices (HPDs) can aid in understanding communication in background noise.

Method: Speech was recorded using an intra-aural HPD from 12 different talkers at 5 different distances in 3 different
noise conditions and 2 quiet conditions.

Results: This article proposes models that can predict the difference in speech level as a function of background noise
level and talker-to-listener distance for occluded talkers. The proposed model complements the existing model presented
by Pelegrin-Garcia, Smits, Brunskog, and Jeong (2011) and expands on it by taking into account the effects of occlusion
and background noise level on changes in speech sound level.

Conclusions: Three models of the relationship between vocal effort, background noise level, and talker-to-listener distance
for talkers wearing HPDs are presented. The model with the best prediction intervals is a talker-dependent model that
requires the users' unoccluded speech level at 10 m as a reference. A model describing the relationship between speech
level, talker-to-listener distance, and background noise level for occluded talkers could eventually be incorporated with
radio protocols to transmit verbal communication only to an intended set of listeners within a given spatial range—this
range being dependent on the changes in speech level and background noise level.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Ecole de Technologie Superieure, Universite de
Montreal, Institut National de la Recherche Scientifique
Authors: Bouserhal, R. E. (Ekstern), Bockstael, A. (Ekstern), MacDonald, E. (Intern), Falk, T. H. (Ekstern), Voix, J.
(Ekstern)
Pages: 3393-3403
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Speech, Language, and Hearing Research
Volume: 60
ISSN (Print): 1092-4388
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.463 SJR 1.001 CiteScore 2.35
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.18 SJR 1.182 SNIP 1.403
BFI (2015): BFI-level 1
Modeling the transient security constraints of natural gas network in day-ahead power system scheduling

The rapid deployment of gas-fired generating units makes the power system more vulnerable to failures in the natural gas system. To reduce the risk of gas system failure and to guarantee the security of power system operation, it is necessary to take the security constraints of natural gas pipelines into account in the day-ahead power generation scheduling model. However, the minute- and hour-level dynamic characteristics of gas systems prevents an accurate decision-making simply with the steady-state gas flow model. Although the partial differential equations depict the dynamics of gas flow accurately, they are hard to be embedded into the power system scheduling model, which consists of algebraic equations and inequations. This paper addresses this dilemma by proposing an algebraic transient model of natural gas network which is similar to the branch-node model of power network. Based on the gas flow model, the day-ahead power system scheduling model is then proposed with the solution technique of successive linear programming and Benders decomposition. Tests are conducted to prove the effectiveness of the proposed models.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Tsinghua University
Authors: Yang, J. (Ekstern), Zhang, N. (Ekstern), Kang, C. (Ekstern), Pinson, P. (Intern)
Number of pages: 5
Pages: 5 pp.
Publication date: 2017
Modelling and Validating a Deoiling Hydrocyclone for Fault Diagnosis using Multilevel Flow Modeling

Decision support systems are a key focus in research on developing control rooms to aid operators in making reliable decisions, and reducing incidents caused by human errors. For this purpose, models of complex systems can be developed to diagnose causes or consequences for specific alarms. Models applied in safety systems of complex and safety critical systems, require rigorous and reliable model building and testing. Multilevel Flow Modeling is a qualitative method for diagnosing faults, and has previously only been validated by subjective and qualitative means. This work aims to synthesize a procedure to measure model performance, according to diagnostic requirements, to ensure reliability during operation. A simple procedure is proposed for validating and evaluating Multilevel Flow Modeling models. For this purpose expert statements, a dynamic process simulation in K-spice, and pilot plant experiments are used for validation of two simple Multilevel Flow Modeling models of a deoiling hydrocyclone, used for water and oil separation.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Chemical and Biochemical Engineering, PROSYS - Process and Systems Engineering Centre, Aalborg University
Authors: Nielsen, E. K. (Intern), Bram, M. V. (Forskerdatabase), Frutiger, J. (Intern), Sin, G. (Intern), Lind, M. (Intern)
Number of pages: 9
Publication date: 2017
Main Research Area: Technical/natural sciences
Multilevel Flow Modelling, Model Validation, Water treatment, Fault Diagnosis

Modelling the Aggregated Dynamic Response of Electric Vehicles

There is an increasing interest in the use of electric vehicles (EVs) for providing fast frequency reserves due to their large installed capacity and their very fast response. Most works focus on scheduling and optimization and usually neglect their aggregated dynamic response, which is particularly important from the power system perspective when EVs offer significant shares of such services. We present a literature review on the aggregated modelling of EVs and derive analytical expressions for the representation of EV populations based on the probability distributions of their parameters. Such approximations can be used in power system studies, in order to capture the dynamics of an EV population more accurately. Finally, we compare our approach to the most widely used in the literature, i.e. the averaging method where all EVs are represented with the population’s average values, and discuss the key differences of the two approaches.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Ziras, C. (Intern), Hu, J. (Intern), You, S. (Intern), Bindner, H. W. (Intern)
Number of pages: 6
Publication date: 2017
Module Integrated GaN Power Stage for High Switching Frequency Operation

An increased attention has been detected to develop smaller and lighter high voltage power converters in the range of 50 V to 400 V domains. The applications for these converters are mainly focused for Power over Ethernet (PoE), LED lighting, and ac adapters. Design for high power density is one of the targets for next generation power converters. This paper presents an 80 V input capable multi-chip module integration of enhancement mode gallium nitride (GaN) field effect transistors (FETs) based power stage. The module design is presented and validated through experimental results. The power stage is integrated on a high glass transition temperature 0.4 mm thick FR4 substrate configured as a 70 pin ball grid array package. The power stage is tested up to switching frequency of 12 MHz. The power stage achieved 88.5 % peak efficiency when configured as a soft switching buck converter operating at 7 MHz. The converter is tested up to 12 W of output power at 13 V ± 1.5 V output voltage. The converter achieved a volume power density of 20 W/cm³ and area power density of 9.4 W/cm².

Monitoring Cancer Response to Treatment with Hyperpolarized ¹³C MRS

Monitoring the cancer response to treatment, non-invasively, by medical imaging is a key element in the management of cancer. For patients undergoing treatment, it is crucial to determine responders from non-responders in order to guide treatment decisions. Currently, PET is the most widely used technique for imaging tumor function by measuring the uptake of the glucose analogue FDG. FDG-PET can visualize changes in metabolic activity and indicate if a patient will respond to a particular therapy, sometimes within hours of the first treatment. However, PET is not effective in all tumor types, and the patient is exposed to ionizing radiation. The introduction of hyperpolarized ¹³C MRS has opened completely new possibilities to study the biochemical changes in disease processes. Numerous ¹³C-labeled compounds were proposed to interrogate various aspects of cancer cell metabolism. The aim of this study is to investigate the relevance of [1-¹³C]pyruvate and [1,4-¹³C₂]fumarate in monitoring the changes in cellular metabolism and necrosis that may occur as a result of cancer therapy. This project also aims to improve existing ¹³C MRI methods to efficiently utilize the signal from hyperpolarized ¹³C substrates. Firstly, we investigate the effectiveness of hyperpolarized [1-¹³C]pyruvate in detecting the treatment response in two types of NSCLC xenografted in mice, in comparison with FDG- and FLT-PET. We show here a significant reduction in tumor lactate levels, obtained by MRS, in HCC-827 tumors, as well as lower FLT- and FDG-PET uptake with erlotinib treatment. These findings were validated ex vivo, where LDH activity level and Ki-67 IHC staining was significantly lower in treated HCC-827 tumors. Furthermore, the reduction in LDH activity levels correlated with the lactate levels found using ¹³C MRS. These findings indicate the hyperpolarized [1-¹³C]pyruvate can be an alternative to FDG-PET.

In the second study, a polarization scheme for [1,4-¹³C₂]fumarate in the SPINlab polarizer is presented. The feasibility of using [1,4-¹³C₂]fumarate as marker for monitoring induced necrosis is demonstrated in vivo in two rat models: ischemia/reperfusion induced necrosis in kidneys and turpentine induced necrosis in muscle. High polarization was achieved for [1,4-¹³C₂]fumarate in the SPINlab and high [1,4-¹³C₂]malate signal was observed from the necrotic tissue in both models. The elevated malate signal observed in the ischemia/reperfusion induced injury in kidney showed high correlation with well-known blood and urine bio-markers used to characterize acute kidney injuries. Moreover, simultaneous assessment of metabolism and necrosis was achieved using dual polarization of [1,4-¹³C₂]fumarate and [1-
13Cpyruvate. Finally, a symmetric echo planar spectroscopic imaging sequence for hyperpolarized 13C spectroscopic acquisition in clinical scanners is presented with a reconstruction algorithm that separately reconstruct the data from odd and even echoes in order to reduce artifacts from gradient imbalances. The reconstruction algorithm employs re-gridding in the spatio-temporal frequency space to compensate for the chemical shift displacements. The sequence is compared with conventional phase-encoded chemical shift imaging on a clinical PET/MRI system in phantoms and a large animal model. The SNR per unit time of EPSI for 13C at thermal equilibrium was comparable to CSI. The reconstruction pipeline improved the localization compared to direct FFT, which resulted in spatial blurring. The encoding speed of EPSI allowed dynamic imaging of tumor metabolism with high spatial and temporal resolutions and reduced blurring due to T1 decay.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance
Authors: Eldirdiri, A. (Intern), Ardenkjær-Larsen, J. H. (Intern), Hanson, L. G. (Intern), Kjaer, A. (Intern)
Number of pages: 217
Publication date: 2017

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions: my_thesis_eldirdiri.pdf

Relations
Projects:
Monitoring Cancer Response to Treatment with Hyperpolarized 13C MRS
Publication: Research › Ph.D. thesis – Annual report year: 2017

MRI
This chapter discusses principles of nuclear magnetic resonance (NMR) and MRI followed by a survey on the major classes of MRI contrast agents (CA), their modes of action, and some of the most significative applications. The two more established classes of MRI-CA are represented by paramagnetic metal complexes (i.e., Gd(III) and Mn(II)) and iron oxide particles, acting on T1 and T2 of the water protons signals, respectively. Along the years many efforts have been devoted to endow these relaxation enhancement agents with improved sensitivity, targeting, and responsive properties that have markedly broadened the range of applications in respect to the clinically used systems. CEST agents represent innovative frequency-encoding probes that yield negative contrast in the MR images upon transfer of saturated magnetization from the agent to the "bulk" water signal. Interesting developments have been attained that markedly increase the number and typology of systems with CEST properties. Currently much attention is also devoted to hyperpolarized molecules that display a sensitivity enhancement sufficient for their direct exploitation for the formation of the MR image. A real breakthrough is provided by the use of molecules (such as pyruvate) that report about the cellular metabolism, thanks to the maintenance of the hyperpolarization in the derived species.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, ETH Zurich, University of Torino, University of Freiburg, Lausanne University Hospital, Ecole Polytechnique Federale de Lausanne (EPFL), Technical University of Munich, Bruker Biospin GmbH
Pages: 227-324
Publication date: 2017

Host publication information
Title of host publication: Small Animal Imaging: Basics and Practical Guide
Publisher: Springer
Editors: Kiessling, F., Pichler, B. J., Hauff, P.
ISBN (Print): 978-3-319-42200-8
ISBN (Electronic): 978-3-319-42202-2
Chapter: 13
Main Research Area: Technical/natural sciences
MRI, Paramagnetic probes, Molecular imaging, Hyperpolarization, CEST, MRS, MRSI, Dissolution DNP, Para-hydrogen, Metabolism, 13C
DOIs:
Multi-dimensional procurement auction under uncertain and asymmetric information

This article addresses two important issues in public procurement: ex ante uncertainty about the participating agents’ qualities and costs and their strategic behaviour. We present a novel multi-dimensional auction that incentivises agents to make a partial inquiry into the procured task and to honestly report quality-cost probabilistic estimates based on which the principal can choose the agent that offers the best value for money. The mechanism extends second score auction design to settings where the quality is uncertain and it provides incentives to both collect information and deliver desired qualities.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Copenhagen Business School
Authors: Papakonstantinou, A. (Intern), Bogetoft, P. (Forskerdatabase)
Number of pages: 31
Pages: 1171–1180
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: European Journal of Operational Research
Volume: 258
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ISSN (Print): 0377-2217
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 4.08 SJR 2.437 SNIP 2.375
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.83 SJR 2.489 SNIP 2.433
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.225 SNIP 2.364 CiteScore 3.59
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.143 SNIP 2.444 CiteScore 3.21
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.238 SNIP 2.691 CiteScore 3.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.328 SNIP 2.567 CiteScore 3.01
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.352 SNIP 2.422 CiteScore 3.02
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.383 SNIP 2.426
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Multi-port isolated LLC resonant converter for distributed energy generation with energy storage

Distributed energy generation systems with energy storage and microgrids have attracted increasing research interest in recent years. Therefore, multi-ports dc-dc converters have gained more interest. However, when integrating into multiple port converters, the power flow control and ports regulation increase in complexity. In this paper, an isolated multi-port bidirectional converter based on an LLC converter is presented. The converter operates as a dc transformer at a fixed switching frequency and duty cycle without any control loop. The resonant tanks are designed to ensure soft-switching for the whole power range and minimize the voltage variation of the unregulated ports. In order to verify the converter operation, a 1 kW prototype with a 600 V maximum voltage has been implemented.

General information

State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Tomas Manez, K. (Intern), Zhang, Z. (Intern), Ouyang, Z. (Intern)
Pages: 2219-2226
Publication date: 2017

Host publication information

Title of host publication: Proceedings of 2017 IEEE Energy Conversion Congress and Exposition (ECCE)
Publisher: IEEE

Series: 2017 Ieee Energy Conversion Congress and Exposition (ecce)
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE Energy Conversion Congress and Exposition (ECCE), Cincinnati, United States, 01/10/2017 - 01/10/2017
DOIs:
10.1109/ECCE.2017.8096434
Source: Findit
Source-ID: 2392836500
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Multi-Scale Modeling of the Structural and Vibrational Behavior of Carbon Nanotube Reinforced Polymeric Nanocomposite Plates

Polymeric nanocomposites reinforced with carbon nanotubes are being considered as alternatives in many industrial applications. However, the mechanical behavior of the industrially produced nanocomposites is yet to be fully understood. In this study, Polyamide 6,6-based nanocomposites reinforced with different contents of multi-walled carbon nanotubes (MWCNTs) were manufactured using an injection moulding process. A multi-scale approach was followed to numerically model the mechanical behavior of the nanostructured materials. In order to find the stiffness matrix of the carbon nanotubes, different loading scenarios were conducted on the tubes using molecular dynamics simulations (LAMMPS). The derived properties of the carbon nanotubes from the atomistic simulations were included in a Benveniste Mori-Tanaka based micromechanical model allowing us to acquire the elastic mechanical properties in the produced nanocomposites with different arrangements and contents of the nanotubes. The numerical results were also compared with the experimental properties of the nanocomposites produced via different processing settings leading to distinct microstructures. Eventually the derived properties and stiffness matrices were incorporated in an in-house finite element code for plate vibrations. The results show how the arrangement and the content of the carbon nanotubes in the injection-moulded nanocomposite plates define their structural and vibrational behavior.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology
Authors: Doagou Rad, S. (Intern), Jensen, J. S. (Intern), Islam, A. (Intern)
Pages: 94-106
Publication date: 2017

Musicians do not benefit from differences in fundamental frequency when listening to speech in competing speech backgrounds

Recent studies disagree on whether musicians have an advantage over non-musicians in understanding speech in noise. However, it has been suggested that musicians may be able to use differences in fundamental frequency (F0) to better understand target speech in the presence of interfering talkers. Here we studied a relatively large (N=60) cohort of young adults, equally divided between nonmusicians and highly trained musicians, to test whether the musicians were better able to understand speech either in noise or in a two-talker competing speech masker. The target speech and competing speech were presented with either their natural F0 contours or on a monotone F0, and the F0 difference between the target and masker was systematically varied. As expected, speech intelligibility improved with increasing F0 difference between the target and the two-talker masker for both natural and monotone speech. However, no significant intelligibility advantage was observed for musicians over non-musicians in any condition. Although F0 discrimination was significantly better for musicians than for non-musicians, it was not correlated with speech scores. Overall, the results do not support the hypothesis that musical training leads to improved speech intelligibility in complex speech or noise backgrounds.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, University of Minnesota
Authors: Madsen, S. M. K. (Intern), Whiteford, K. L. (Ekstern), Oxenham, A. J. (Ekstern)
Number of pages: 9
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Scientific Reports
Volume: 7
Article number: 12624
ISSN (Print): 2045-2322
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Myoendothelial coupling through Cx40 contributes to EDH-induced vasodilation in murine renal arteries: evidence from experiments and modelling

Regulation of renal vascular resistance plays a major role in controlling arterial blood pressure. The endothelium participates in this regulation as endothelial derived hyperpolarization plays a significant role in smaller renal arteries and arterioles, but the exact mechanisms are still unknown. To investigate the role of vascular gap junctions and potassium channels in the renal endothelial derived hyperpolarization, in interlobar arteries from wild-type and connexin40 knockout mice, we assessed the role of calcium-activated small (SK) and intermediate (IK) conductance potassium channels. The role of inward rectifier potassium channels (Kir) and Na+/K+ -ATPases was evaluated as was the contribution from gap junctions. Mathematical models estimating diffusion of ions and electrical coupling in myoendothelial gap junctions were used to interpret the results. Lack of connexin40 significantly reduces renal endothelial hyperpolarization. Inhibition of SK and IK channels significantly attenuates renal EDH to a similar degree in wild-type and knockout mice. Inhibition of Kir and Na+/K+ -ATPases affected the response in wild-type and knockout mice but at different levels of stimulation. The model confirms that activation of endothelial SK and IK channels generates a hyperpolarizing current that enters the vascular smooth muscle cells. Also, extracellular potassium increases sufficiently to activate Kir and Na+/K+ -ATPases. Renal endothelial hyperpolarization is mainly initiated by activation of IK and SK channels. The model shows that hyperpolarization can spread through myoendothelial gap junctions but enough potassium is released to activate Kir and Na+/K+ -ATPases. Reduced coupling seems to shift the signalling pathway towards release of potassium. However, an alternative pathway also exists and needs to be investigated.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Universität zu Lübeck, University of Copenhagen
Authors: Brasen, J. C. (Intern), de Wit, C. A. (Ekstern), Sorensen, C. M. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Physiologica
Volume: 222
Endothelial derived hyperpolarization, Mathematical model, Renal, Vasodilation

Original language: English

DOIs:

10.1111/apha.12906

Source: FindIt

Source-ID: 2371490084

Publication: Research - peer-review > Journal article – Annual report year: 2018
New Frontiers in Passive and Active Nanoantennas
The articles included in this special section focus on several recent advances in the field of passive and active nanoantennas that employ not only traditional based realizations but also their new frontiers.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems
Authors: Arslanagic, S. (Intern), Ziolkowski, R. W. (Ekstern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Antennas and Propagation Magazine
Volume: 59
Issue number: 6
ISSN (Print): 1045-9243
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 1.7 SJR 0.491 SNIP 1.299
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.38 SJR 0.615 SNIP 1.275
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.82 SNIP 1.455 CiteScore 1.29
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.874 SNIP 1.341 CiteScore 1.26
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.556 SNIP 1.263 CiteScore 1.24
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.445 SNIP 1.168 CiteScore 1.26
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.498 SNIP 1.32 CiteScore 1.28
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.41 SNIP 1.15
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.645 SNIP 1.332
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.415 SNIP 1.148
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.589 SNIP 1.72
Scopus rating (2006): SJR 0.861 SNIP 1.749
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.987 SNIP 2.042
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.12 SNIP 2.232
Scopus rating (2003): SJR 0.673 SNIP 2.178
Scopus rating (2002): SJR 1.021 SNIP 1.978
Scopus rating (2001): SJR 1.096 SNIP 2.072
Scopus rating (2000): SJR 0.53 SNIP 1.56
Noise-robust cortical tracking of attended speech in real-world acoustic scenes

Selectively attending to one speaker in a multi-speaker scenario is thought to synchronize low-frequency cortical activity to the attended speech signal. In recent studies, reconstruction of speech from single-trial electroencephalogram (EEG) data has been used to decode which talker a listener is attending to in a two-talker situation. It is currently unclear how this generalizes to more complex sound environments. Behaviorally, speech perception is robust to the acoustic distortions that listeners typically encounter in everyday life, but it is unknown whether this is mirrored by a noise-robust neural tracking of attended speech. Here we used advanced acoustic simulations to recreate real-world acoustic scenes in the laboratory. In virtual acoustic realities with varying amounts of reverberation and number of interfering talkers, listeners selectively attended to the speech stream of a particular talker. Across the different listening environments, we found that the attended talker could be accurately decoded from single-trial EEG data irrespective of the different distortions in the acoustic input. For highly reverberant environments, speech envelopes reconstructed from neural responses to the distorted stimuli resembled the original clean signal more than the distorted input. With reverberant speech, we observed a late cortical response to the attended speech stream that encoded temporal modulations in the speech signal without its reverberant distortion. Single-trial attention decoding accuracies based on 40-50s long blocks of data from 64 scalp electrodes were equally high (80-90% correct) in all considered listening environments and remained statistically significant using down to 10 scalp electrodes and short
Non-Cartesian Parallel Imaging Reconstruction of Undersampled IDEAL Spiral 13C CSI Data

The short-lived nature of hyperpolarization places high demands on signal acquisition. To acquire large FOVs with high spatial resolution, and to fully capture substrate uptake and metabolic conversion, fast data acquisition is crucial. Parallel imaging uses multi-channel coils to achieve reduced scan times based on spatial information inherent to each coil element. In this work, we explored the combination of non-cartesian parallel imaging reconstruction and spatially undersampled IDEAL spiral CSI1 acquisition for efficient encoding of multiple chemical shifts within a large FOV with high spatial resolution.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance
Authors: Hansen, R. B. (Intern), Hanson, L. G. (Intern), Ardenkjær-Larsen, J. H. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
Non-Cooperative Regulation Coordination Based on Game Theory for Wind Farm Clusters during Ramping Events

With increasing penetration of wind power in power systems, it is important to track scheduled wind power output as much as possible during ramping events to ensure security of the system. In this paper, a non-cooperative coordination strategy based on the game theory is proposed for the regulation of wind farm clusters (WFCs) in order to track scheduled wind power of the WFC during ramping events. In the proposed strategy, a non-cooperative game is formulated and wind farms compete to provide regulation to the WFC during ramping events. A regulation revenue function is proposed to evaluate the competition process of wind farms to provide regulation to the WFC which includes revenue of effective regulation (ER), power support regulation and punishment regulation. The multi-time-interval Nash equilibrium condition is derived for the regulation competition process of wind farms. By setting parameters of the regulation revenue function according to the derived Nash equilibrium condition, the ER strategy is the Nash equilibrium of the regulation competition. Case studies were conducted with the power output data of wind farms from State Grid Jibei Electric Power Company Limited of China to demonstrate the efficacy of the proposed coordination strategy during ramping events.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University
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Number of pages: 11
Pages: 136-146
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Main Research Area: Technical/natural sciences

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Journal: Energy
Volume: 132
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 5.6 SJR 1.99 SNIP 1.923
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.974 SNIP 1.823
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.22 SNIP 2.037 CiteScore 5.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.575 SNIP 2.602 CiteScore 5.7
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.458 SNIP 2.556 CiteScore 5.02
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.935 SNIP 2.214 CiteScore 4.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.566 SNIP 2.01 CiteScore 4
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
The phase variable model is used commonly when simulating a motor drive system with a three-phase permanent magnet brushless DC (PMBLDC) motor. The phase variable model neglects core losses and this affects its accuracy when modelling fractional-slot machines. The inaccuracy of phase variable model of fractional-slot machines can be attributed to considerable armature flux harmonics, which causes an increased core loss. This study proposes a nonlinear phase variable model of PMBLDC motor that considers the core losses induced in the stator and the rotor. The core loss model is developed based on the detailed analysis of the flux path and the variation of flux in different components of the machine. A prototype of fractional slot axial flux PMBLDC in-wheel motor is used to assess the proposed nonlinear dynamic model.

**General information**
- State: Published
- Organisations: Center for Electric Power and Energy, Electric Equipment Technologies, Department of Electrical Engineering, University of the Faroe Islands
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- Number of pages: 8
- Pages: 9282-9280
- Publication date: 2017
- Main Research Area: Technical/natural sciences

**Publication information**
- Journal: IEEE Transactions on Industrial Electronics
- Volume: 64
- Issue number: 12
- ISSN (Print): 0278-0046
- Ratings:
  - BFI (2018): BFI-level 2
  - Web of Science (2018): Indexed yes
  - BFI (2017): BFI-level 2
Novel Approach for Automatic Detection of Atrial Fibrillation Based on Inter Beat Intervals and Support Vector Machine

Atrial fibrillation (AF) is the most common cardiac arrhythmia associated with a major economic burden for the society. Automatic detection of AF in long term recordings can efficiently assist in early diagnosis and management of comorbidities associated with AF. This study presents a novel approach for AF detection based on Inter Beat Intervals (IBI) extracted from long term electrocardiogram (ECG) recordings. Five time-domain features are extracted from the IBIs and a Support Vector Machine (SVM) is used for classification. The results are compared to a state of the art algorithm...
based on raw ECG. Both algorithms are evaluated on the MIT-BIH Atrial Fibrillation database resulting in equally high classification performance (Sensitivity ≥ 95%). The proposed approach requires detection of R-peaks in the ECG signal but allows for significantly reduced computation time without loss of performance.

**General information**
State: Published
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Pages: 2039-2042
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of 39th Annual International Conference of the IEEE Engineering in Medicine and Biology Society
Publisher: IEEE
ISBN (Print): 978-1-5090-2809-2
Main Research Area: Technical/natural sciences
DOI: 10.1109/EMBC.2017.8037253
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Numerical Acoustic Models Including Viscous and Thermal losses: Review of Existing and New Methods**
This work presents an updated overview of numerical methods including acoustic viscous and thermal losses. Numerical modelling of viscothermal losses has gradually become more important due to the general trend of making acoustic devices smaller. Not including viscothermal acoustic losses in such numerical computations will therefore lead to inaccurate or even wrong results. Both, Finite Element Method (FEM) and Boundary Element Method (BEM), formulations are available that incorporate these loss mechanisms. Including viscothermal losses in FEM computations can be computationally very demanding, due to the meshing of very thin boundary layers and the added degrees of freedom[3]. These implications can be avoided using the BEM with losses, but other shortcomings affect this formulation as well.

Through a simple academic test case, well established acoustic implementations and a newly proposed coupled FEM and BEM method including viscothermal dissipation are compared and investigated.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering, Solid Mechanics, Technical University of Munich
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Number of pages: 4
Publication date: 2017

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Main Research Area: Technical/natural sciences
Conference: 43. Jahrestagung für Akustik, Kiel, Germany, 06/03/2017 - 06/03/2017
Source: PublicationPreSubmission
Source-ID: 130700498
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Numerical models of single- and double-negative metamaterials including viscous and thermal losses**
Negative index acoustic metamaterials are artificial structures made of subwavelength units arranged in a lattice, whose effective acoustic parameters, bulk modulus and mass density, can be negative. In these materials, sound waves propagate inside the periodic structure, assumed rigid, showing extraordinary properties. We are interested in two particular cases: a double-negative metamaterial, where both parameters are negative at some frequencies, and a single-negative metamaterial with negative bulk modulus within a broader frequency band. In previous research involving the double-negative metamaterial, numerical models with viscous and thermal losses were used to explain that the extraordinary behavior, predicted by analytical models and numerical simulations with no losses, disappeared when the metamaterial was measured in physical setups. The improvement of the models is allowing now a more detailed understanding on how viscous and thermal losses affect the setups at different frequencies. The modeling of a simpler single-negative metamaterial also broadens this overview. Both setups have been
modeled with quadratic BEM meshes. Each sample, scaled at two different sizes, has been represented with a detailed frequency step. The influence of viscous and thermal losses as a function of the scale has been studied at two different scales, in both metamaterials. It is shown that the effect of losses on the scale is not the same for the different regimes of the metamaterials. Special attention is also given to the double-negative frequency band, where a fine frequency step of the simulation reveals details about the Fabry-Perot resonances in the metamaterial slab. The numerical model with losses, which is computationally very demanding, will also be commented.

General information
State: Published
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Number of pages: 7
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 24th International Congress on Sound and Vibration : London Calling, 2017
ISBN (Print): 978-1-906913-27-4
Main Research Area: Technical/natural sciences
Conference: The 24th International Congress on Sound and Vibration, London, United Kingdom, 23/07/2017 - 23/07/2017
Acoustic metamaterials, Boundary element method
Source: PublicationPreSubmission
Source-ID: 134247357
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Offering strategy of a price-maker energy storage system in day-ahead and balancing markets
Energy storage systems (ESS) are considered as a promising solution to improve power system flexibility and facilitate the integration of renewables in electricity markets. This paper investigates the impact of strategic offering by an ESS operator in the day-ahead and balancing market. The offering strategy of a price-maker ESS operator is formulated as a bilevel model, where the upper-level problem represents the profit maximization of the ESS operator and the lower-level problem simulates the market-clearing outcome. This methodological framework can be used either to assess market efficiency distortion or as a trading strategy from the perspective of the ESS operator. Our analysis shows that adopting strategic behavior may improve ESS expected profit but reduces social welfare, especially for high ESS energy-to-power ratios.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets , ETH Zurich
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Number of pages: 6
Pages: 6 pp.
Publication date: 2017

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Title of host publication: Proceedings of 2017 IEEE Manchester PowerTech
Publisher: IEEE
ISBN (Print): 9781509042371
Main Research Area: Technical/natural sciences
Conference: 12th IEEE Power and Energy Society PowerTech Conference, Manchester, United Kingdom, 18/06/2017 - 18/06/2017
Power system management, operation and economics, Optimisation techniques, energy storage, optimisation, power markets, pricing, State of charge, Wind forecasting, Energy storage, Electricity supply industry
DOIs: 10.1109/PTC.2017.7981050
Source: FindIt
Source-ID: 2372482669
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

On-chip patch antenna on InP substrate for short-range wireless communication at 140 GHz
This paper presents the design of an on-chip patch antenna on indium phosphide (InP) substrate for short-range wireless communication at 140 GHz. The antenna shows a simulated gain of 5.3 dBi with 23% bandwidth at 140 GHz and it can be used for either direct chip-to-chip communication or chip-level integration and packaging. In the transmission frequency band from 130 GHz to 150 GHz the estimated in-band gain variation is 0.5 dBi which guarantees gain uniformity. The antenna with optimized dimension is implemented for a transition between elevated coplanar waveguide (ECPW) and rectangular waveguide. The chip-to-waveguide transition in back-to-back configuration exhibits a simulated return loss of 10 dB and insertion loss of 3 dB from 128 GHz to 153 GHz. For higher directivity, a horn antenna is used together with the chip-to-waveguide transition forming an extended packaging structure that is suitable for the transceiver (Tx and Rx)
on chips. The simulated gain of the extended packaging structure is 11.9 dBi with 23% bandwidth at 140 GHz and the in-band gain variation is 2 dBi.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Center for Magnetic Resonance
Authors: Dong, Y. (Intern), Johansen, T. K. (Intern), Zhurbenko, V. (Intern)
Number of pages: 5
Pages: 1-5
Publication date: 2017

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Title of host publication: Proceedings of Microwave and Optoelectronics Conference (IMOC), 2017 SBMO/IEEE MTT-S International Publisher: IEEE
ISBN (Print): 978-1-5090-6241-6
Main Research Area: Technical/natural sciences
Conference: 2017 SBMO/IEEE MTT-S International Microwave and Optoelectronics Conference (IMOC), Águas de Lindoia, Brazil, 27/08/2017 - 27/08/2017
DOIs:
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Source: FindIt
Source-ID: 2393853389
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**On maximizing profit of wind-battery supported power station based on wind power and energy price forecasting**
This paper proposes a framework to develop an optimal power dispatch strategy for grid-connected wind power plants containing a Battery Energy Storage System (BESS). Considering the intermittent nature of wind power and rapidly varying electricity market price, short-term forecasting of these variables is used for efficient energy management. The predicted variability trends in market price assist in earning additional income which subsequently increase the operational profit. Then on the basis of income improvement, optimal capacity of the BESS can be determined. The proposed framework utilizes Dynamic Programming tool which can incorporate the predictions of both wind power and market price simultaneously as inputs in a receding horizon approach. The proposed strategy is validated using real electricity market price and wind power data in different scenarios of BESS power and capacity. The obtained results depict the effectiveness of the strategy to help power system operators in ensuring economically optimal energy dispatch. Moreover, the results can aid power system planners in the selection of optimal BESS capacity for given power ratings in order to maximize their operational profits.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, King Fahd University of Petroleum and Minerals, University of Technology Sydney, University of New South Wales
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Number of pages: 10
Pages: 764-773
Publication date: 2017
Main Research Area: Technical/natural sciences

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Volume: 211
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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 8.44 SJR 3.162 SNIP 2.765
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.011 SNIP 2.61
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
On-site and laboratory evaluations of soundscape quality in recreational urban spaces

Regulations for quiet urban areas are typically based on sound level limits alone. However, the nonacoustic context may be crucial for subjective soundscape quality. Aims: This study aimed at comparing the role of sound level and nonacoustic context for subjective urban soundscape assessment in the presence of the full on-site context, the visual context only, and without context. Materials and Methods: Soundscape quality was evaluated for three recreational urban spaces by using four subjective attributes: loudness, acceptance, stressfulness, and comfort. The sound level was measured at each site and simultaneous sound recordings were obtained. Participants answered questionnaires either on site or during laboratory listening tests, in which the sound recordings were presented with or without each site’s visual context consisting of two pictures. They rated the four subjective attributes along with their preference toward eight sound sources. Results: The sound level was found to be a good predictor of all subjective parameters in the laboratory, but not on site.
Although all attributes were significantly correlated in the laboratory setting, they did not necessarily covary on site. Moreover, the availability of the visual context in the listening experiment had no significant effect on the ratings. The participants were overall more positive toward natural sound sources on site. Conclusion: The full immersion in the on-site nonacoustic context may be important when evaluating overall soundscape quality in urban recreational areas. Laboratory evaluations may not fully reflect how subjective loudness, acceptance, stressfulness, and comfort are affected by sound level.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Acoustic Technology, Technical University of Denmark
Authors: Bjerre, L. C. (Ekstern), Larsen, T. M. (Ekstern), Sørensen, A. J. (Intern), Santurette, S. (Intern), Jeong, C. (Intern)
Pages: 183-192
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 2.15
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.03
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.98
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 2.02
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.77
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 1.71
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 1.37
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Original language: English
Electronic versions:
On_site_and_laboratory_evaluations_of_soundscape_quality_in_recreational_urban_spaces_Bjerre_LC_Larsen_TM_Soren sen_A_J_Santurette_S_Jeong_CH_Noise_Health.pdf

Bibliographical note
The article is available open-access online in its HTML version: http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2017;volume=19;issue=89;spage=183;epage=192;aulast=Bjerre
Source: PublicationPreSubmission
Source-ID: 134613381
Publication: Research - peer-review › Journal article – Annual report year: 2017

On the accuracy of Friis' transmission formula at short range
This paper presents a numerical investigation on the accuracy of Friis' transmission formula for short distances between the transmitting and receiving antennas. It addresses the accuracy of the formula around the far-field distance where effects due to multiple reflections may be of significance.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems
Authors: Breinbjerg, O. (Intern), Kaslis, K. (Intern)
On-the-go throughput prediction in a combine harvester using sensor fusion

The paper addresses design of a clean grain throughput observer for a combine harvester, i.e. delay free yield sensing. The aim is to predict grain throughput changes using the forward speed and a throughput sensor in the feederhouse. By utilising a grain flow model and sensor fusion an estimate of the current grain throughput is obtained, hence the effect from the lag in the momentary yield sensor reading due to material transport delays can be reduced. Statistical change detection is used to detect feederhouse load condition as well as sensor discrepancies using the observer innovation signal. The system is able to predict changes originating from forward speed and local crop density variations. Also temporary sensor discrepancies are detected and compensated in the grain flow estimate.

Optimal approach for the interaction between dsoo and aggregators to activate der flexibility in the distribution grid

The process of predicting the behaviors of distributed energy resources (DER) and controlling them is complex. It will require a huge effort from the DSO to establish communication channels to all available DERs in the network and to integrate new ones into the automation system. It is therefore important that a third party takes care of the communication with DERs in the network. This third party is called the Aggregator (A). This paper will focus on the following: 1. DSO functionalities that enable communication with the flexibility market and the aggregator 2. The aggregator role and the functionalities required to be a successful business entity 3. The approach (DSO/aggregator model) that was identified and adopted by the IDE4L project as the most efficient one to solve congestion and to ensure harmony in the sequence of events. The paper concludes and recommends the IDE4L approach, which is the approach that was adopted by the IDE4L project. Based on the achieved results, we believe that the IDE4L approach is the optimal method of communication that insures efficiency, effectiveness and harmony in communication among the DSO and all other flexibility market players. However, a full scale field demonstration of the whole IDE4L approach was not applicable during the duration of the IDE4L project. Therefore it’s hereby recommended for future projects.
Optimal Day-ahead Charging Scheduling of Electric Vehicles through an Aggregative Game Model

The electric vehicle (EV) market has been growing rapidly around the world. With large scale deployment of EVs in power systems, both the grid and EV owners will benefit if the flexible demand of EV charging is properly managed through the electricity market. When EV charging demand is considerable in a grid, it will impact spot prices in the electricity market and consequently influence the charging scheduling itself. The interaction between the spot prices and the EV demand needs to be considered in the EV charging scheduling, otherwise it will lead to a higher charging cost. A day-ahead EV charging scheduling based on an aggregative game model is proposed in this paper. The impacts of the EV demand on the electricity prices are formulated with the game model in the scheduling considering possible actions of other EVs. The existence and uniqueness of the pure strategy Nash equilibrium are proved for the game. An optimization method is developed to calculate the equilibrium of the game model through quadratic programming. The optimal scheduling of the individual EV controller considering the actions of other EVs in the game is developed with the EV driving pattern distribution. Case studies with the proposed game model were carried out using real world driving data from the Danish National Travel Surveys. The impacts of the EV driving patterns and price forecasts on the EV demand with the proposed game model were also analysed.
Optimal Design of DC Fast-Charging Stations for EVs in Low Voltage Grids

DC Fast Charging Station (DCFCS) is essential for widespread use of Electric Vehicle (EVs). It can recharge EVs in direct current in a short period of time. In recent years, the increasing penetration of EVs and their charging systems are going through a series of changes. This paper addresses the design of a new DCFCS for EVs coupled with a local Battery Energy Storage (BES). DCFCS is equipped with a bidirectional AC/DC converter for feeding power back to the grid, two lithium batteries and a DC/DC converter. This paper proposes an optimal size of the BES to reduce the negative impacts on the power grid through the application of electrical storage systems within the DC fast charging stations. The proposed solution decreases the charging time and the impact on the low voltage (LV) grid significantly. The charger can be used as a multifunctional grid-utility such as congestion management and load levelling. Finally, an optimal design of the DCFSC has been done to evaluate the feasibility and the operability of the system in different EVs load conditions.
Optimal Modulator with Loudspeaker Parameter Inclusion

Today, most class-D amplifier designs are able to deliver high efficiency and low distortion. However, the effect of parasitic components and speaker dynamics are not taken into account, resulting in a degradation of the performance. This paper proposes a new PWM modulator which is able to capture an arbitrary amount of dynamics through optimization based design methods. This makes it possible to include the parasitic components in the amplifier and the loudspeaker parameters in the design, thus creating a more linear response.

Optimal offering and allocation policies for wind power in energy and reserve markets

Proliferation of wind power generation is increasingly making this power source an important asset in designs of energy and reserve markets. Intuitively, wind power producers will require the development of new offering strategies that maximize the expected profit in both energy and reserve markets while fulfilling the market rules and its operational limits. In this paper, we implement and exploit the controllability of the proportional control strategy. This strategy allows the splitting of potentially available wind power generation in energy and reserve markets. In addition, we take advantage of better forecast information from the different day-ahead and balancing stages, allowing different shares of energy and reserve in both stages. Under these assumptions, different mathematical methods able to deal with the uncertain nature of wind power generation, namely, stochastic programming, with McCormick relaxation and piecewise linear decision rules are adapted and tested aiming to maximize the expected revenue for participating in both energy and reserve markets, while accounting for estimated balancing costs for failing to provide energy and reserve. A set of numerical examples, as well as a case study based on real data, allow the analysis and evaluation of the performance and behavior of such techniques. An important conclusion is that the use of the proposed approaches offers a degree of freedom in terms of minimizing balancing costs for the wind power producer strategically to participate in both energy and reserve markets.
Wind farms and energy storage systems are playing increasingly more important roles in power systems, which makes their offering non-negligible in some markets. From the perspective of wind farm-energy storage systems (WF-ESS), this
The paper proposes an integrated strategy of day-ahead offering and real-time operation policies to maximize their overall profit. As participants with large capacity in electricity markets can influence cleared prices by strategic offering, a large scaled WFESS is assumed to be a price maker in day-ahead markets. Correspondingly, the strategy considers influence of offering quantity on cleared day-ahead prices, and adopts linear decision rules as the real time control strategy. These allow enhancing overall profits from both day-ahead and balancing markets. The integrated price-maker strategy is formulated as a stochastic programming problem, where uncertainty of wind power generation and balancing prices are taken into account in the form of scenario sets, permitting to reformulate the optimization problem as a linear program. Case studies validate the effectiveness of the proposed strategy by highlighting and quantifying benefits comparing with the price-taker strategy, and also show the profit enhancement brought to the distributed resources.

With the present trend towards Smart Grids and Smart Energy Systems it is important to look for the opportunities for integrated development between different energy sectors, such as electricity, heating, gas and transportation. This paper investigates the problem of optimal placement of a heat pump – a component that links electric and heating utilities together. The system used to demonstrate the integrated planning approach has two neighboring 10kV feeders and several distribution substations with loads that require central heating from the heat pump. The optimal location is found with the help of mathematical optimization that minimizes investments of both electric and heating utilities, achieving the reduction of the total investment. The optimization is performed in Matlab using built-in Genetic Algorithm function and Matpower software package for calculating power flow equations.

Optimal planning of integrated multi-energy systems

In this paper, a mathematical approach for the optimal planning of integrated energy systems is proposed. In order to address the challenges of future, RES-dominated energy systems, the model deliberates between the expansion of traditional energy infrastructures, the integration of these infrastructures using conversion technologies (e.g. gas-to-electricity-and-heat, power-to-heat, power-to-gas), and the placement of energy storage. The model is demonstrated using
a representative case study from the city of Eindhoven. Current energy data from 2015 is combined with city development scenarios and sustainability goals for 2030 and 2045. Optimal green- and brownfield designs for a district's future integrated energy system are compared using a one-step, as well as a two-step planning approach. As expected, the greenfield designs are more cost efficient, as their results are not constrained by the existing infrastructure.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Eindhoven University of Technology
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Number of pages: 6
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Main Research Area: Technical/natural sciences
Conference: 12th IEEE Power and Energy Society PowerTech Conference, Manchester, United Kingdom, 18/06/2017 - 18/06/2017
Energy and environmental policy, economics and legislation, Energy resources and fuels, Energy resources, Planning, Environmental factors, Optimisation techniques, RES dominated energy systems, Investment, Resistance heating, Cogeneration, Mathematical model, Urban areas, Energy storage
DOIs: 10.1109/PTC.2017.7980886
Source: FindIt
Source-ID: 2372483029
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Optimal Power Flow Modelling and Analysis of Hybrid AC-DC Grids with Offshore Wind Power Plant**
In order to develop renewables based energy systems, the installation of the offshore wind power plants (WPPs) is globally encouraged. However, wind power generation is intermittent and uncertain. An accurate modelling and evaluation reduces investment and provide better operation. Hence, it is essential to develop a suitable model and apply optimization algorithms for different application scenarios. The objective of this work is to develop a generalized model and evaluate the Optimal Power Flow (OPF) solutions in a hybrid AC/DC system including HVDC (LCC based) and offshore WPP (VSC based). This paper also shows the significance and impact of control parameters in OPF applications. An integrated hybrid power system network is adopted in this paper and OPF techniques are applied on it by considering the impact of different control parameters. In addition to the impact of the control variables, the wind power production level also plays a major role in a hybrid system on transmission loss evaluation. The developed model is tested in Low, Medium and High wind power production levels to determine the objective function of the OPF solution. MATLAB Optimization Toolbox and MATLAB script are used to develop the model for the case studies.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark
Authors: Dhua, D. (Ekstern), Huang, S. (Intern), Wu, Q. (Intern)
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Journal: Energy Procedia
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BFI (2018): BFI-level 1
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Scopus rating (2017): CiteScore 1.44 SJR 0.495 SNIP 0.799
BFI (2016): BFI-level 1
Optimal scheduling for electric heat booster under day-ahead electricity and heat pricing
Multi-energy system (MES) operation calls for active management of flexible resources across energy sectors to improve efficiency and meet challenging environmental targets. Electric heat booster, a solution for Domestic Hot Water (DHW) preparation under Low-Temperature-District-Heating (LTDH) context, is identified as one of aforementioned flexible resources for electricity and heat sectors. This paper extends the concept of optimal load scheduling under day-ahead pricing from electricity sector only to both electricity and heat sectors. A case study constructing day-ahead energy prices to shift energy consumption to low carbon content energy is provided. Results show that 0.5 DKK/kWhel add-ons on top of electricity spot price makes electricity and heat price not comparable such that electricity price variation will have no impact on load scheduling. This result suggests aforementioned concept is not feasible with current Danish electricity taxation.

Optimized dispatch of wind farms with power control capability for power system restoration
As the power control technology of wind farms develops, the output power of wind farms can be constant, which makes it possible for wind farms to participate in power system restoration. However, due to the uncertainty of wind energy, the
actual output power can’t reach a constant dispatch power in all time intervals, resulting in uncertain power sags which may induce the frequency of the system being restored to go outside the security limits. Therefore, it is necessary to optimize the dispatch of wind farms participating in power system restoration. Considering that the probability distribution function (PDF) of transient power sags is hard to obtain, a robust optimization model is proposed in this paper, which can maximize the output power of wind farms participating in power system restoration. Simulation results demonstrate that the security constraints of the restored system can be kept within security limits when wind farm dispatch is optimized by the proposed method.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Nanjing University of Science and Technology, State Grid Jiangsu Electric Power Company
Authors: Xie, Y. (Ekstern), Liu, C. (Ekstern), Wu, Q. (Intern), Li, K. (Ekstern), Zhou, Q. (Ekstern), Yin, M. (Ekstern)
Number of pages: 9
Pages: 908-916
Publication date: 2017
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Issue number: 6
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Scopus rating (2017): CiteScore 3.81
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 3.35
Web of Science (2016): Indexed yes
Scopus rating (2015): SNIP 1.478 CiteScore 2.45
Web of Science (2015): Indexed yes
Scopus rating (2014): SNIP 0.678
Web of Science (2014): Indexed yes
ISI indexed (2013): ISI indexed no
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Original language: English
Blackout, Dispatch optimization of wind farm, Power control of wind farm, System restoration, Uncertainty of wind energy
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Optimum phase shift in the self-oscillating loop for piezoelectric transformer-based power converters
A new method is implemented in designing of self-oscillating loop for driving piezoelectric transformers. The implemented method is based on combining both analog and digital control systems. Digitally controlled time delay through the self-oscillating loop results in very precise frequency control and ensures optimum operation of the piezoelectric transformer in terms of gain and efficiency. Time delay is implemented digitally for the first time through a 16 bit digital-to-analog converter in the self-oscillating loop. The new design of the delay circuit provides 45 ps time resolution, enabling fine-grained control of phase in the self-oscillating loop. This allows the control loop to dynamically follow frequency changes of the transformer in each resonant cycle. Ultimately, by selecting the optimum phase shift, maximum efficiency under the load and temperature condition is achievable.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Ekhtiari, M. (Intern), Zsurzsan, T. (Intern), Andersen, M. A. E. (Intern), Zhang, Z. (Intern)
Number of pages: 9
Output Pressure and Pulse-Echo Characteristics of CMUTs as Function of Plate Dimensions

This paper presents an experimental study of the acoustic performance of Capacitive Micromachined Ultrasonic Transducers (CMUTs) as function of plate dimensions. The objective is to increase the output pressure without decreasing the pulse-echo signal. The CMUTs are fabricated with a LOCOS process, followed by direct wafer fusion bonding to a Silicon-On-Insulator (SOI) wafer. In this way, the plate thickness is determined by the SOI wafer device layer thickness, resulting in CMUTs with plate thicknesses of 2, 9.3 and 15 μm. The corresponding radii and gap heights resulting in an immersion frequency of 5 MHz and a pull-in voltage of 200 V are obtained using finite element analysis. Hydrophone and plane reflector measurements are used to assess the acoustic performance. Increasing the plate thickness from 2 μm to 15 μm decreases the pulse-echo bandwidth from >100% to 30%. A maximum in both peak-to-peak output pressure and pulse-echo signal is obtained for the 9.3 μm plate, which still has a moderate pulse-echo bandwidth of 60%. The 9.3 μm plate results in a 1.9 times higher peak-to-peak output pressure and a 3.6 times higher pulse-echo signal compared to the 2 μm plate. By adjusting the plate dimensions of a CMUT it is possible to optimize its acoustic performance for medical imaging applications, including visualization of deeper structures in the body, as well as nonlinear imaging such as tissue harmonic imaging.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Department of Electrical Engineering, Biomedical Engineering
Authors: Diederichsen, S. E. (Intern), Hansen, J. M. F. (Intern), Engholm, M. (Intern), Jensen, J. A. (Intern), Thomsen, E. V. (Intern)
Number of pages: 4
Publication date: 2017

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ISBN (Electronic): 978-1-5386-3383-0
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE International Ultrasonics Symposium (IUS), Washington, United States, 06/09/2017 - 06/09/2017
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10.1109/ULTSYM.2017.8092352
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Passive Reactor Compensated Cascaded H-Bridge Multilevel LC-StatCom
The cascaded H-bridge (CHB) low-capacitance StatCom (LC-StatCom) has a limited operating area in the inductive region compared to a conventional StatCom's V–I characteristic. This limitation for operation in the inductive region is considered to be the biggest disadvantage of CHB LC-StatCom. In this paper, the effect of adding parallel and series reactors on the LC-StatCom system's V–I characteristic is analyzed. Then, a new configuration, which fully compensates for the lost operating area of the LC-StatCom, is introduced. A scaled down single-phase seven-level laboratory prototype is used to confirm practicability of the proposed system.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Nanyang Technological University, University of New South Wales, University of Newcastle
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Pages: 8338 - 8348
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Main Research Area: Technical/natural sciences

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Peptide-MHC-directed expansion of multifunctional antigen-responsive T cells

General information
State: Published
Organisations: Department of Electrical Engineering, Section for Immunology and Vaccinology, National Veterinary Institute, T-cells & Cancer

Original language: English
Capacitors, Automatic voltage control, Inductors, Control systems, Capacitance, Voltage measurement, Cascaded H-bridge, low-capacitance (LC)-StatCom, reactive power compensation, thin dc capacitor

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Performance Comparison of Controllers with Fault-Dependent Control Allocation for UAVs

This paper combines fault-dependent control allocation with three different control schemes to obtain fault tolerance in the longitudinal control of unmanned aerial vehicles. The paper shows that fault-dependent control allocation is able to accommodate actuator faults that would otherwise be critical and it makes a performance assessment for the different control algorithms: an L1 adaptive backstepping controller; a robust sliding mode controller; and a standard PID controller. The actuator faults considered are the partial to total loss of the elevator, which is a critical component for the safe operation of unmanned aerial vehicles. During nominal operation, only the main actuator, namely the elevator, is active for pitch control. In the event of a partial or total loss of the elevator, fault-dependent control allocation is used to redistribute control to available healthy actuators. Using simulations of a Cessna 182 aircraft model, controller performance and robustness are evaluated by metrics that assess control accuracy and energy use. System uncertainties are investigated over an envelope of pertinent variation, showing that sliding mode and L1 adaptive backstepping provide robustness, where PID control falls short. Additionally, a key finding is that the fault-dependent control allocation is instrumental when handling actuator faults.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Norwegian University of Science and Technology
Authors: Nørgaard Sørensen, M. E. (Ekstern), Hansen, S. (Intern), Breivik, M. (Ekstern), Blanke, M. (Intern)
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.624 SNIP 1.432 CiteScore 1.79
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.682 SNIP 1.701 CiteScore 1.91
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.469 SNIP 1.69 CiteScore 1.74
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.619 SNIP 1.887 CiteScore 1.7
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.523 SNIP 1.858 CiteScore 1.44
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.467 SNIP 1.65
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.357 SNIP 1.235
Performance Requirements Modeling and Assessment for Active Power Ancillary Services

New sources of ancillary services are expected in the power system. For large and conventional generation units the dynamic response is well understood and detailed individual measurement is feasible, which factors in to the straightforward performance requirements applied today. For secure power system operation, a reliable service delivery is required, yet it may not be appropriate to apply conventional performance requirements to new technologies and methods. The service performance requirements and assessment methods therefore need to be generalized and standardized in order to include future ancillary service sources. This paper develops a modeling method for ancillary services performance requirements, including performance and verification indices. The use of the modeling method and the indices is exemplified in two case studies.

General information
State: Published
Organisations: Center for Electric Power and Energy, Energy System Management, Department of Electrical Engineering, Technical University of Denmark
Authors: Bondy, D. E. M. (Intern), Thavlov, A. (Intern), Tougaard, J. B. M. (Ekstern), Heussen, K. (Intern)
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Phasor Measurement Unit Test and Applications for Small Signal Stability Assessment and Improvement of Power System

The power system is constantly changing and as new technologies are being developed, it is pushing forward towards a decrease in fossil-fuel need. As the conventional generation is being replaced by renewable energy sources (RES) such as wind and solar power, it is expected for the power system to be less predictable. Therefore, the methods used for stability and security assessment will most likely use information from the wide-area measurements systems (WAMS). The work presented in this thesis deals on one hand with the development of test methods and validation of phasor...
measurement units (PMUs) which are considered to be one of the key technologies in WAMS, and on the other hand with the possibility of using PMU measurements together with large wind power plants (WPPs) to help improve the damping of inter area oscillations. To validate the PMUs, a laboratory test setup is assembled. The hardware components are capable of generating, with the required accuracy, the test signals injected in the PMUs. The signals are created according to the requirements defined in the current IEEE C37.118.1-2011 standard, to test the steady-state and dynamic compliance of the PMUs. The performance of the PMUs is evaluated according to the IEEE C37.118.1a2014 amendment to the standard which defines the allowed error limits for the units. It was found that the devices under test did not meet all the specifications of the IEEE C37.118.1a-2014, especially for the dynamic tests. Furthermore, the PMUs were tested under three scenarios that were not covered by the current standard. It was found that two of the scenarios affected the measurement accuracy of the units, while the third did not have a significant impact on the PMU performance.

A full scale converter based wind turbine (WT) model suitable for small-signal stability analysis was developed during the project. The model can be used in both dynamic simulations of the nonlinear system, and it can be linearized together with the entire power system model in order to study the eigenvalues of the system. In this thesis, the WT model was used as an aggregated WPP with the active and reactive power outputs controlled by a Wind Plant Controller (WPC). The WPP was used to help improve the damping of inter-area oscillations. The WPP was equipped with a power oscillation damping (POD) controller which modulated the active power output of the WPP. Two types of POD were considered in the investigation: a conventional power system stabiliser (PSS) type and a phasor POD. Remote PMU measurements were used as input signals for the PODs, and measurement latency was included for comparison. It was found that the PODs had similar performance when there was no latency in the input signals. The phasor POD showed a clear advantage when latency was considered. The reason was that the phasor POD can easily and adaptively compensate for delays in the input signals, while the conventional PSS type uses the lead-lag block to achieve a fixed phase compensation which is chosen during the design stage.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Ghiga, R. (Intern), Nielsen, A. H. (Intern), Wu, Q. (Intern)
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**Phasor Measurement Unit Test and Applications for Small Signal Stability Assessment and Improvement of Power System**
Publication: Research › Ph.D. thesis – Annual report year: 2017

**Phasor Measurement Unit under Interference Conditions**
This paper investigates the performance of Phasor Measurement Units (PMUs) under interference conditions which can appear in a power system and are not tested by the C37.118.1 standard. Three PMUs from different vendors configured for the M-class requirements were used to test three possible interference condition scenarios. In the first scenario, noise is added to the PMU input signal. The test runs a sweep of Signal-to-Noise Ratios (SNR) and the accuracy versus the noise level is obtained. The second scenario injects multiple harmonics with the input to test the influence on accuracy. The last scenario focuses on instrument transformer saturation which leads to a modified waveform injected in the PMU. This test goes through different levels of Current Transformer (CT) saturation and analyzes the effect of saturation on the accuracy of PMUs. The test results show PMU measurements will be degraded when the input signal is distorted by high noise or a saturated current waveform, but is not particularly affected by multiple harmonics. This information can be used when selecting a PMU to ensure it will provide a reliable measurement for the intended use. It can also be used for developing more robust PMUs and applications resistant to degraded measurements.
Interference conditions, Phasor Measurement Unit (PMU), PMU testing

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Phasor model of full scale converter wind turbine for small-signal stability analysis

The small-signal stability analysis of power system electromechanical oscillations is a well-established field in control and stability assessment of power systems. The impact of large wind farms on small-signal stability of power systems has been a topic of high interest in recent years. This study presents a phasor model of full scale converter wind turbines (WTs) implemented in MATLAB/SIMULINK for small-signal stability studies. The phasor method is typically used for dynamic studies of power systems consisting of large electric machines. It can also be applied to any linear system. This represents an advantage in small-signal stability studies, which are based on modal analysis of the linearised model and are usually complemented with dynamic simulations. The proposed model can represent a single WT or an aggregated wind power plant. The implemented model for small-signal stability analysis was tested in the Kundur's two area system. The results show that the proposed WT model is accurately linearised and its impact on power system oscillation is similar to that of previous research findings.

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Authors: Ghiga, R. (Intern), Wu, Q. (Intern), Nielsen, A. H. (Intern)
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Main Research Area: Technical/natural sciences

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Scopus rating (2015): SJR 0.152 SNIP 0.476
Scopus rating (2014): SJR 0.15 SNIP 0.397
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DOIs:
10.1049/joe.2017.0476
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Publication: Research - peer-review › Journal article – Annual report year: 2018

Photonics-assisted wireless link based on mm-wave reconfigurable antennas

The authors report a novel concept for photonics-assisted and broadband optical-wireless indoor networks based on optically-controlled reconfigurable antenna arrays (OCRAAs) and photonic down conversion (PDC) techniques, operating in the 28 and 38 GHz frequency bands. The antenna bandwidth is optically reconfigured by using photoconductive switches. In this way, the optical backhaul can either be used for high data rate transmission and remotely controlling the antenna operation. Experimental results on 40 Mbaud with complex modulation formats up to 64-QAM wireless transmission supported by PDC are successfully reported under 78 dB link budget requirement. Two OCRAAs have been simultaneously tested in an indoor environment at 1.25 Gb/s wireless data signal transmission. The proposed antenna design significantly increases the degrees of freedom, opening new possibilities in the development of antennas for access networks in the mm-wave frequency range.

General information
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Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Electromagnetic Systems, National Institute of Telecommunications, Universidade Federal de Itajuba
Photovoltaics merging with the active integrated grid: Grid integration white paper of the EU PV technology platform, working group on grid integration.

How much is too much? Asking this question with respects to photovoltaics would have seemed absurd just a few years ago. Yet from Japan [1] to Europe to the Americas, loud voices are claiming that Photovoltaics (PV) is reaching excessive levels on the grids or, at least, growing at excessive rates. Economic as well as technical issues are put forward. Indeed, PV power generation has moved in just a decade from a curiosity to a significant part of power systems around the world. Global investment in new PV generation capacity was US$ 173.6 billion in 2013, nearly two thirds of the gross investment in fossil-fuel power generation (US$ 270 billion) [2]. Solar PV is estimated to have provided 0.7% of the global electricity demand in 2013 [3]. The central point in Levelised Cost of Electricity (LCoE) at the beginning of 2014 was about US$ 150 per MWh; there is now a significant overlap between the LCOE ranges of PV electricity and conventional power generation (natural gas combined-cycle turbines, coal, nuclear) [2], which means that solar PV can be cost-competitive at the point of generation in some regions. As PV is essentially a distributed energy resource, it clashes with the centralised architecture of existing grids. Together with other renewable energy sources, it challenges the business models of incumbents in the power sector, be they network operators or power generators. Some of these incumbents may be tempted to exaggerate the negative impact of PV, and minimise its benefits. Others have already taken radical steps to adapt to this new situation [4]. The benefits of PV generation in terms of environmental impact and energy security are well documented [5]. This is why the European PV Technology Platform aims at enabling the massive deployment of photovoltaics into the power system. It acknowledges the technical challenges that come with it. We believe that these challenges are best addressed through rational assessment of the situation and co-operation between the power and PV industries. With this paper we set to clarify the terms of this discussion: how is penetration of PV into power grids evaluated? What are the current levels? Which barriers may prevent increasing these levels? Which concepts have been put forward to open these barriers? Which benefits can PV systems provide for existing and new grids? Immediate recommendations are formulated in this paper; we also expect that further collaboration with the power sector will lead to more robust knowledge and to a power system with PV at its heart.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Centre Suisse d'Electronique et de Microtechnique S.A., Enel Green Power SpA, ENEA Centro Ricerche Casaccia, University of Cyprus, Austrian Institute of Technology, ENEA Portici Research Center, SINTEF, EURAC Research, Centre for Renewable Energy Sources
Authors: Alet, P. (Ekstern), Baccaro, F. (Ekstern), De Felice, M. (Ekstern), Efthymiou, V. (Ekstern), Mayr, C. (Ekstern), Graditi, G. (Ekstern), Juel, M. (Ekstern), Moser, D. (Ekstern), Petitta, M. (Ekstern), Tselepis, S. (Ekstern), Yang, G. (Intern)
Number of pages: 19
Publication date: 2017

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Piezoelectric transformers: Control

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Automation and Control
Authors: Zsurszan, T. (Intern), Andersen, M. A. E. (Intern), Andersen, N. A. (Intern), Zhang, Z. (Intern)
Number of pages: 20
Publication date: 2017

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Original language: English
Main Research Area: Technical/natural sciences
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Pitch matching in bimodal cochlear implant patients: Effects of frequency, spectral envelope, and level

This study systematically investigated the effects of frequency, level, and spectral envelope on pitch matching in twelve bimodal cochlear implant (CI) users. The participants were asked to vary the frequency and level of a pure or complex tone (adjustable sounds) presented in the nonimplanted ear to match the pitch and loudness of different reference stimuli presented to the implanted ear. Three reference sounds were used: single electrode pulse trains, pure tones, and piano notes. The data showed a significant effect of the frequency and complexity of the reference sounds. No significant effect of the level of the reference sounds was found. The magnitude of effect of frequency was compressed in the implanted ear: on average a difference of seven semitones in the non-implanted ear induced the same pitch change as a difference of 19 to 24 semitones for a stimulus presented to the implanted ear. The spectral envelope of the adjustable sound presented to the non-implanted ear also had a significant effect. The matched frequencies were higher by an average of six semitones for the pure tone compared to a complex tone. Overall, the CI listeners might have matched the stimuli based on timbre characteristics such as brightness.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, The Bionics Institute, The Bionic Ear Institute
Authors: Maarefvand, M. (Ekstern), Blamey, P. J. (Ekstern), Marozeau, J. (Intern)
Pages: 2854–2865
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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Playware ABC 2: a Disruptive Technology for Global Development

The Playware ABC concept is used to create solutions that are usable by all kinds of users and contexts in our globalized society. In this paper, the Playware ABC can be exemplified with the development of the modular interactive tiles for health prevention and rehabilitation of anybody, anywhere, anytime. The paper gives examples of how playware becomes a disruptive technology for global development, for instance in the health sector. For instance, in Tanzania doctors and community-based rehabilitation workers are constructing and combining modular playware tiles to easily create the right kind of intervention for their patients in both urban and deep rural areas in Tanzania.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Centre for Playware
Authors: Lund, H. H. (Intern)
Number of pages: 4
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Main Research Area: Technical/natural sciences

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Journal: Journal of Robotics Networks and Artificial Life
Volume: 3
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ISSN (Print): 2352-6386
Ratings:
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Web of Science (2017): Indexed yes
Playware ABC: Engineering Play for Everybody
This paper describes the Playware ABC concept, and how it allows anybody, anywhere, anytime to be building bodies and brains, which facilitates users to construct, combine and create. The Playware ABC concept focuses engineering and IT system development on creating solutions that are usable by all kinds of users and contexts. The result becomes solutions, often based on modular technologies that are highly flexible and adaptable to different contexts, users, and applications.

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Web of Science (2017): Indexed yes

Plural three-wave resonances of space charge wave harmonics in transit section of klystron-type two-stream FEL with helical electron beam
We have carried out the research of plural three-wave resonances of space charge wave (SCW) harmonics in the transit section of the klystron type two-stream superheterodyne free-electron laser (TSFEL) with helical electron beam in cubic non-linear approximation. We have found out that two-stream instability critical frequency increases with increasing of two-stream electron beam input angle in the focusing longitudinal magnetic field. Due to this fact, the frequency domain in which plural three-wave parametric resonances of SCW harmonics take place increases. The two-stream instability growth rate also increases in helical electron beams with increasing of the beam input angle. Therefore, the saturation lengths in TSFELs with helical electron beams are shorter compared to TSFELs utilizing straight electron beams. We have shown that SCWs with broad frequency spectrum form in two-velocity helical relativistic electron beam due to plural three-wave parametric resonances. We have demonstrated that klystron-type TSFEL with helical electron beam can be used as a source of powerful multiharmonic electromagnetic waves in millimeter-infrared wavelength ranges.
Portable Ultrasound Imaging

This PhD project investigates hardware strategies and imaging methods for hand-held ultrasound systems. The overall idea is to use a wireless ultrasound probe linked to general-purpose mobile devices for the processing and visualization. The approach has the potential to reduce the upfront costs of the ultrasound system and, consequently, to allow for a wide-scale utilization of diagnostic ultrasound in any medical specialties and out of the radiology department. The first part of the contribution deals with the study of hardware solutions for the reduction of the system complexity. Analog and digital beamforming strategies are simulated from a system-level perspective. The quality of the B-mode image is evaluated and the minimum specifications are derived for the design of a portable probe with integrated electronics in-handle. The system is based on a synthetic aperture sequential beamforming approach that allows to significantly reduce the data rate between the probe and processing unit. The second part investigates the feasibility of vector flow imaging in a hand-held ultrasound system. Vector flow imaging overcomes the limitations of conventional imaging methods in terms of flow angle compensation. Furthermore, high frame rate can be obtained by using synthetic aperture focusing techniques. A method is developed combining synthetic aperture sequential beamforming and directional transverse oscillation to achieve the wireless transmission of the data along with a relatively inexpensive 2-D velocity estimation. The performance of the method is thoroughly assessed through simulations and measurements, and in vivo investigations are carried out to show its potential in presence of complex flow dynamics. A sufficient frame rate is achieved to allow for the visualization of vortices in the carotid bifurcation. Furthermore, the method is implemented on a commercially available tablet to evaluate the real-time processing performance in the built-in GPU with concurrent wireless transmission of the data. Based on the demonstrations in this thesis, a flexible framework can be implemented with performance that can be scaled to the needs of the user and according to the computing resources available. The integration of high-frame-rate vector flow imaging in a hand-held ultrasound scanner, in addition, has the potential to improve the operator’s workflow and opens the way to new possibilities in the clinical practice.
Position Dependence of Fractional Derivative Models for Loudspeaker Voice Coils with Lossy Inductance

Commonly used models of moving-coil loudspeaker voice coils, which include effects from eddy current losses, are either inaccurate or contain an abundance of parameters, and are difficult to extend to the nonlinear domain. On the contrary, fractional derivative models accurately describe the frequency and position dependence of the lossy inductance, with meaningful connections to the underlying physics, while keeping the number of parameters low. These fractional derivatives are also compatible with state-space polynomial methods of modeling nonlinear behavior. It is shown that the fractional order derivative approaches a value of 1, corresponding to an ideal inductance, when the voice coil is completely outside the magnetic system. Finally, the developed model reveals details about the effect of conductive voice coil formers.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: King, A. W. (Intern), Agerkvist, F. T. (Intern)
Number of pages: 10
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 142nd Audio Engineering Convention
Publisher: Audio Engineering Society
Article number: 9723
Main Research Area: Technical/natural sciences
Conference: 142nd Audio Engineering Society Convention, Berlin, Germany, 20/05/2017 - 20/05/2017
Source: PublicationPreSubmission
Source-ID: 132538357
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Positioning the laparoscopic camera with industrial robot arm

This paper introduces a solution for the movement control of the laparoscopic camera employing a teleoperated robotic assistant. The project propose an autonomous robotic solution based on an industrial manipulator, provided with a modular software which is applicable to large scale. The robot arm is envisioned to orient and move the optic device in direction of a fixed point, the incision on the wall of the abdominal cavity, accordingly to the surgeon's request. To manage the movements of the laparoscope around the fulcrum point a Cartesian control strategy is exploited. A six degrees of freedom industrial robot arm is designated to accomplish this manipulation task. The software is implemented in ROS in order to facilitate future extensions. The experimental results shows a manipulator capable of moving fast and smoothly the surgical tool around a remote center of motion.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control
Authors: Capolei, M. C. (Intern), Wu, H. (Intern), Andersen, N. A. (Intern), Ravn, O. (Intern)
Pages: 138-143
Publication date: 2017

Host publication information
Title of host publication: 2017 3rd International Conference on Control, Automation and Robotics, ICCAR 2017
Publisher: IEEE
Article number: 7942675
ISBN (Electronic): 9781509060870
Main Research Area: Technical/natural sciences
Conference: 2017 3rd International Conference on Control, Automation and Robotics, Nagoya, Japan, 24/04/2017 - 24/04/2017
Cartesian robot control, Laparoscopy, Medical robotics, Robot arm, ROS, Telerobotics
DOIs: 10.1109/ICCAR.2017.7942675
Source: Scopus
Source-ID: 85022347080
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Potential Energy Flexibility for a Hot-Water Based Heating System in Smart Buildings Via Economic Model Predictive Control

This paper studies the potential of shifting the heating energy consumption in a residential building to low price periods based on varying electricity price signals suing Economic Model Predictive Control strategy. The investigated heating
system consists of a heat pump incorporated with a hot water tank as active thermal energy storage, where two optimization problems are integrated together to optimize both the heat pump electricity consumption and the building heating consumption. A sensitivity analysis for the system flexibility is examined. The results revealed that the proposed controller can successfully achieve significant shifting potentials compared to a baseline case.

**General information**

State: Published

Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, University of Oldenburg, Oestfold University College, Universidad de Zaragoza, Sichuan University

Authors: Ahmed, A. M. A. (Ekstern), Zong, Y. (Intern), Mihet-Popa, L. (Ekstern), Bruna, J. (Ekstern), Agert, C. (Ekstern), Xiao, X. (Ekstern)

Number of pages: 5

Pages: 1-5

Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of 2017 International Symposium on Computer Science and Intelligent Controls

Publisher: IEEE

ISBN (Print): 978-1-5386-2941-3

Main Research Area: Technical/natural sciences

Conference: 2017 International Symposium on Computer Science and Intelligent Controls, Budapest, Hungary, 20/10/2017 - 20/10/2017


**DOIs:**

10.1109/ISCSIC.2017.14

**Relations**

Projects:

Potential Energy Flexibility for a Hot-Water Based Heating System in Smart Buildings Via Economic Model Predictive Control

Source: FindIt

Source-ID: 2396620466

Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

**Practical Aspects of Preamplifier Designs for 13C Imaging.**

**General information**

State: Published

Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Electromagnetic Systems, Technical University of Denmark

Authors: Johansen, D. H. (Intern), Sánchez-Heredia, J. D. (Ekstern), Zhurbenko, V. (Intern), Ardenkjær-Larsen, J. H. (Intern)

Number of pages: 5

Publication date: 2017

Event: Abstract from ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.

Main Research Area: Technical/natural sciences

Electronic versions:

Johansen_ISMRM17_LNA_final.pdf

Source: PublicationPreSubmission

Source-ID: 131964723

Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Predicting consonant recognition and confusions in normal-hearing listeners**

The perception of consonants in background noise has been investigated in various studies and was shown to critically depend on fine details in the stimuli. In this study, a microscopic speech perception model is proposed that represents an extension of the auditory signal processing model by Dau, Kollmeier, and Kohlrausch [(1997). J. Acoust. Soc. Am. 102, 2892–2905]. The model was evaluated based on the extensive consonant perception data set provided by Zaar and Dau [(2015). J. Acoust. Soc. Am. 138, 1253–1267], which was obtained with normal-hearing listeners using 15 consonant-vowel combinations mixed with white noise. Accurate predictions of the consonant recognition scores were obtained across a large range of signal-to-noise ratios. Furthermore, the model yielded convincing predictions of the consonant confusion scores, such that the predicted errors were clustered in perceptually plausible confusion groups. The large predictive power of the proposed model suggests that adaptive processes in the auditory preprocessing in combination with a cross-correlation based template-matching back end can account for some of the processes underlying consonant perception in normal-hearing listeners. The proposed model may provide a valuable framework, e.g., for investigating the
effects of hearing impairment and hearing-aid signal processing on phoneme recognition.
Predicting effects of additive noise and hearing-instrument signal processing on consonant recognition and confusions

**General information**
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Zaa, J. (Intern), Dau, T. (Intern)
Number of pages: 1
Publication date: 2017
Event: Poster session presented at 9th Speech in Noise Workshop, Oldenburg, Germany.
Main Research Area: Technical/natural sciences

Electronic versions:

SpIN_poster_v02.pdf
Source: PublicationPreSubmission
Source-ID: 129907689
Publication: Research › Poster – Annual report year: 2017

Predicting effects of hearing-instrument signal processing on consonant perception

This study investigated the influence of hearing-aid (HA) and cochlear-implant (CI) processing on consonant perception in normal-hearing (NH) listeners. Measured data were compared to predictions obtained with a speech perception model [Zaar and Dau (2017). J. Acoust. Soc. Am. 141, 1051–1064] that combines an auditory processing front end with a correlation-based template-matching back end. In terms of HA processing, effects of strong nonlinear frequency compression and impulse-noise suppression were measured in 10 NH listeners using consonant-vowel stimuli. Regarding CI processing, the consonant perception data from DiNino et al. [(2016). J. Acoust. Soc. Am. 140, 4404-4418] were considered, which were obtained with noise-vocoded vowel-consonant-vowel stimuli in 12 NH listeners. The inputs to the model were the same stimuli as were used in the corresponding experiments. The model predictions obtained for the two data sets showed a large agreement with the perceptual data both in terms of consonant recognition and confusions, demonstrating the model's sensitivity to supra-threshold effects of hearing-instrument signal processing on consonant perception. The results could be useful for the evaluation of hearing-instrument processing strategies, particularly when combined with simulations of individual hearing impairment.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Sonova AG, University of Washington
Authors: Zaa, J. (Intern), Schmitt, N. (Ekstern), Derleth, R. (Ekstern), DiNino, M. (Ekstern), Arenberg, J. G. (Ekstern), Dau, T. (Intern)
Number of pages: 11
Pages: 3216-26
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of the Acoustical Society of America
Predicting effects of hearing-instrument signal processing on consonant recognition and confusions

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Zaar, J. (Intern), Dau, T. (Intern)
Pages: 1438-1441
Publication date: 2017

Host publication information
Title of host publication: Proceedings of DAGA 2017
Publisher: Deutsche Gesellschaft für Akustik e.V.
Main Research Area: Technical/natural sciences
Conference: 43. Jahrestagung für Akustik, Kiel, Germany, 06/03/2017 - 06/03/2017
Source: PublicationPreSubmission
Source-ID: 136921613
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Prediction of Motion Induced Image Degradation Using a Markerless Motion Tracker
In this work a markerless motion tracker, TCL2, is used to predict image quality in 3D T1 weighted MPRAGE MRI brain scans. An experienced radiologist scored the image quality for 172 scans as being usable or not usable, i.e. if a repeated scan was required. Based on five motion parameters, a classification algorithm was trained and an accuracy for identifying not usable images of 95.9% was obtained with a sensitivity of 91.7% and specificity of 96.3%. This work shows the feasibility of the markerless motion tracker for predicting image quality with a high accuracy.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Copenhagen University Hospital
Authors: Olsen, R. M. (Intern), Johannesen, H. H. (Ekstern), Henriksen, O. M. (Forskerdatabase), Marner, L. (Ekstern), Olesen, O. V. (Intern)
Publication date: 2017
Event: Abstract from ISMRM 25th Annual Meeting & Exhibition, Honolulu, United States.
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Prediction of speech intelligibility based on a correlation metric in the envelope power spectrum domain
A powerful tool to investigate speech perception is the use of speech intelligibility prediction models. Recently, a model was presented, termed correlation-based speechbased envelope power spectrum model (sEPSMcorr) [1], based on the auditory processing of the multi-resolution speech-based Envelope Power Spectrum Model (mr-sEPSM) [2], combined with the correlation back-end of the Short-Time Objective Intelligibility measure (STOI) [3]. The sEPSMcorr can accurately predict NH data for a broad range of listening conditions, e.g., additive noise, phase jitter and ideal binary mask processing.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Relano-Iborra, H. (Intern), May, T. (Intern), Zaar, J. (Intern), Scheidiger, C. (Intern), Dau, T. (Intern)
Number of pages: 1
Publication date: 2017
Event: Poster session presented at 40th MidWinter Meeting of the Association for Research in Otolaryngology, Baltimore, United States.
Predictive Control of Wind Turbine for Load Reduction during Ramping Events

With increasing penetration of wind power, the impact of its intermittence and volatility on power systems becomes more severe. A predictive control strategy for wind turbines (WTs) is proposed to deal with wind power ramping events and reduce WT load on the blades. The blade load model is based on the Blade Element Momentum (BEM) theory. The generator speed and pitch angle are simultaneously regulated to realize the control objectives. A two-stage optimization is designed in order to reduce the computational complexity. The objectives of the first stage are minimizing the ramping rate and maximizing the power generation. A trade-off is made between the two contradictory objectives by setting weight coefficients. The second stage reduces the WT load and meanwhile guarantees the power reference from the first stage is tracked. Feedback is designed based on neural network prediction to compensate the error of the prediction model. Case studies with a 1.5 MW WT were conducted to demonstrate the efficacy of the proposed predictive control strategy. Simulation results show that the proposed control can reduce the WT load during ramping events and the risk of ramping events.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Shandong University
Authors: Liu, W. (Ekstern), Li, C. (Ekstern), Liu, Y. (Ekstern), Wu, Q. (Intern)
Pages: 135-145
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 93
ISSN (Print): 0142-0615
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 4.63 SJR 1.276 SNIP 1.662
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.3 SJR 1.472 SNIP 1.843
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.441 SNIP 2.031 CiteScore 3.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.328 SNIP 2.312 CiteScore 4.34
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.231 SNIP 2.731 CiteScore 4.54
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.106 SNIP 2.758 CiteScore 4.37
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.985 SNIP 2.394 CiteScore 3.46
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Preliminary investigation of the categorization of gaps and overlaps in turn-taking interactions: Effects of noise and hearing loss

Normal conversation requires interlocutors to monitor the ongoing acoustic signal to judge when it is appropriate to start talking. Categorical thresholds for gaps and overlaps in turn-taking interactions were measured for normal-hearing and hearing-impaired listeners in both quiet and multitalker babble (+6 dB SNR). The slope of the categorization functions were significantly shallower for hearing impaired listeners and in the presence of background noise. Moreover, the categorization threshold for overlaps increased in background noise.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, GN ReSound A/S
Authors: Sørensen, A. J. (Intern), Weisser, A. (Ekstern), MacDonald, E. (Intern)
Number of pages: 8
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the International Symposium on Auditory and Audiological Research
ISBN (Print): 978-87-990013-6-1
Main Research Area: Technical/natural sciences
Conference: International Symposium on Auditory and Audiological Research, Nyborg, Denmark, 23/08/2017 - 23/08/2017
Electronic versions:

Bibliographical note
Source: PublicationPreSubmission
Source-ID: 145258987
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018
Preparation of Radical-Free Hyperpolarized Water using Photo-induced non-persistent Radicals on a "SpinLab-like" dissolution-DNP Polarizer

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Technical University of Denmark
Number of pages: 1
Publication date: 2017
Event: Abstract from 58th Experimental Nuclear Magnetic Resonance Conference, Pacific Grove, , United States.
Main Research Area: Technical/natural sciences
Electronic versions:
ENC_2017_abstract_Capozzi.pdf
Source: PublicationPreSubmission
Source-ID: 130573835
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Preserving spatial perception in rooms using direct-sound driven dynamic range compression
Fast-acting hearing-aid compression systems typically distort the auditory cues involved in the spatial perception of sounds in rooms by enhancing low-level reverberant energy portions of the sound relative to the direct sound. The present study investigated the benefit of a direct-sound driven compression system that adaptively selects appropriate time constants to preserve the listener's spatial impression. Specifically, fast-acting compression was maintained for time-frequency units dominated by the direct sound while the processing of the compressor was linearized for time-frequency units dominated by reverberation. This compression scheme was evaluated with normal-hearing listeners who indicated their perceived location and distribution of sound images in the horizontal plane for virtualized speech. The experimental results confirmed that both independent compression at each ear and linked compression across ears resulted in broader, sometimes internalized, sound images as well as image splits. In contrast, the linked direct-sound driven compression system provided the listeners with a spatial perception similar to that obtained with linear processing that served as the reference condition. The independent direct-sound driven compressor created a sense of movement of the sound between the two ears, suggesting that preserving the interaural level differences via linked compression is advantageous with the proposed direct-sound driven compression scheme.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Hassager, H. G. (Intern), May, T. (Intern), Wiinberg, A. (Intern), Dau, T. (Intern)
Pages: 4556–4566
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 6
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 1.77 SJR 0.695 SNIP 1.224
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.83 SJR 0.819 SNIP 1.271
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.854 SNIP 1.416 CiteScore 1.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.887 SNIP 1.402 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.707 SNIP 1.937 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.771 SNIP 1.619 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.686 SNIP 1.624 CiteScore 1.68
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.734 SNIP 1.511
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.778 SNIP 1.692
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.83 SNIP 1.657
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.838 SNIP 1.635
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.739 SNIP 1.678
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.946 SNIP 1.728
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.77 SNIP 1.761
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.875 SNIP 1.695
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.785 SNIP 1.572
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.727 SNIP 1.483
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.639 SNIP 1.404
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.56 SNIP 1.306
Original language: English
Electronic versions:
  pdf_archiveJASMANvol_141iss_64556_1.pdf
DOIs:
  10.1121/1.4984040

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C 2017 Author(s). All article content, except where otherwise noted, is licensed under a Creative Commons Attribution (CC BY) license.
Source: PublicationPreSubmission
Source-ID: 133122827
Publication: Research - peer-review › Journal article – Annual report year: 2017
Pre-treatment of Biomass By Rolling - A Combined Experimental and Numerical Analysis

Pre-treatment of bulk straw material by rolling is studied as a possible method to prepare for subsequent biogas production. A combined experimental and theoretical study is presented. A pilot rolling mill with a double screw feeder is designed and constructed for crushing of bulk straw. Experiments show that the roll speed and the roll reduction should be chosen within a specific range depending on the injection screw speed to avoid blocking or insufficient compaction. A mechanical testing procedure of the bulk straw material including closed die compaction testing as well as simple upsetting of pre-compacted billets of straw is carried out based on which a mathematical model for the yield surface is determined fitting to a geological cap model for porous material similar to the Drucker-Prager spherical cap model. An experimental test campaign is carried out to determine the feasible process window for pre-treatment of wheat straw by roll pressing varying the feed, the roll gap, the roll speed and the moisture content of the bulk straw.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Mechanical Engineering, Manufacturing Engineering, TK Energi AS
Authors: Hansen, K. S. (Intern), Ravn, C. (Intern), Nielsen, E. K. (Intern), Koch, T. (Ekstern), Porte, C. (Ekstern), Christiansen, P. (Intern), Rasmussen, A. A. (Intern), Bay, N. O. (Intern)
Pages: 492 - 499
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 25th European Biomass Conference and Exhibition
ISBN (Print): 978-88-89407-17-2
Main Research Area: Technical/natural sciences
Conference: 25th European Biomass Conference and Exhibition, Stockholm, Sweden, 12/06/2017 - 12/06/2017
Pre-treatment of biomass, Roll pressing of straw, Process window
Electronic versions:
pre_treatment_of_biomass_by_rolling_a_combined_experimental_and_numerical_analysis.pdf
DOIs:
10.5071/25thEUBCE2017-2CO.13.1
Source: PublicationPreSubmission
Source-ID: 134459053
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Probabilistic Forecasting of Photovoltaic Generation: An Efficient Statistical Approach

This letter proposes a novel efficient probabilistic forecasting approach to accurately quantify the variability and uncertainty of the power production from photovoltaic (PV) systems. Distinguished from most existing models, a linear programming based prediction interval construction model for PV power generation is proposed based on extreme learning machine and quantile regression, featuring high reliability and computational efficiency. The proposed approach is validated through the numerical studies on PV data from Denmark.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Tsinghua University, Hong Kong Polytechnic University
Authors: Wan, C. (Ekstern), Lin, J. (Ekstern), Song, Y. (Ekstern), Xu, Z. (Ekstern), Yang, G. (Intern)
Pages: 2471 - 2472
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Power Systems
Volume: 32
Issue number: 3
ISSN (Print): 0885-8950
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.58 SJR 2.742 SNIP 2.662
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 8.17 SJR 3.368 SNIP 3.584
Probabilistic Harmonic Modeling of Wind Power Plants

A probabilistic sequence domain (SD) harmonic model of a grid-connected voltage-source converter is used to estimate harmonic emissions in a wind power plant (WPP) comprised of Type-IV wind turbines. The SD representation naturally partitioned converter generated voltage harmonics into those with deterministic phase and those with probabilistic phase. A case study performed on a string of ten 3MW, Type-IV wind turbines implemented in PSCAD was used to verify the probabilistic SD harmonic model. The probabilistic SD harmonic model can be employed in the planning phase of WPP projects to assess harmonic emissions to a given quantile, potentially avoiding an over-engineering of passive filters.
otherwise needed to satisfy infrequently occurring cases.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Siemens Wind Power A/S
Authors: Guest, E. (Intern), Jensen, K. H. (Ekstern), Rasmussen, T. W. (Intern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 16th Wind Integration Workshop
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 16th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power Plants, Berlin, Germany, 25/10/2017 - 25/10/2017
Electronic versions:
WIW17_paper_EmersonGuest.pdf
Source: PublicationPreSubmission
Source-ID: 138660004
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Probing of biochemical pathways in clonal pancreatic β–cells by quantitative dDNP of metabolite extracts

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, University of Copenhagen
Authors: Malinowski, R. M. (Intern), Ghiasi, S. M. (Ekstern), Mandrup-Poulsen, T. (Ekstern), Jensen, P. R. (Intern), Ardenkjær-Larsen, J. H. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from EUROMAR 2017, Warsaw, Poland.
Main Research Area: Technical/natural sciences
Electronic versions:
EUROMAR2017RonjaMalinowski.pdf

Quality factor enhancement in photonic crystal slabs by manipulation of the ring of exceptional points

Presently, we investigate the influence of the extent of a ring of exceptional points on the Q-factor of three-dimensional photonic crystal slabs. By changing the thickness of the slab, the extent of the ring of exceptional points is varied, allowing us to recover the Dirac cones in open, non-Hermitian systems. In this case, three bound states in the continuum are exhibited close to the Gamma-point. For an optimized thickness of the slab, the associated Q-factors are found to grow rapidly with the size of the slab. The present results may lead to novel, small area and high Q-factor photonic crystal surface-emitting lasers.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Department of Photonics Engineering, Nanophotonics Theory and Signal Processing
Authors: Kaminski, P. M. (Intern), Taghizadeh, A. (Intern), Breinbjerg, O. (Intern), Mørk, J. (Intern), Arslanagic, S. (Intern)
Pages: 11-12
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the International Conference on Numerical Simulation of Optoelectronic Devices, Nusod
Publisher: IEEE
Main Research Area: Technical/natural sciences
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Quantifying Biochemical Activities in Living Cells with $^{13}$C dDNP NMR

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance
Authors: Jensen, P. R. (Intern), Karlsson, M. (Intern), Capozzi, A. (Intern), Ardenkjær-Larsen, J. H. (Intern), Lerche, M. H. (Intern)
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Main Research Area: Technical/natural sciences
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Queue-based modelling and detection of parameters involved in stroke outcome
We designed a queue-based model, and investigated which parameters are of importance when predicting stroke outcome. Medical record forms have been collected for 57 ischemic stroke patients, including medical history and vital sign measurement along with neurological scores for the first twenty-four hours of admission. The importance of each parameter is identified using multiple regression combined with a circular queue to iteratively fit outcome. Out of 39 parameters, the model isolated 14 which combined could estimate outcome with a root mean square error of 1.69 on the Scandinavian Stroke Scale, where outcome for patients were $36.75 \pm 10.99$. The queue-based model integrating multiple linear regression shows promising results for automatic selection of significant medically relevant parameters.

Real-time 2.5 Gbit/s ultra-wideband transmission using a Schottky diode-based envelope detector
An experimental demonstration of 2.5 Gbit/s real-time ultra-wideband transmission is presented, using a Schottky diode-based envelope detector fabricated ad-hoc using microstrip technology on a Rogers6002 substrate and surface-mount components. Real-time transmission with a BER below FEC threshold is achieved for 20 cm of wireless transmission at 2.5 Gbit/s and 50 cm at 1.25 Gbit/s.
Real-Time Congestion Management in Distribution Networks by Flexible Demand Swap

In addition to the day-ahead congestion management in distribution networks, the real-time congestion management is very important because many unforeseen events can occur at the real operation time, e.g. loss of generation of distributed energy resources (DERs) or inaccurate forecast of energy consumption or production. Flexibility service from demand will be a good option to solve the real-time congestions if the cost of activating the flexibility service is fully addressed. This paper proposes a new method, namely “swap”, to employ the flexibility service from electric vehicles (EVs) and heat pumps (HPs) for real time congestion management. The swap method can maintain the power balance of the system and avoid the imbalance cost of activating the flexibility service. An algorithm for forming swaps through optimal power flow (OPF) and mixed integer linear programming (MILP) is proposed to implement the swap method. Case studies were carried out to validate the efficacy of the proposed swap method for real time congestion management and the proposed algorithm for forming swaps. The settlement process for the swaps in different markets is analyzed.

General information

State: Accepted/In press
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Huang, S. (Intern), Wu, Q. (Intern)
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Scopus rating (2017): CiteScore 9.02 SJR 2.854 SNIP 2.995
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Scopus rating (2013): SJR 2.581 SNIP 4.642 CiteScore 9.88
ISI indexed (2013): ISI indexed no
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Scopus rating (2012): SJR 1.797 SNIP 6.273 CiteScore 13.33
**Real-time estimation of eye gaze by in-ear electrodes**

Cognitive control of a hearing aid is the topic for several ongoing studies. The relevance of these studies should be seen in the light of inadequate steering of current hearing aids. While most studies are concerned with auditory attention tracking from the electroencephalogram (EEG), a complimentary approach may be to use visual attention tracking to steer the devices. Visual attention may be characterized by gaze direction, which can be obtained by electrooculography (EOG). EOG may be recorded from electrodes placed in the ear canal, termed EarEOG. To test the comparison of conventional EOG and EarEOG recordings, we conducted two experiments with six subjects. In the first experiment, the subjects were instructed to follow a moving dot on the screen moving in large saccades. In the second experiment, there were five large targets, and within each target, the dot had minor movements. When comparing conventional EOG and EarEOG, correlations of 0.9 and 0.91 with standard deviations of 0.02 were obtained for the two experiments respectively. To assess the feasibility of using EarEOG in real-time, correlation between EarEOG and the timecourse of the dot position was performed. When both signals were filtered with the same real-time applicable filter, correlations of 0.83 and 0.85 with standard deviations of 0.09 and 0.05 were found respectively to the two experiments. In conclusion, this study provides motivational aspects of using EarEOG to estimate eye gaze, as well as it identifies important future challenges in real-time applications to steer external devices such as a hearing aid.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Eriksholm Research Centre
Authors: Favre-Félix, A. (Intern), Graversen, C. (Ekstern), Dau, T. (Intern), Lunner, T. (Ekstern)
Number of pages: 4
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Main Research Area: Technical/natural sciences
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**Real-time Implementation of Synthetic Aperture Vector Flow Imaging on a Consumer-level Tablet**

In this work, a 2-D vector flow imaging (VFI) method based on synthetic aperture sequential beamforming (SASB) and directional transverse oscillation is implemented on a commercially available tablet. The SASB technique divides the beamforming process in two parts, whereby the required data rate between the probe and back-end can be reduced by a factor of 64 compared to conventional delay-and-sum focusing. The lowered data rate enables real-time wireless transfer for both B-mode and VFI data. In the present setup, element data were acquired from a straight vessel with the SARUS research scanner and processed by a first-stage beamformer in a fixed focus. The data were subsequently transferred to an HTC Nexus 9 tablet through an ASUS RT-AC68U Wi-Fi router to simulate a wireless probe. The second-stage beamforming of the B-mode and flow data and the velocity estimation were implemented on the tablet’s built-in GPU (Nvidia Tegra K1) through the OpenGL ES 3.1 API. Real-time performance was achieved with rates up to 26 VFI frames per second (38 ms/frame) for concurrent processing and Wi-Fi transmission.

**General information**

State: Published
Real-Time Trading Strategies of Proactive DISCO with Heterogeneous DG Owners.

This paper presents a methodology to obtain the optimal trading strategies between the proactive distribution company (PDISCO), heterogeneous distributed generation owners (DGOs) and wholesale market in a real-time trading framework. In this framework, the PDISCO’s decisions cover the power procurements from DGOs and the transactions within the real-time market. A one-leader multi-follower-type bilevel model is proposed to embody the PDISCO-DGO gaming structure. The upper-level (UL) problem is to maximize the PDISCO’s profit, while the lower-level (LL) problem indicates the profit maximization per DGO. Since the UL problem is non-linear and non-convex and the LL problems are linear and convex, we reformulate the proposed model to a solvable mathematical program with equilibrium constraints (MPEC) by an equivalent primal-dual approach. The numerical results of the case studies show the effectiveness and scalability of the proposed model.
There is an interest in introducing topology optimization techniques in the design process of structural-acoustic systems. In topology optimization, the design space must be finely meshed in order to obtain an accurate design, which results in large numbers of degrees of freedom when designing complex 3D parts. The optimization process can therefore become highly time consuming due to the need to solve a large system of equations at each iteration. Projection-based parametric Model Order Reduction (pMOR) methods have successfully been applied for reducing the computational cost of material or size optimization in large vibroacoustic models; however, new challenges are encountered when dealing with topology optimization. Since a design parameter per element is considered, the total number of design variables becomes very large; this poses a challenge to most existing pMOR techniques, which suffer from the curse of dimensionality. Moreover, the fact that the nature of the elements changes throughout the optimization (material to void or material to air) makes it more difficult to create a global basis that is accurate throughout the whole design space. In this work, these challenges are investigated and different approaches to achieving an efficient reduction technique for such problems are discussed.
RE-Europe, a large-scale dataset for modeling a highly renewable European electricity system
Future highly renewable energy systems will couple to complex weather and climate dynamics. This coupling is generally not captured in detail by the open models developed in the power and energy system communities, where such open models exist. To enable modeling such a future energy system, we describe a dedicated large-scale dataset for a renewable electric power system. The dataset combines a transmission network model, as well as information for generation and demand. Generation includes conventional generators with their technical and economic characteristics, as well as weather-driven forecasts and corresponding realizations for renewable energy generation for a period of 3 years. These may be scaled according to the envisioned degrees of renewable penetration in a future European energy system. The spatial coverage, completeness and resolution of this dataset, open the door to the evaluation, scaling analysis and replicability check of a wealth of proposals in, e.g., market design, network actor coordination and forecasting of renewable power generation.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Energy Analytics and Markets
Authors: Jensen, T. V. (Intern), Pinson, P. (Intern)
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Relations Between Self-Reported Daily-Life Fatigue, Hearing Status, and Pupil Dilation During a Speech Perception in Noise Task
People with hearing impairment are likely to experience higher levels of fatigue because of effortful listening in daily communication. This hearing-related fatigue might not only constrain their work performance but also result in withdrawal from major social roles. Therefore, it is important to understand the relationships between fatigue, listening effort, and hearing impairment by examining the evidence from both subjective and objective measurements. The aim of the present study was to investigate these relationships by assessing subjectively measured daily-life fatigue (self-report questionnaires) and objectively measured listening effort (pupillometry) in both normally hearing and hearing-impaired participants. Twenty-seven normally hearing and 19 age-matched participants with hearing impairment were included in this study. Two self-report fatigue questionnaires Need For Recovery and Checklist Individual Strength were given to the participants before the test session to evaluate the subjectively measured daily fatigue. Participants were asked to perform a speech reception threshold test with single-talker masker targeting a 50% correct response criterion. The pupil diameter was recorded during the speech processing, and we used peak pupil dilation (PPD) as the main outcome measure of the pupillometry. No correlation was found between subjectively measured fatigue and hearing acuity, nor was a group difference found between the normally hearing and the hearing-impaired participants on the fatigue scores. A significant negative correlation was found between self-reported fatigue and PPD. A similar correlation was also found between Speech Intelligibility Index required for 50% correct and PPD. Multiple regression analysis showed that factors representing “hearing acuity” and “self-reported fatigue” had equal and independent associations with the PPD during the
speech in noise test. Less fatigue and better hearing acuity were associated with a larger pupil dilation. To the best of our knowledge, this is the first study to investigate the relationship between a subjective measure of daily-life fatigue and an objective measure of pupil dilation, as an indicator of listening effort. These findings help to provide an empirical link between pupil responses, as observed in the laboratory, and daily-life fatigue. This is an open-access article distributed under the terms of the Creative Commons Attribution-Non Commercial-No Derivatives License 4.0 (CCBY-NC-ND), where it is permissible to download and share the work provided it is properly cited. The work cannot be changed in any way or used commercially without permission from the journal.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Technical University of Denmark
Authors: Wang, Y. (Ekstern), Naylor, G. (Ekstern), Kramer, S. E. (Ekstern), Zekveld, A. A. (Ekstern), Wendt, D. (Intern), Ohlenforst, B. (Ekstern), Lunner, T. (Ekstern)
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Scopus rating (2016): CiteScore 2.97 SJR 2.067 SNIP 1.602
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BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.844 SNIP 2.048 CiteScore 2.94
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Scopus rating (2014): SJR 1.892 SNIP 1.726 CiteScore 2.86
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BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.91 SNIP 2.118 CiteScore 3.18
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.918 SNIP 1.685 CiteScore 2.95
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.828 SNIP 1.725 CiteScore 2.85
ISI indexed (2011): ISI indexed yes
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Scopus rating (2010): SJR 1.993 SNIP 1.839
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Scopus rating (2009): SJR 2.274 SNIP 1.9
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.871 SNIP 1.814
Scopus rating (2007): SJR 1.858 SNIP 2.103
Scopus rating (2006): SJR 1.527 SNIP 1.617
Scopus rating (2005): SJR 1.746 SNIP 1.914
Scopus rating (2004): SJR 1.419 SNIP 2.013
Scopus rating (2003): SJR 0.825 SNIP 1.376
Scopus rating (2002): SJR 0.881 SNIP 1.384
Relationship between overall comfort and combined thermal and acoustic conditions in urban recreational spaces

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Hearing Systems, Technical University of Denmark
Authors: Bjerre, L. C. (Ekstern), Santurette, S. (Intern), Jeong, C. (Intern)
Number of pages: 8
Publication date: 2017

Remote Off-Grid Solutions for Greenland and Denmark
Renewable off-grid solutions are steadily growing in both developed and developing countries (R. Kempener et al. 2015). With the decreasing cost and improving performance of small hydro installations, solar power, wind power, and energy storage systems, renewable energy is expected to supplement or replace existing diesel grids on islands and in remote areas.

General information
State: Published
Authors: Wu, Q. (Intern), Larsen, E. (Intern), Heussen, K. (Intern), Bindner, H. W. (Intern), Douglass, P. J. (Ekstern)
Pages: 64-73
Publication date: 2017
Main Research Area: Technical/natural sciences

Renal MR angiography and perfusion in the pig using hyperpolarized water
Purpose: To study hyperpolarized water as an angiography and perfusion tracer in a large animal model. Methods: Protons dissolved in deuterium oxide (D2O) were hyperpolarized in a SPINlab dissolution dynamic nuclear polarization (dDNP) polarizer and subsequently investigated in vivo in a pig model at 3 Tesla (T). Approximately 15 mL of hyperpolarized water was injected in the renal artery by hand over 4-5 s. Results: A liquid state polarization of 5.3 ± 0.9% of 3.8 M protons in 15 mL of deuterium oxide was achieved with a T1 of 24 ± 1 s. This allowed injection through an arterial catheter into the renal artery and subsequently high-contrast imaging of the entire kidney parenchyma over several seconds. The dynamic images allow quantification of tissue perfusion, with a mean cortical perfusion of 504 ± 123 mL/100 mL/min. Conclusion: Hyperpolarized water MR imaging was success-fully demonstrated as a renal angiography and perfusion method.
Quantitative perfusion maps of the kidney were obtained in agreement with literature and control experiments with gadolinium contrast.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, Aarhus University
Authors: Lipsø, H. K. W. (Intern), Hansen, E. S. S. (Ekstern), Tougaard, R. S. (Ekstern), Laustsen, C. (Ekstern), Ardenkjær-Larsen, J. H. (Intern)
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 3.77 SJR 1.89 SNIP 1.411
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.329 SNIP 1.481 CiteScore 3.54
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 2.015 SNIP 1.382 CiteScore 3.32
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.039 SNIP 1.433 CiteScore 3.46
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.158 SNIP 1.553 CiteScore 3.61
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.16 SNIP 1.461 CiteScore 3.45
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.356 SNIP 1.606
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.331 SNIP 1.553
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 2.468 SNIP 1.5
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.397 SNIP 1.536
Scopus rating (2006): SJR 2.319 SNIP 1.756
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.298 SNIP 1.833
Renewable energy sources offering flexibility through electricity markets

All over the world, penetration of renewable energy sources in power systems has been increasing, creating new challenges in electricity markets and for operation and management of power systems, since power production from these resources is by nature uncertain and variable. New methods and tools to support optimal decisionmaking under uncertainty in the electricity markets and power system operation, for both producers and system operators, are developed in this thesis. The existing market architecture integrates, to some extent, the participation of renewables by allowing these producers to offer in the day-ahead market and to correct for potential energy imbalances in the intraday market and ultimately in the balancing market. However, the design and rules of electricity markets do not support the transition from conventional generation to renewable energy sources as recently sought by many governments. Renewable energy sources are characterized by their uncertain and variable production that limits the current operation and management tools of the power system. Nevertheless, recent developments of renewable energy technologies enable these resources to provide, to some extent, ancillary services. Hence, the opening of the reserve market for renewables participation is crucial for the integration of 100% renewables into the system. New business models will emerge from these challenges, while renewable energy producers will require appropriate decision-making support tools to jointly offer in both energy and reserve markets. In this context, the main contribution of this thesis is the design and development of optimal offering strategies for the joint participation of renewables in the energy and reserve markets. Two distinct control policies for the splitting of available wind power in energy and reserve are considered. Different methods and optimization tools are developed based on these control policies, considering distinct goals of producers’ participation in energy and reserve markets. Nonetheless, these tools allow renewable producers to move forward in the decisionmaking process of future energy and reserve markets. Towards a power system based on distributed energy resources, mainly comprising renewable sources, new operation and management of distribution systems needs to be thought of. In fact, the existing passive distribution grid management does not provide the flexibility to deal with uncertainty and intermittency of distributed energy resources. In this context, a major contribution of this work is the design and development of a preventive distribution grid management that allows distribution system operators to contract flexibility (ahead in time) from distributed energy resources to assist in the management and operation of the grid in case of congestion and voltage problems. Such a proposed methodology opens the door to other methods in this timely research problem. Finally, new costs for this operation and management of the network will arise, requiring new cost allocation methods to split these costs between the energy resources that induce such congestion and voltage problems. To deal with this concern, one can propose new cost allocation methods that divide the costs of operation and management of the distribution network among all network users (generators and consumers) promoting equity, fairness, impartiality and equality. The hybrid methodology combines different costs (fixed, network usage/congestion and losses) covering all the gaps of each conventional cost allocation method.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Soares, T. (Intern), Pinson, P. (Intern)
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Publication date: 2017

Publication information
Representing Operational Modes for Situation Awareness

Operating complex plants is an increasingly demanding task for human operators. Diagnosis of and reaction to on-line events requires the interpretation of real time data. Vast amounts of sensor data as well as operational knowledge about the state and design of the plant are necessary to deduce reasonable reactions to abnormal situations. Intelligent computational support tools can make the operator's task easier, but they require knowledge about the overall system in form of some model. While tools used for fault-tolerant control design based on physical principles and relations are valuable tools for designing robust systems, the models become too complex when considering the interactions on a plant-wide level. The alarm systems meant to support human operators in the diagnosis of the plant-wide situation on the other hand fail regularly in situations where these interactions of systems lead to many related alarms overloading the operator with alarm floods. Functional modelling can provide a middle way to reduce the complexity of plant-wide models by abstracting from physical details to more general functions and behaviours. Based on functional models the propagation of failures through the interconnected systems can be inferred and alarm floods can potentially be reduced to their root-cause. However, the desired behaviour of a complex system changes due to operating procedures that require more than one physical and functional configuration. In this paper a consistent representation of possible configurations is deduced from the analysis of an exemplary start-up procedure by functional models. The proposed interpretation of the modelling concepts simplifies the functional modelling of distinct modes. The analysis further reveals relevant links between the quantitative sensor data and the qualitative perspective of the diagnostics tool based on functional models. This will form the basis for the ongoing development of a novel real-time diagnostics system based on the on-line adaptation of the underlying MFM model.
Requirements for future control room and visualisation features in the Web-of-Cells framework defined in the ELECTRA project

This study outlines an overview of the general requirements for the control rooms of the future power systems (2030+). The roles and activities in the future control centres will evolve with respect to the switching, dispatching and restoration functions currently active. The control centre operators will supervise on the power system and intervene when necessary - thanks to the maturation and wide scale deployment of flexible controls. For the identification of control room requirements, general trends in power system evolution are considered and mainly the outcomes of the ELECTRA IRP project, that proposes a new Web-of-Cell (WoC) power system control architecture. Dedicated visualisation features are proposed, aimed to support the control room operators activities in a WoC-oriented approach. Furthermore, the work takes into account the point of view of network operators about future control rooms and feedback about the proposed visualisation features, collected by means of interviews and questionnaires.
Residential Demand Response Behaviour Modeling applied to Cyber-physical Intrusion Detection

A real-time demand response system can be viewed as a cyber-physical system, with physical systems dependent on cyber infrastructure for coordination and control, which may be vulnerable to cyber-attacks. The time domain dynamic behaviour of individual residential demand responses is governed by a mix of physical system parameters, exogenous influences, user behaviour and preferences, which can be characterized by unstructured models such as a time-varying finite impulse response. In this study, which is based on field data, it is shown how this characteristic response behaviours can be identified and how the characterization can be updated continuously. Finally, we propose an approach to apply this behaviour characterization to the identification of anomalous and potentially malicious behaviour modifications as part of a cyber-physical intrusion detection mechanism.

Residual signal feature extraction for gearbox planetary stage fault detection

Faults in planetary gears and related bearings, e.g. planet bearings and planet carrier bearings, pose inherent difficulties on their accurate and consistent detection associated mainly to the low energy in slow rotating stages and the operating complexity of planetary gearboxes. In this work, statistical features measuring the signal energy and Gaussianity are calculated from the residual signals between each pair from the first to the fifth tooth mesh frequency of the meshing process in a multi-stage wind turbine gearbox. The suggested algorithm includes resampling from time to angular domain, identification of the expected spectral signature for proper residual signal calculation and filtering of any frequency component not related to the planetary stage. Two field cases of planet carrier bearing defect and planet wheel spalling are presented and discussed, showing the efficiency of the followed approach and the possibility of characterizing a fault as localized or distributed.
Resonant Quasi-Optical Systems with Multi-Row Periodic Structures

Selective properties of resonant quasi-optical systems with periodical multi-row structures in millimeter wavelength range are described. The possibility of selection fluctuations in the volume of open resonator using double-row periodic elements was shown in the experiment at 70-80 GHz. Advantages and possibility of control the energy characteristics of such structures are also described. The obtained experimental data is used to confirm the results of computational analysis previously described in the literature. Implementation of resonant quasi-optical systems with multi-row periodic structures in practical schemes of high frequency devices are discussed and described.

General information
State: Published
Organisations: Department of Electrical Engineering, University of Porto, Sumy State University
Authors: Oleksandr, R. (Intern), Rybalko, Y. A. (Ekstern), Buriak, I. A. (Ekstern), Zhurba, V. O. (Ekstern)
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Main Research Area: Technical/natural sciences
Quasi-optical system, Open resonator, Periodic structures, Diffraction grating, Dielectric waveguide
DOIs:
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Source: FindIt
Source-ID: 2392837478
Publication: Research › Article in proceedings – Annual report year: 2018

Response to Comment: RE: Ohlenforst et al. (2016) Exploring the Relationship Between Working Memory, Compressor Speed, and Background Noise Characteristics, Ear Hear 37, 137–143
We appreciate the opportunity to respond to the comment on our study (Ohlenforst et al. 2016). The issue of concern to the letter writer, “The speech and the noise signals were separately compressed before the SNRs [signal-to-noise ratios] were computed based on the signal’s root mean square values.” referred to a calibration process in which the compressor gain function, derived from the mixed signal, was applied separately to the speech signal and to the separate noise signals to quantify the output signal to noise ratio. This was done to investigate compressor functionality. However, to create the test stimuli presented to the participants, the compressor was applied to the mixed speech-plus-noise signal at a specified input signal to noise ratio (~4, ~2, and 0 dB), not on the speech signal or the noise signals alone. That is, the actual stimulus processing was all done on the mixed speech-plus-noise signal, which we believe to be the method that best represents realistic hearing aid situations. We regret the confusion that this inadvertent omission has caused and would like to thank Dr. Leijon for bringing the issue to our attention.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Technical University of Denmark
Retrieving complex surface impedances from statistical absorption coefficients
In room acoustic simulations the surface materials are commonly represented with energy parameters, such as the absorption and scattering coefficients, which do not carry phase information. This paper presents a method to transform statistical absorption coefficients into complex surface impedances which are needed for phased or time-domain calculation methods. An impedance model based on fractional calculus is suggested to achieve a general model for common acoustic materials. The parameters governing the model are determined by solving an optimisation problem, with constraints ensuring that the impedance found has a physical meaning and respects causality in the time domain. Known material models, such as Miki’s and Maa’s models, are taken as references to assess the validity of the suggested model. Due to the non-uniqueness of retrieving complex-valued impedances from real-valued absorption coefficients, prior information about the absorber of interest can be used as constraints, which is shown to help determine the correct impedance from absorption coefficient. Further stability and sensitivity investigations indicate that the method presented constitutes an efficient solution to convert sound absorption coefficients back to their original complex surface impedances.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Odeon A/S
Authors: Mondet, B. J. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern), Rindel, J. H. (Ekstern)
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Phase retrieval, Surface impedance, Absorption coefficient
Source: PublicationPreSubmission
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Review of High Efficiency Bidirectional dc-dc Topologies with High Voltage Gain
A review of high voltage gain, high efficiency bidirectional dc-dc topologies is presented. Each converters primary benefit is highlighted, and a summary of all the converters is presented. It is observed that voltage gains higher than 20 is only achieved with topologies using a transformer. The average efficiency of the topologies is slightly lower for isolated topologies. Different strategies are utilized in most of the topologies in order to achieve the high voltage gain, and high efficiency, for example charge pumps, resonant circuits, coupled inductors, and switching cells

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Jørgensen, K. L. (Intern), Mira Albert, M. D. C. (Intern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
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Revision of the qualification framework at the Technical University of Denmark: Part 1: Concepts
When the Technical University of Denmark (DTU) adopted the National Qualification Framework (NQF), it was implemented as an add-on to the existing concept in place for describing educational outcomes, rather than by redesigning the educational outcomes themselves. The system in place does not emphasize the type and extent of knowledge, skills, and competencies adequately to facilitate programme development and evaluations. In this work, an expansion and reorganization of the qualification elements in the NQF at DTU is proposed as a means to facilitate a more detailed design and evaluation of the educational programmes. The top level categories of knowledge, skills, and
competencies are reorganized into four categories: -to know, - to be, -to interact, and -to do. Knowledge of praxis is a new element in the category -to know. The new category, -to be, includes mind-set development and self-instruction. The category, -to interact, includes competencies in communication and teamwork. The category, -to do, includes operative skills and competencies in problem solving. Each of the four main categories contain a number of qualification elements. Suitable taxonomies are suggested for each of the main categories.

Revision of the qualification framework at the Technical University of Denmark Part 2: Applications

Using a revised Qualification Framework (QF) with four main categories: -to know, - to be, -to interact, and -to do, this paper demonstrates how to use the elements of the QF to construct Programme-Qualification Matrices. A general Programme- Qualification Matrix defines the qualifications and their respective conceptual understanding common to all engineering programmes. This is complemented by programme-specific qualification matrices with added emphasis on content and context. Redesigned educational outcomes for three bachelor programmes are presented to demonstrate the versatility of the concept.

Robust Multi-Objective PQ Scheduling for Electric Vehicles in Flexible Unbalanced Distribution Grids

With increased penetration of distributed energy resources and electric vehicles (EVs), different EV management strategies can be used for mitigating adverse effects and supporting the distribution grid. This paper proposes a robust multi-objective methodology for determining the optimal day-ahead EV charging schedule while complying with unbalanced distribution grid constraints. The proposed methodology considers partially competing objectives of an EV aggregator and the respective distribution system operator, and applies a fuzzy-based mechanism for obtaining the best compromise solution. The robust formulation effectively considers the errors in the electricity price forecast and its influence on the EV schedule. Moreover, the impact of EV reactive power support on objective values and technical parameters is analysed both when EVs are the only flexible resources and when linked with other demand response programs. The method is tested on a real Danish unbalanced distribution grid with 35% EV penetration to demonstrate the effectiveness of the proposed approach. It is shown that the proposed formulation guarantees an optimal EV cost as long
as the price uncertainties are lower than the aggregator’s conservativeness degree, and that EV reactive power improves local conditions without significantly affecting the EV cost.

**General information**
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, University College Dublin
Authors: Knezovic, K. (Intern), Soroudi, A. (Ekstern), Marinelli, M. (Intern), Keane, A. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.2 SJR 1.03 SNIP 1.457
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.01 SNIP 1.496 CiteScore 2.74
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.923 SNIP 1.61 CiteScore 2.36
Web of Science (2014): Indexed yes
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ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 0.899 SNIP 1.782 CiteScore 2.58
ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.766 SNIP 1.768 CiteScore 2.27
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.723 SNIP 1.444
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BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.747 SNIP 1.254
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.596 SNIP 1.114
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Scopus rating (2006): SJR 0.606 SNIP 1.246
Scopus rating (2005): SJR 0.757 SNIP 1.189
Scopus rating (2004): SJR 0.54 SNIP 1.386
Scopus rating (2003): SJR 0.879 SNIP 1.138
Scopus rating (2002): SJR 0.785 SNIP 1.516
Scopus rating (2001): SJR 1.004 SNIP 1.151
Role of renal vascular potassium channels in physiology and pathophysiology

The control of renal vascular tone is important for the regulation of salt and water balance, blood pressure and the protection against damaging elevated glomerular pressure. The K+ conductance is a major factor in the regulation of the membrane potential (V_m) in vascular smooth muscle (VSMC) and endothelial cells (EC). The vascular tone is controlled by V_m via its effect on the opening probability of voltage operated Ca2+ channels (VOCC) in VSMC. When K+ conductance increases V_m becomes more negative and vasodilation follows, while deactivation of K+ channels leads to depolarization and vasoconstriction. K+ channels in EC indirectly participate in the control of vascular tone by endothelium derived vasodilation. Therefore, by regulating the tone of renal resistance vessels, K+ channels have a potential role in the control of fluid homeostasis and blood pressure as well as in the protection of the renal parenchyma. The main classes of K+ channels (calcium activated (KCa), inward rectifier (Kir), voltage activated (Kv) and ATP sensitive (KATP)) have been found in the renal vessels. In this review, we summarize results available in the literature and our own studies in the field. We compare the ambiguous in vitro and in vivo results. We discuss the role of single types of K+ channels and the integrated function of several classes. We also deal with the possible role of renal vascular K+ channels in the pathophysiology of hypertension, diabetes mellitus and sepsis. This article is protected by copyright. All rights reserved.

General information
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Organisations: Department of Electrical Engineering, Trelleborg Hospital, University of Copenhagen
Authors: Salomonsson, M. (Ekstern), Brasen, J. C. (Intern), Sorensen, C. M. (Ekstern)
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.654 SNIP 1.075 CiteScore 2.78
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.66 SNIP 1.083 CiteScore 3.66
ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 1.531 SNIP 1.191 CiteScore 4.05
ISI indexed (2012): ISI indexed yes
Here, the authors analyse the operator point of view of the Web-of-Cells concept defined in the EU project ELECTRA, by identifying operator tasks into the supervision of a highly automated power system, and the information requirements to facilitate appropriate operator situation awareness. The study outlines the methodology adopted, which is based on the cognitive work analysis framework, to provide an overview of the most interesting scenarios and to summarise the requirements analysis results. In order to derive required control room functionality, a set of relevant control room scenarios have been identified based on the Web-of-Cells control concept. The authors considered scenarios that challenge traditional control schemes, scenarios that caused major failures (i.e. blackouts), and scenarios that can be expected to appear in the future. For each scenario, information concerning network layout, triggering events, physical constraints, manually/automatic operations, operators' tasks, and relevant analytics have been analysed.
Searching for Plausible N-k Contingencies Endangering Voltage Stability

This paper presents a novel search algorithm using time-domain simulations to identify plausible N − k contingencies endangering voltage stability. Starting from an initial list of disturbances, progressively more severe contingencies are investigated. After simulation of a N − k contingency, the simulation results are assessed. If the system response is unstable, a plausible harmful contingency sequence has been found. Otherwise, components affected by the contingencies are considered as candidate next event leading to N − (k + 1) contingencies. This implicitly takes into account hidden failures of component protections. The performance of the proposed search algorithm is compared to a brute-force algorithm and demonstrated on the IEEE Nordic test system.

Self-reconfiguration of Modular Underwater Robots using an Energy Heuristic

This paper investigates self-reconfiguration of a modular robotic system, which consists of a cluster of modular vehicles that can attach to each other by a connection mechanism. Thereby, they can form a desired morphology to meet task specific requirements. Reconfiguration can be needed due to limitations from dimensions of passable corridors for an underwater maintenance task, for supplemental instrumentation that is available on a particular robot, or as remedial action if one robot in a cluster suffers from malfunction. Being crucial for autonomous underwater vehicles, energy consumed is employed as a heuristic. The paper shows how the Basic Theta* algorithm can be guided by an energy criterion to calculate a transition from start- to goal morphology. Individual robots are guided while minimizing the overall energy for propulsion and for balancing restoring forces and moments in morphologies. The properties of the proposed self-reconfiguration algorithm are evaluated through simulations and preliminary model tank experiments. The energy based heuristic for reconfiguration is compared to a traditional solution that minimizes the Euclidean distance.
Sensitivity analysis of magnetic field measurements for magnetic resonance electrical impedance tomography (MREIT)

Purpose: Clinical use of magnetic resonance electrical impedance tomography (MREIT) still requires significant sensitivity improvements. Here, the measurement of the current-induced magnetic field (DBz,c) is improved using systematic efficiency analyses and optimization of multi-echo spin echo (MESE) and steady-state free precession free induction decay (SSFP-FID) sequences. Theory and Methods: Considering T1, T2, and T 2 relaxation in the signal-to-noise ratios (SNRs) of the MR magnitude images, the efficiency of MESE and SSFP-FID MREIT experiments, and its dependence on the sequence parameters, are analytically analyzed and simulated. The theoretical results are experimentally validated in a saline-filled homogenous spherical phantom with relaxation parameters similar to brain tissue. Measurement of DBz,c is also performed in a cylindrical phantom with saline and chicken meat. Results: The efficiency simulations and experimental results are in good agreement. When using optimal parameters, DBz,c can be reliably measured in the phantom even at injected current strengths of 1 mA or lower for both sequence types. The importance of using proper crusher gradient selection on the phase evolution in a MESE experiment is also demonstrated. Conclusion: The efficiencies observed with the optimized sequence parameters will likely render in-vivo human brain MREIT feasible.
Sensitivity to Angular and Radial Source Movements as a Function of Acoustic Complexity in Normal and Impaired Hearing

In contrast to static sounds, spatially dynamic sounds have received little attention in psychoacoustic research so far. This holds true especially for acoustically complex (reverberant, multisource) conditions and impaired hearing. The current study therefore investigated the influence of reverberation and the number of concurrent sound sources on source movement detection in young normal-hearing (YNH) and elderly hearing-impaired (EHI) listeners. A listening environment based on natural environmental sounds was simulated using virtual acoustics and rendered over headphones. Both near-far (‘radial’) and left-right (‘angular’) movements of a frontal target source were considered. The acoustic complexity was varied by adding static lateral distractor sound sources as well as reverberation. Acoustic analyses confirmed the expected changes in stimulus features that are thought to underlie radial and angular source movements under anechoic conditions and suggested a special role of monaural spectral changes under reverberant conditions. Analyses of the
detection thresholds showed that, with the exception of the single-source scenarios, the EHI group was less sensitive to source movements than the YNH group, despite adequate stimulus audibility. Adding static sound sources clearly impaired the detectability of angular source movements for the EHI (but not the YNH) group. Reverberation, on the other hand, clearly impaired radial source movement detection for the EHI (but not the YNH) listeners. These results illustrate the feasibility of studying factors related to auditory movement perception with the help of the developed test setup.

**General information**

State: Published  
Organisations: Department of Acoustic Technology, Department of Electrical Engineering  
Authors: Lundbeck, M. (Ekstern), Grimm, G. (Ekstern), Hohmann, V. (Ekstern), Laugesen, S. (Intern), Neher, T. (Ekstern)  
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Sequence Domain Harmonic Modeling of Type-IV Wind Turbines

A sequence domain (SD) harmonic model of a gridconnected voltage-source converter is developed for decoupling converter generated voltage harmonics from voltage harmonics in the external grid. The modeling procedure includes a derivation of the baseband frequency response for regular-sampled pulsedwidth modulation and an analysis of converter generated voltage harmonics due to compensated dead-time. The decoupling capabilities of the proposed the SD harmonic model are verified through a power quality (PQ) assessment of a 3MW Type-IV wind turbine. The assessment shows that the magnitude and phase of low-order odd converter generated voltage harmonics are dependent on the converter operating point and the phase of the fundamental component of converter current respectively. The SD harmonic model can be used to make PQ assessments of Type-IV wind turbines or incorporated into harmonic load flows for computation of PQ in wind power plants.

**General information**

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Authors: Guest, E. (Intern), Jensen, K. H. (Ekstern), Rasmussen, T. W. (Intern)  
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Setting the foundations for international and crossdisciplinary learning: The US-Denmark Summer School "Renewable Energy: In Practice"
The grand challenges posed by global climate change, scarce natural resources, and the volatility of the international energy market require targeted action towards finding technologically, economically, and socially viable solutions based on renewable energy generation and sustainable practice. As such, impactful innovation requires skills and interactions beyond that available in traditional, single track curriculum.

The U.S.-Denmark Summer Workshop on Renewable Energy is a unique educational initiative developed by several universities in Denmark and California to address these themes and foster a holistic and creative mind set. The three-week workshop takes place annually, alternating each summer between California and Denmark, and is open to selected students from US and European Universities. The program is preceded by a week of online preparation, where students utilize video conferencing and other tools to facilitate interaction between the international participants and learn more about the communities and technologies involved. A primary focus of the program is experiential learning through diverse and cross-cultural interactions, with participants coming not only from the US and Denmark, but also over a dozen other countries. The program introduces and reinforces a holistic approach to sustainable development by offering access to leading experts in politics, economics, science, and technology in parallel with multi-disciplinary, client-oriented projects. Participants are either senior undergraduate/graduate students and more recently, professionals representing different disciplines. Faculty, mentors, and participants interact daily while exploring currently implemented technological solutions and their limitations through community and industrial site visits, seminars, and real-world case studies. Students apply these learnings by collaborating in bi-national team-based projects performing feasibility studies for specified clients. The close collaboration with local communities, businesses, and industry to provide concrete solutions to an identified problem while engaging across disciplines cultivates entrepreneurially-minded and complex systems thinking necessary for innovation.

Over the eight years of the summer school, a number of lessons have been learned regarding effective program design and assessment. In this proceeding, we will elaborate on these learnings through participant feedback and faculty observations, to articulate a detailed program design that accounts for some of the challenges inherent to multi-national and multi-cultural collaborations with real-world impact.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, University of California at Santa Cruz, University of California at Davis, Aalborg University
Authors: Favaloro, T. (Ekstern), Jenkins, B. M. (Ekstern), Lehmann, M. (Ekstern), Traeholt, C. (Intern), Lipschutz, R. D. (Ekstern), Kornbluth, K. L. (Ekstern), Isaacson, M. S. (Ekstern)
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Short Circuits of a 10-MW High-Temperature Superconducting Wind Turbine Generator
Direct Drive high-temperature superconducting (HTS) wind turbine generators have been proposed to tackle challenges for ever increasing wind turbine ratings. Due to smaller reactances in HTS generators, higher fault currents and larger transient torques could occur if sudden short circuits take place at generator terminals. In this paper, a finite element model that couples magnetic fields and the generator's equivalent circuits is developed to simulate short-circuit faults. Afterward, the model is used to study the transient performance of a 10-MW HTS wind turbine generator under four different short circuits, i.e., three-phase, phase–phase clear of earth, phase-phase-earth, and phase-earth. The stator current, fault torque, and field current under each short circuit scenario are examined. Also included are the forces experienced by the HTS field winding under short circuits. The results show that the short circuits pose great challenges to the generator, and careful consideration should be given to protect the generator. The findings presented in this paper would be beneficial to the design, operation and protection of an HTS wind turbine generator.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Delft University of Technology, University of the Faroe Islands
Authors: Song, X. (. (Intern), Liu, D. (Ekstern), Polinder, H. (Ekstern), Mijatovic, N. (Intern), Holbøll, J. (Intern), Jensen, B.
B. (Ekstern)
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.368 SNIP 1.062 CiteScore 1.16
ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.473 SNIP 1.065
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.447 SNIP 1.021
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 0.884 SNIP 0.981
Scopus rating (2007): SJR 0.629 SNIP 1.093
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.734 SNIP 1.05
Scopus rating (2005): SJR 0.652 SNIP 0.992
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.882 SNIP 0.904
Scopus rating (2003): SJR 0.51 SNIP 1.054
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.226 SNIP 1.024
Short Range Inter-Datacenter Transmission with Carrier Delivery and Remote Modulation for 112 Gb/s PM-QPSK Signals

The increasing demand for bandwidth in datacenter interconnect links is currently driving a transition towards four level pulse-amplitude modulation (PAM-4) as the de facto modulation format. Nevertheless, other schemes with even higher spectral efficiency will be required in the future given the challenges of increasing baud rate or number of channels. As enabling technology, we propose and demonstrate a coherent link concept inspired from passive optical networks (PON) where carrier delivery and remote modulation are used to achieve single wavelength transmission of polarization multiplexing quadrature phase shift keying (PM-QPSK) at 112 Gb/s in channels of 5 and 10 km single mode fiber (SMF). By using a single laser for modulation and local oscillator the required complexity of digital signal processing is reduced in comparison to traditional digital coherent links.

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Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Networks Technology and Service Platforms, Electromagnetic Systems, Mellanox Technologies
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Simulating CMUT Arrays Using Time Domain FEA
PZFlex is a commercial FEA software that has been optimized for the ultrasound industry and is commonly used to design piezoelectric ultrasound transducers. However, PZFlex is not commonly used within the CMUT research field. Nevertheless, it has an explicit modeling approach allowing large structures like CMUT arrays to be modeled and its transient analysis intrinsically supplies non-linear and broadband results from a single run. A 3-D model of a CMUT array is developed with multiple cells in each element and one active element surrounded by N passive elements. It is demonstrated that the electro-mechanics can precisely be predicted, within 3%, including the pull-in voltage and the spring softening effect. The transmit impulse response is simulated by deconvolving the extrapolated pressure with the excitation pulse, and it is in excellent agreement with the measured. It is shown that the impulse response can directly be used in Field II to assess the image quality of the transducer using the lateral, axial and cystic resolution for two different CMUT designs.

General information
Simulation-based Validation of Smart Grids - Status Quo and Future Research Trends

Smart grid systems are characterized by high complexity due to interactions between a traditional passive network and active power electronic components, coupled using communication links. Additionally, automation and information technology plays an important role in order to operate and optimize such cyber-physical energy systems with a high(er) penetration of fluctuating renewable generation and controllable loads. As a result of these developments the validation on the system level becomes much more important during the whole engineering and deployment process, today. In earlier development stages and for larger system configurations laboratory-based testing is not always an option. Due to recent developments, simulation-based approaches are now an appropriate tool to support the development, implementation, and rollout of smart grid solutions. This paper discusses the current state of simulation-based approaches and outlines the necessary future research and development directions in the domain of power and energy systems.
Simultaneous imaging of hyperpolarized [1,4-13 C2]fumarate, [1-13 C]pyruvate and 18 F-FDG in a rat model of necrosis in a clinical PET/MR scanner

A co-polarization scheme for [1,4-13 C2]fumarate and [1-13 C]pyruvate is presented to simultaneously assess necrosis and metabolism in rats with hyperpolarized 13 C magnetic resonance (MR). The co-polarization was performed in a SPINlab polarizer. In addition, the feasibility of simultaneous positron emission tomography (PET) and MR of small animals with a clinical PET/MR scanner is demonstrated. The hyperpolarized metabolic MR and PET was demonstrated in a rat model of necrosis. The polarization and T1 of the co-polarized [1,4-13 C2]fumarate and [1-13 C]pyruvate substrates were measured in vitro and compared with those obtained when the substrates were polarized individually. A polarization of 36 ± 4% for fumarate and 37 ± 6% for pyruvate was obtained. We found no significant difference in the polarization and T1 values between the dual and single substrate polarization. Rats weighing about 400 g were injected intramuscularly in one of the hind legs with 200 μL of turpentine to induce necrosis. Two hours later, 13 C metabolic maps were obtained with a chemical shift imaging sequence (16 × 16) with a resolution of 3.1 × 5.0 × 25.0 mm3. The 13 C spectroscopic images were acquired in 12 s, followed by an 8-min 18 F-2-fluoro-2-deoxy-d-glucose (18 F-FDG) PET acquisition with a resolution of 3.5 mm. [1,4-13 C2]Malate was observed from the tissue injected with turpentine indicating necrosis. Normal [1-13 C]pyruvate metabolism and 18 F-FDG uptake were observed from the same tissue. The proposed co-polarization scheme provides a means to utilize multiple imaging agents simultaneously, and thus to probe various metabolic pathways in a single examination. Moreover, it demonstrates the feasibility of small animal research on a clinical PET/MR scanner for combined PET and hyperpolarized metabolic MR.

General information
State: Published
Organisations: Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance, University of Copenhagen
Authors: Eldirdiri, A. (Intern), Clemmensen, A. (Ekstern), Bowen, S. (Intern), Kjær, A. (Ekstern), Ardenkjær-Larsen, J. H. (Intern)
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Scopus rating (2016): CiteScore 3.18 SJR 1.46 SNIP 1.062
Web of Science (2015): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.624 SNIP 1.032 CiteScore 3.23
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.635 SNIP 1.162 CiteScore 3.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.681 SNIP 1.31 CiteScore 3.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 1.628 SNIP 1.24 CiteScore 3.47
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Wind energy have for many years been a growing alternative to fossil energy. The sizes of turbines are increasing to megawatt level. Wind turbines operate in a wide range of wind speeds but are shut down for high wind speeds. Traditional concepts are relatively stiff and have a cause stress on the gearbox. The turbine described in this paper overcomes some of these challenges by having flexibly and pitchably blades. This means that the turbine can operate at turbulent sites and withstand wind burst without high stress level on the gearbox. This paper describes the mechanical principle, electrical power production and measurements from the sites. At the end of the paper conclusions are described.

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Independent Wind Power
Authors: Rasmussen, T. W. (Intern), Johansen, A. (Ekstern)
Number of pages: 5
Publication date: 2017

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Publisher: IEEE
Article number: 08231967
Main Research Area: Technical/natural sciences
Conference: 52nd International Universities' Power Engineering Conference, Heraklion, Greece, 28/08/2017 - 28/08/2017
Variable speed, Flexibly blades, Mechanical pitching, Voltage control, Frequency control
DOIs:
10.1109/UPEC.2017.8231967
Source: FindIt
Source-ID: 2394348461
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Smart Grid Communication Comparison: Distributed Control Middleware and Serialization Comparison for the Internet of Things
To solve the problems caused by intermittent renewable energy production, communication between Distributed Energy Resources (DERs) and system operators is necessary. The communication middleware and serialization used for
communication are essential to ensure delivery of the messages within the required timeframe, to provide the necessary ancillary services to the power grid. This paper shows that there are better alternatives to using Web Services and XMPP as middleware and that there are better alternatives than using XML for serialization. The paper also gives guidance at choosing the best communication middleware and serialization format/library, aided by the authors' earlier work, which investigates the performance and characteristics of communication middleware and serialization independently. Given the performance criteria of the paper, ZeroMQ, YAMI4, and ICE are the middleware that performs the best, and ProtoBuf (ProtoStuff), and ProtoStuff are the serialization that performs the best.

General information
State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), Poulsen, B. (Intern), You, S. (Intern)
Number of pages: 6
Pages: 1-6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 7th IEEE International Conference on Innovative Smart Grid Technologies
Publisher: IEEE
ISBN (Print): 9781538619537
Main Research Area: Technical/natural sciences
Conference: 7th IEEE International Conference on Innovative Smart Grid Technologies, Torino, Italy, 26/09/2017 - 26/09/2017
Throughput, Smart grids, Publish-subscribe, Web services, XML, Ice, Smart Grid, Internet of Things, Communication Middleware, Serialization, Performance Comparison
Electronic versions:
Smart_Grid_Petersen_1.pdf
DOIs:
10.1109/ISGTEurope.2017.8260268
Source: PublicationPreSubmission
Source-ID: 131392158
Publication: Research - peer-review » Article in proceedings – Annual report year: 2017

Smart Grid communication middleware comparison distributed control comparison for the internet of things
Communication between Distributed Energy Resources (DERs) is necessary to efficiently solve the intermittency issues caused by renewable energy, using DER power grid auxiliary services, primarily load shifting and shedding. The middleware used for communication determines which services are possible by their performance, which is limited by the middleware characteristics, primarily interchangeable serialization and the Publish-Subscribe messaging pattern. The earlier paper "Smart Grid Serialization Comparison" (Petersen et al. 2017) AIDS in the choice of serialization, which has a big impact on the performance of the communication as a whole. This paper identifies the dis-/advantages of the different middleware, shows that there are better alternatives to Web Services and XMPP, and gives guidance in choosing the most appropriate middleware depending on the context. YAMI4 and ZeroMQ are generally the strongest candidates for Smart Grid distributed control, but WAMP should also be considered in the future.

General information
State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), Poulsen, B. (Intern), You, S. (Intern)
Pages: 219-226
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 6th International Conference on Smart Cities and Green ICT Systems
Publisher: SCITEPRESS Digital Library
ISBN (Electronic): 9789897582417
Main Research Area: Technical/natural sciences
Conference: 6th International Conference on Smart Cities and Green ICT Systems, Porto, Portugal, 22/04/2017 - 22/04/2017
Smart Grid, Internet of Things, Communication Middleware, RMI, XML-RPC, CORBA, ICE, Web Services, OPC UA, XMPP, WAMP, YAMI4, ZeroMQ
Electronic versions:
Smart_Grid_Communication_Middleware_Comparison.pdf
DOIs:
Smart Grid Serialization Comparison

Communication between DERs and System Operators is required to provide Demand Response and solve some of the problems caused by the intermittency of much Renewable Energy. An important part of efficient communication is serialization, which is important to ensure a high probability of delivery within a given timeframe, especially in the context of the Internet of Things, using low-bandwidth data connections and constrained devices. The paper shows that there are better alternatives than XML & JAXB and gives guidance in choosing the most appropriate serialization format and library depending on the context.

General information
State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), You, S. (Intern), Poulsen, B. (Intern)
Pages: 1339-1346
Publication date: 2017

Host publication information
Title of host publication: Computing Conference 2017
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: Computing Conference 2017, London, United Kingdom, 18/07/2017 - 18/07/2017
Smart Grid, Internet of Things, Serialization, XML, JSON, YAML, FST, JAXB, Jackson, XStream, ProtoStuf, Gson, Genson, SnakeYAML, MsgPack, Smile, ProtoBuf, BSON, Hessian, CBOR, Avro
Electronic versions:
Smart_Grid_Serialization_Comparison.pdf
DOIs:
10.1109/SAI.2017.8252264
Source: PublicationPreSubmission
Source-ID: 127876563
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Smart grid serialization comparison: Comparision of serialization for distributed control in the context of the Internet of Things

Communication between DERs and System Operators is required to provide Demand Response and solve some of the problems caused by the intermittency of much Renewable Energy. An important part of efficient communication is serialization, which is important to ensure a high probability of delivery within a given timeframe, especially in the context of the Internet of Things, using low-bandwidth data connections and constrained devices. The paper shows that there are better alternatives than XML & JAXB and gives guidance in choosing the most appropriate serialization format and library depending on the context.

General information
State: Published
Authors: Petersen, B. S. (Intern), Bindner, H. W. (Intern), You, S. (Intern), Poulsen, B. (Intern)
Number of pages: 8
Pages: 1339-1346
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Host publication information
Title of host publication: Computing Conference 2017
Publisher: IEEE
Article number: 08252264
Main Research Area: Technical/natural sciences
Conference: Computing Conference 2017, London, United Kingdom, 18/07/2017 - 18/07/2017
Smart grid, Internet of things, Serialization, XML, JSON, YAML, FST, Kryo, JAXB, Jackson, XStream, ProtoStuff, Gson, Genson, SnakeYAML, MsgPack, Smile, ProtoBuf, BSON, Hessian, CBOR, Avro
DOIs:
Sound specificity effects in spoken word recognition: The effect of integrality between words and sounds
Recent evidence has shown that nonlinguistic sounds co-occurring with spoken words may be retained in memory and affect later retrieval of the words. This sound-specificity effect shares many characteristics with the classic voice-specificity effect. In this study, we argue that the sound-specificity effect is conditional upon the context in which the word and sound coexist. Specifically, we argue that, besides co-occurrence, integrality between words and sounds is a crucial factor in the emergence of the effect. In two recognition-memory experiments, we compared the emergence of voice and sound specificity effects. In Experiment 1, we examined two conditions where integrality is high. Namely, the classic voice-specificity effect (Exp. 1a) was compared with a condition in which the intensity envelope of a background sound was modulated along the intensity envelope of the accompanying spoken word (Exp. 1b). Results revealed a robust voice-specificity effect and, critically, a comparable sound-specificity effect: A change in the paired sound from exposure to test led to a decrease in word-recognition performance. In the second experiment, we sought to disentangle the contribution of integrality from a mere co-occurrence context effect by removing the intensity modulation. The absence of integrality led to the disappearance of the sound-specificity effect. Taken together, the results suggest that the assimilation of background sounds into memory cannot be reduced to a simple context effect. Rather, it is conditioned by the extent to which words and sounds are perceived as integral as opposed to distinct auditory objects.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Technical University of Denmark, Northwestern University, Ikerbasque Basque Foundation for Science, University of York
Authors: Strori, D. (Ekstern), Zaar, J. (Intern), Cooke, M. (Ekstern), Mattys, S. L. (Ekstern)
Pages: 1-20
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Attention, Perception & Psychophysics
ISSN (Print): 1943-3921
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 0.79 SJR 0.992 CiteScore 1.64
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.77 SJR 1.213 SNIP 0.888
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.378 SNIP 0.904 CiteScore 1.88
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.389 SNIP 1.11 CiteScore 2.27
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.669 SNIP 1.174 CiteScore 2.14
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.515 SNIP 1.081 CiteScore 2.03
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.591 SNIP 1.169 CiteScore 1.86
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.149 SNIP 0.933
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.333 SNIP 1
In this paper, an accurate and efficient numerical method for sound transmission analysis is presented. As an alternative to conventional numerical methods, such as the Finite Element Method (FEM), Boundary Element Method (BEM) and Statistical Energy Analysis (SEA), the FE-ERA method, which combines the FEM and Elementary Radiator Approach (ERA) is proposed. The FE-ERA method analyzes the vibrational response of the plate structure excited by incident sound using FEM and then computes the transmitted acoustic pressure from the vibrating plate using ERA. In order to improve the accuracy and efficiency of the FE-ERA method, a novel criterion for the optimal number of elementary radiators is proposed. The criterion is based on the radiator error index that is derived to estimate the accuracy of the computation with used number of radiators. Using the proposed criterion a radiator selection method is presented for determining the optimum number of radiators. The presented radiator selection method and the FE-ERA method are combined to improve the computational accuracy and efficiency. Several numerical examples that have been rarely addressed in previous studies, are presented with the proposed method. The accuracy and efficiency of the proposed method are validated by comparison with the results of the three dimensional (3D) FEM structure-acoustic interaction models.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Gwangju Institute of Science and Technology
Authors: Jung, J. (Ekstern), Kook, J. (Intern), Goo, S. (Ekstern), Wang, S. (Ekstern)
Pages: 1-15
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Advances in Engineering Software
Volume: 112
ISSN (Print): 0965-9978
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 2.401 SJR 1.159 CiteScore 4.06
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.855 SNIP 1.954 CiteScore 3.26
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.751 SNIP 1.912 CiteScore 2.54
BFI (2014): BFI-level 1
Spatial Filter Feature Extraction Methods for P300 BCI Speller: A Comparison

Brain Computer Interface (BCI) systems enable subjects affected by neuromuscular disorders to interact with the outside world. A P300 speller uses Event Related Potential (ERP) components, generated in the brain in the presence of a target stimulus, to extract information about the user’s intent. Several methods have been proposed for spatial filtering and classification of the P300 components. In this study, xDAWN algorithm, Independent Component Analysis (ICA) and Principal Component Analysis (PCA) methods are used and evaluated based on the classification performance of two different classifiers, namely the Support Vector Machine (SVM) and Fisher’s Linear Discriminant Analysis (FLDA). In addition, it is shown that the incorporation of some prior knowledge regarding the location of P300 elicitation on the scalp can reduce the computational load while maintaining or even improving the classification performance.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Electrical Engineering, Biomedical Engineering, Technical University of Denmark
Authors: Chiou, E. (Ekstern), Puthusserypady, S. (Intern)
Number of pages: 5
Pages: 003859-003863
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2016 IEEE International Conference on Systems, Man, and Cybernetics
Publisher: IEEE
ISBN (Print): 978-1-5090-1897-0
Main Research Area: Technical/natural sciences
Spatial models for probabilistic prediction of wind power with application to annual-average and high temporal resolution data

Producing accurate spatial predictions for wind power generation together with a quantification of uncertainties is required to plan and design optimal networks of wind farms. Toward this aim, we propose spatial models for predicting wind power generation at two different time scales: for annual average wind power generation, and for a high temporal resolution (typically wind power averages over 15-min time steps). In both cases, we use a spatial hierarchical statistical model in which spatial correlation is captured by a latent Gaussian field. We explore how such models can be handled with stochastic partial differential approximations of Matérn Gaussian fields together with Integrated Nested Laplace Approximations. We demonstrate the proposed methods on wind farm data from Western Denmark, and compare the results to those obtained with standard geostatistical methods. The results show that our method makes it possible to obtain fast and accurate predictions from posterior marginals for wind power generation. The proposed method is applicable in scientific areas as diverse as climatology, environmental sciences, earth sciences and epidemiology.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Lenzi, A. (Intern), Pinson, P. (Intern), Clemmensen, L. K. H. (Intern), Guillot, G. (Intern)
Number of pages: 17
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Stochastic Environmental Research and Risk Assessment
ISSN (Print): 1436-3240
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.173 SJR 1.096 CiteScore 2.57
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.54 SJR 1.219 SNIP 1.439
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.051 SNIP 1.015 CiteScore 1.74
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.021 SNIP 1.449 CiteScore 2.3
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.151 SNIP 1.612 CiteScore 2.49
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.326 SNIP 1.457 CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.902 SNIP 1.153 CiteScore 1.56
ISI indexed (2011): ISI indexed yes
Speakers comfort and voice use in different environments and babble-noise. What are the effects on effort and cognition?

Teachers often report voice problems related to the occupational environment, and voice problems are more prevalent in teaching than in other occupations. Relationships between objectively measurable acoustical parameters and voice use have been shown. Speakers have been shown to be able to predict the speaker-comfort of an environment. Teachers with voice problems use the room differently than their voice-healthy controls. The aim of this study was to investigate what vocal changes speakers do in different acoustical environments and noise conditions. Nine female speakers, voice patients, and voice-healthy were exposed to four controlled, acoustical "environments" mounted in the same room: 1. stripped; 2. wall- and ceiling mounted absorbents; 3-4 as 2 but with extra ceiling absorbents and in two positions. The speakers were recorded with voice-accumulator and simultaneous voice recordings and spoke freely for 3-5 min in three noise conditions in each setting: silence, classroom noise (60 dBA), and day-care noise (75 dBA). Questionnaires on effort needed were completed by speakers and listeners. There was a co-play between the rooms and the subjectively assessed vocal- and listening effort and also a correlation to cognitive aspects. Listener assessments and the data from the voice accumulator will be presented. This knowledge may contribute to the area of classroom acoustics and speakers’ comfort in general.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Lund University, Ecophon St. Gobain
Authors: Lyberg-Åhlander, V. (Ekstern), von Lochow, H. (Ekstern), Brunskog, J. (Intern), Whitling, S. (Ekstern), Nilsson, E. (Ekstern), Christensson, J. (Ekstern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Acoustical Society of America
Volume: 141
Issue number: 5
Article number: 3482
ISSN (Print): 0001-4966
Ratings:
Spectrum analysis of a voltage source converter due to semiconductor voltage drops

It is known that power electronic voltage source converters are non-ideal. This paper presents a state-of-the-art review on the effect of semiconductor voltage drop on the output voltage spectrum, using single-phase H-bridge two-level converter topology with natural sampled pulse width modulation. The paper describes the analysis of output voltage spectrum, when the semiconductor voltage drop is added. The results of the analysis of the spectral contribution including and excluding semiconductor voltage drop reveal a good agreement between the theoretical results, simulations and laboratory experiments measurements.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Technical University of Denmark
Authors: Rasmussen, T. W. (Intern), Eltouki, M. (Ekstern)
Number of pages: 9
Publication date: 2017

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Publisher: IEEE
Main Research Area: Technical/natural sciences
DOIs: 10.23919/EPE17ECCEurope.2017.8099034
Source: FindIt
Source-ID: 2392856476
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Stability and Accuracy Considerations in the Design and Implementation of Wind Turbine Power Hardware in the Loop Platform

There is increasing interest in the evaluation of wind turbine control capabilities for providing grid support. Power hardware in the loop (PHIL) simulation is an advanced method that can be used for studying the interaction of hardware with the power network, as the scaled-down actual wind turbine is connected with a simulated system through an amplifier. Special consideration must be made in the design of the PHIL platform to ensure that the system is stable and yields accurate results. This paper presents a method for stabilizing the PHIL interface and improving the accuracy of PHIL simulation in a real-time application. The method factors in both the power and voltage scaling level, and a phase compensation scheme. It uses the reactive power control capability of the wind turbine inverter to eliminate the phase shift imposed by the feedback current filter. This is accomplished with no negative impact on the dynamic behavior of the wind turbine. The PHIL simulation results demonstrate the effectiveness of the proposed stability analysis method and phase compensation scheme. The strength of the platform is demonstrated by extending the simulation method to wind turbine control validation.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, China Electric Power Research Institute
Authors: Luo, K. (Ekstern), Shi, W. (Ekstern), Chi, Y. (Ekstern), Wu, Q. (Intern), Wang, W. (Ekstern)
Pages: 167-175
Stability Boundaries for Offshore Wind Park Distributed Voltage Control

In order to identify mechanisms causing slow reactive power oscillations observed in an existing offshore wind power plant, and be able to avoid similar events in the future, voltage control is studied in this paper for a plant with a static synchronous compensator, type-4 wind turbines and a park pilot control. Using data from the actual wind power plant, all stabilizing subsystem voltage proportional-integral controller parameters are first characterized based on their Hurwitz signature. Inner loop current control is then designed using Internal Mode Control principles, and guidelines for feed forward filter design are given to obtain required disturbance rejection properties. The paper contributes by providing analytical relations between power plant control, droop, sampling time, electrical parameters and voltage control characteristics, and by assessing frequencies and damping of reactive power modes over a realistic envelope of electrical impedances and control parameters.
Statistical modelling of space-time processes with application to wind power.

Short-term wind power forecasts together with a quantification of uncertainties are required for the reliable operation of power systems with significant wind power penetration. A challenge for utilizing wind power as a source of energy is the intermittent and hardly predictable nature of wind. This thesis aims at contributing to the wind power literature by building and evaluating new statistical techniques for producing forecasts at multiple locations and lead times using spatio-temporal information. By exploring the features of a rich portfolio of wind farms in western Denmark, we investigate different types of models and provide several forms of predictions. Starting with spatial prediction, we then extend the methodology to spatio-temporal prediction of individual wind farms and aggregated wind power at monitored locations as well as at locations where recent observations are not available. We propose spatial models for predicting wind power generation at two different time scales: for annual average wind power generation and for a high temporal resolution (typically wind power averages over 15-min time steps). In both cases, we use a spatial hierarchical statistical model in which spatial correlation is captured by a latent Gaussian field. We explore how such models can be handled with stochastic partial differential approximations of Matérn Gaussian fields together with integrated nested Laplace approximations. We show that complex hierarchical spatial models are well suited for wind power data and provide results in reasonable computational time. Moreover, the hierarchical approach for obtaining predictions at a high temporal resolution is found to produce accurate predictions with improved performance compared to a standard geostatistical method at a small additional computational cost. The use of the integrated nested Laplace approximations is motivated by the desire to produce forecasts on large data sets with hundreds of locations, which is critical during periods of high wind penetration. Subsequently, the extension from spatial to spatio-temporal models is given. Three different hierarchical
models are developed for obtaining probabilistic wind power forecasts. First, a time series model consisting of an
autoregressive process with a location specific intercept is considered. This approach gives satisfactory results for
individual forecasts but fails to generate calibrated aggregated forecasts. The second approach has a common intercept
for all farms and a spatio-temporal model that varies in time with first order autoregressive dynamics and has spatially
correlated innovations given by a zero mean Gaussian process. The third model, which also has a common intercept as
well as an autoregressive process to capture the local variability and the spatio-temporal term from the second approach,
is able to produce reliable individual and aggregated forecasts for multiple lead times. Finally, very-short-term wind power
forecasting is considered. Probabilistic forecasts from 15 minutes up to two hours ahead are produced by using
anisotropic spatio-temporal correlation models to account for the propagation of weather fronts and a transformed latent
Gaussian field is used to accommodate the probability masses that occur in wind power distribution due to chains of zero
measurements. Using what is called kriging equations, even the simplest proposed covariance model is able to produce
calibrated spatio-temporal predictions of wind power production.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Department of
Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Lenzi, A. (Intern), Ersbøll, B. K. (Intern), Clemmensen, L. K. H. (Intern), Pinson, P. (Intern)
Number of pages: 192
Publication date: 2017

Publication information
Publisher: DTU Compute
Original language: English

Series: DTU Compute PHD-2017
Volume: 451
ISSN: 0909-3192
Main Research Area: Technical/natural sciences
Electronic versions:
phd451_Lenzi_A.pdf

Relations
Projects:
Statistical modelling of space-time processes with application to wind power.
Publication: Research › Ph.D. thesis – Annual report year: 2017

Stenosis of the superficial femoral artery evaluated in-vivo with vector concentration - a novel ultrasound vector velocity
derived flow parameter for measurement of flow complexity

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering
Authors: Hansen, K. L. (Ekstern), Hansen, P. M. (Ekstern), Ewertsen, C. (Ekstern), Lonn, L. (Ekstern), Jensen, J. A.
(Intern), Nielsen, M. B. (Ekstern)
Number of pages: 1
Pages: 11-11
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Radiologica
Volume: 58
ISSN (Print): 0284-1851
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.906 SJR 0.754 CiteScore 1.62
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.54 SJR 0.725 SNIP 0.926
BFI (2015): BFI-level 1
Strain histograms are equal to strain ratios in predicting malignancy in breast tumours

Objectives: To assess whether strain histograms are equal to strain ratios in predicting breast tumour malignancy and to see if either could be used to upgrade Breast Imaging Reporting and Data System (BI-RADS) 3 tumours for immediate biopsy. Methods: Ninety-nine breast tumours were examined using B-mode BI-RADS scorings and strain elastography. Strain histograms and ratios were assessed, and areas-under-the-receiver-operating-characteristic-curve (AUROC) for each method calculated. In BI-RADS 3 tumours cut-offs for strain histogram and ratio values were calculated to see if some tumours could be upgraded for immediate biopsy. Linear regression was performed to evaluate the effect of tumour depth and size, and breast density on strain elastography. Results: Forty-four of 99 (44.4%) tumours were malignant. AUROC of BI-RADS, strain histograms and strain ratios were 0.949, 0.830 and 0.794 respectively. There was no significant difference between AUROCs of strain histograms and strain ratios (P = 0.405), while they were both inferior to BI-RADS scoring (P<0.001, P = 0.008). Four out of 26 BI-RADS 3 tumours were malignant. When cut-offs of 189 for strain histograms and 1.44 for strain ratios were used to upgrade BI-RADS 3 tumours, AUROCS were 0.961 (Strain histograms and BI-RADS) and 0.941 (Strain ratios and BI-RADS). None of them was significantly different from BI-RADS scoring alone (P = 0.249 and P = 0.414). Tumour size and depth, and breast density influenced neither strain histograms (P = 0.196, P = 0.115 and P = 0.321) nor strain ratios (P = 0.411, P = 0.596 and P = 0.321). Conclusion: Strain histogram analyses are reliable and easy to do in breast cancer diagnosis and perform comparably to strain ratio analyses. No significant difference in AUROCs between BI-RADS scoring and elastography combined with BI-RADS scoring was found in this study.
Structural Emergency Control for Power Grids

In this paper, we introduce a structural emergency control to render post-fault dynamics of power systems from the critical fault-cleared state to a stable equilibrium point (EP).

Theoretically, this is a new control paradigm that does not rely on any continuous measurement or load shedding, as in the classical setup. Instead, the grid is made stable by intentionally changing the power network structure, and thereby, discretely relocating the EP and its stability region such that the system is consecutively driven from fault-cleared state through a set of EPs to the desired EP. The proposed control is designed by solving convex optimization problems, making it possibly scalable to large-scale power grids. In the practical side, the proposed control can be implemented by exploiting the FACTS devices that will be widely available on the grids, and hence, requiring minor investment.

Structural Emergency Control Paradigm

Power grids normally operate at some stable operating condition where power supply and demand are balanced. In response to emergency situations, load shedding is a prevailing approach where local protective devices are activated to cut a suitable amount of load to quickly rebalance the supply demand and hopefully stabilize the system. This traditional emergency control results in interrupted service with severe economic damage to customers. Also, such control is usually less effective due to the lack of coordination among protective devices. In this paper, we propose a novel structural emergency control to render post-fault dynamics from the critical/emergency fault cleared state to the stable equilibrium point. This is a new control paradigm that does not rely on any continuous measurement or load shedding, as in the classical setup. Instead, the grid is made stable by discretely relocating the equilibrium point and its stability region, such that the system is consecutively attracted from the fault-cleared state back to the original equilibrium point. The proposed control is designed by solving linear and convex optimization problems, making it possibly scalable to large-scale power grids. Finally, this emergency control scheme can be implemented by exploiting transmission facilities available on the existing grids.
Study protocol: effect of playful training on functional abilities of older adults - a randomized controlled trial

Background: Loss of functional capabilities due to inactivity is one of the most common reasons for fall accidents, and it has been well established that loss of capabilities can be effectively reduced by physical activity. Pilot studies indicate a possible improvement in functional abilities of community dwelling elderly as a result of short-term playing with an exergame system in the form of interactive modular tiles. Such playful training may be motivational to perform and viewed by the subjects to offer life-fulfilling quality, while providing improvement in physical abilities, e.g. related to prevent fall accidents. The RCT will test for a variety of health parameters of community-dwelling elderly playing on interactive modular tiles.

Methods: The study will be a single blinded, randomized controlled trial with 60 community-dwelling adults 70+ years. The trial will consist an intervention group of 30 participants training with the interactive modular tiles, and a control group of 30 participants that will receive the usual care provided to non-patient elderly. The intervention period will be 12 weeks. The intervention group will perform group training (4-5 individuals for 1 h training session with each participant receiving 13 min training) on the interactive tiles twice a week. Follow-up tests include 6-min Walk Test (6MWT), the 8-ft Timed Up & Go Test (TUG), and the Chair-Stand Test (CS) from the Senior Fitness Test, along with balancing tests (static test on Wii Board and Line Walk test). Secondary outcomes related to adherence, motivation and acceptability will be investigated through semi-structured interviews. Data will be collected from pre-and post-tests. Data will be analyzed for statistically significant differences by checking that there is a Gaussian distribution and then using paired t-test, otherwise using Wilcoxon signed-rank test. "Intention to treat" analysis will be done. Discussion: The trial tests for increased mobility, agility, balancing and general fitness of community-dwelling elderly as a result of playing, in this case on modular interactive tiles. A positive outcome may help preventing loss of functional capabilities due to inactivity.
Subcortical and cortical correlates of pitch discrimination: Evidence for two levels of neuroplasticity in musicians

Musicians are highly trained to discriminate fine pitch changes but the neural bases of this ability are poorly understood. It is unclear whether such training-dependent differences in pitch processing arise already in the subcortical auditory system or are linked to more central stages. To address this question, we combined psychoacoustic testing with functional MRI to measure cortical and subcortical responses in musicians and non-musicians during a pitch-discrimination task. First, we estimated behavioral pitch-discrimination thresholds for complex tones with harmonic components that were either resolved or unresolved in the auditory system. Musicians outperformed non-musicians, showing lower pitch-discrimination thresholds in both conditions. The same participants underwent task-related functional MRI, while they performed a similar pitch-discrimination task. To account for the between-group differences in pitch-discrimination, task difficulty was adjusted to each individual's pitch-discrimination ability. Relative to non-musicians, musicians showed increased neural responses to complex tones with either resolved or unresolved harmonics especially in right-hemispheric areas, comprising the right superior temporal gyrus, Heschl's gyrus, insular cortex, inferior frontal gyrus, and in the inferior colliculus. Both subcortical and cortical neural responses predicted the individual pitch-discrimination performance. However, functional activity in the inferior colliculus correlated with differences in pitch discrimination across all participants, but not within the musicians group alone. Only neural activity in the right auditory cortex scaled with the fine pitch-discrimination thresholds within the musicians. These findings suggest two levels of neuroplasticity in musicians, whereby training-dependent changes in pitch processing arise at the collicular level and are preserved and further enhanced in the right auditory cortex.
Today, face-to-face meetings are frequently replaced by video conferences in order to reduce costs and carbon footprint related to travels and to increase the company efficiency. Yet, complaints about the difficulty of understanding the speech of the participants in both rooms of the video conference occur. The aim of this study is to find out the main causes of difficulties in speech communication. Correlation studies between subjective perceptions were conducted through questionnaires and objective acoustic and indoor climate parameters related to video conferencing. Based on four single-room and three combined-room measurements, it was found that the traditional measure of speech, such as the speech transmission index, was not correlated with the subjective classifications. Thus, a correlation analysis was conducted as an attempt to find the hidden factors behind the subjective perceptions, revealing the speech intelligibility during video conferencing was highly correlated to EDT, D50, and MTI in the 125 Hz frequency band.
Super-Positioning of Voltage Sources for Fast Assessment of Wide-Area Thévenin Equivalents

A method for superimposing voltage sources is sought optimized by using a sparse triangular solver and multiprocessing. A revision to the method is suggested which exploits Schur’s complement of the network admittance matrix and optimal re-use of computations. The algorithm is implemented and parallelized for shared memory multiprocessing. The proposed algorithm is tested on a collection of large test systems and performance is found to be significantly better than the reference method. The algorithm will thereby facilitate a speed-up of methods relying on Thévenin equivalent representation such as the Thévenin equivalent method for contingency assessment.
Super-resolution Axial Localization of Ultrasound Scatter Using Multi-focal Imaging

This paper aims to develop a method for achieving micrometre axial scatterer localization for medical ultrasound, surpassing the inherent, pulse length dependence limiting ultrasound imaging. Methods: The method, directly translated from cellular microscopy, is based on multi-focal imaging and the simple, aberration dependent, image sharpness metric of a single point scatterer. The localization of a point scatterer relies on the generation of multiple overlapping sharpness curves, created by deploying three foci during receive processing, and by assessing the sharpness values after each acquisition as a function of depth. Each derived curve peaks around the receive focus and the unique position of the scatterer is identified by combining the data from all curves using a maximum likelihood algorithm with a calibration standard. Results: Simulated and experimental ultrasound point scatter data show that the sharpness method can provide scatterer axial localization with an average accuracy down to 10.21 µm (≈ L/21) and with up to 11.4 times increased precision compared to conventional localization. The improvements depend on the rate of change of sharpness using each focus, and the signal to noise ratio in each image. Conclusion: Super-resolution axial imaging from optical microscopy has been successfully translated into ultrasound imaging by using raw ultrasound data and standard beamforming. Significance: The normalized sharpness method has the potential to be used in scatterer localization applications and contribute in current super-resolution ultrasound imaging techniques.
Supporting Control Room Operators in Highly Automated Future Power Networks

Operating power systems is an extremely challenging task, not least because power systems have become highly interconnected, as well as the range of network issues that can occur. It is therefore a necessity to develop decision support systems and visualisation that can effectively support the human operators for decisionmaking in the complex and dynamic environment of future highly automated power system. This paper aims to investigate the decision support functions associated with frequency deviation events for the proposed Web of Cells concept.

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Supporting involvement of electric vehicles in distribution grids: Lowering the barriers for a proactive integration

Increasing environmental concerns are driving an evolution of the energy system in which electric vehicles (EVs) play an important role. Still, as the EV number increases, the adverse impact of charging is observed more widely, especially at the low-voltage level where high EV concentrations cause various detrimental effects due to the coincidence between EV charging and residential peak load. However, if managed properly, EVs become flexible resources which can improve the system operation, making them an attractive asset for the distribution system operator. With the recent technology development, new forms of local EV support can be developed, provided that an appropriate regulatory framework is established. Whereas the technical value of such EV distribution grid services has already been proven, integrating them into the European regulatory context is not straightforward. In the context where active distribution grid management schemes are still to be developed, it is important to recognise the barriers for active EV involvement in the early stage of the development. This manuscript focuses on identifying these barriers from a technology and infrastructure perspective as well as from the regulatory and market aspect. Various policy recommendations are provided for the stakeholders involved in the EV value chain.
A switched capacitor dc-dc converter with frequency-planned control is presented. By splitting the output stage switches in eight segments the output voltage can be regulated with a combination of switching frequency and switch conductance. This allows for switching at predetermined frequencies, 31.25 kHz, 250 kHz, 500 kHz, and 1 MHz, while maintaining regulation of the output voltage. The controller is implemented in 180 CMOS with a 1/3 series-parallel output stage designed for 3.6–4.2 V input, 1.2 V output, and 1–40 mA load current. The proposed controller is compared with a co-integrated pulse skipping controller and yields a 84.8% reduction in worst-case low-load output ripple voltage and a 1.5% increase in peak efficiency reaching 92.5%, while also providing a predictable spectrum of the switching noise, reducing the risk of interfering with other sensitive circuits.
Synthesis and design of a fully integrated multi-topology switched capacitor DC-DC converter with gearbox control

This paper discusses a methodology of minimizing the amount of switches in a multi-topology fully integrated switched capacitor dc-dc converter powered by a super capacitor for energy harvesting purposes. The design of a simple controlling circuit for the multi-topology power stage using a gearbox approach is presented with all the required circuits. The converter is able to generate a output voltage of 1.2 V from a 470 mF capacitor charged to 3 V down to 1.4 V. The output voltage is regulated with a ripple voltage below 7 mV. The controlling circuit including buffers with ideal comparators has a power consumption of 129 μW, the average efficiency is 67% and the peak efficiency of the converter is 81%.

Synthetic Aperture Sequential Beamforming using Spatial Matched Filtering

Synthetic Aperture Sequential Beamforming (SASB) has shown to achieve a good resolution and high penetration depth. The low complexity at the transducer level of the beamformer makes it ideal for use with a handheld device. SASB with a low F# (≤ 0.5) can achieve even better resolution at the cost of high grating lobes, which causes loss of contrast in the final image. In this paper, Spatial Matched Filtering (SMF) was used instead the second stage of beamformer, in an attempt to suppress the grating lobes. The advantage of SMF over SASB was investigated by pushing the limits of F#, from 1.5 to 0.5. The effect of the number of emissions used in first stage was also investigated. A 3.3 MHz BK Ultrasound 9040 convex array was simulated in Field II on a point scatter phantom and a cyst phantom. The resolution was quantified with the full-width-half-max (FWHM), and the contrast was measured with the 20 dB cystic resolution. The contrast-to-noise ratio (CNR) was calculated for the cyst mimicking phantom. The results showed that SMF achieved similar resolution as SASB and improved grating lobe suppression leading to an increase in contrast. The grating lobes caused by an F# of 0.5 are dominant in the SASB images, but not as much in SMF images. The CNR for a cyst mimicking phantom was improved 7 dB and 6 dB for SMF over SASB at depth 20 mm and 30 mm, with an F# of 0.5 and 256 emissions. The FWHM for SMF was slightly higher than SASB across all depth and parameter settings, with a maximum difference of 0.3 mm. It was demonstrated that SMF can achieve similar resolution to SASB and for certain parameter settings improve the contrast by suppressing the grating lobe artifacts.
System Level Power Optimization of Digital Audio Back End for Hearing Aids

This work deals with power optimization of the audio processing back end for hearing aids - the interpolation filter (IF), the sigma-delta (SD modulator and the Class D power amplifier (PA) as a whole. Specifications are derived and insight into the tradeoffs involved is used to optimize the interpolation filter and the SD modulator on the system level so that the switching frequency of the Class D PA - the main power consumer in the back end - is minimized. A figure-of-merit (FOM) which allows judging the power consumption of the digital part of the back end early in the design process is used to track the hardware and power demands as the tradeoffs of the system level parameters are investigated. The result is the digital part of the back end optimized with respect to power which provides audio performance comparable to state-of-the-art. A combination of system level parameters leading to the lowest switching frequency of the Class D power amplifier reported in literature for the SD modulator based back end is derived using this approach.
Tailoring the nonlinear response of MEMS resonators using shape optimization

We demonstrate systematic control of mechanical nonlinearities in micro-electromechanical (MEMS) resonators using shape optimization methods. This approach generates beams with non-uniform profiles, which have nonlinearities and frequencies that differ from uniform beams. A set of bridge-type microbeams with selected variable profiles that directly affect the nonlinear characteristics of in-plane vibrations was designed and characterized. Experimental results have demonstrated that these shape changes result in more than a three-fold increase and a two-fold reduction in the Duffing nonlinearity due to resonator mid-line stretching. The manipulation of this nonlinearity has significant interest in many applications, including precise mass sensing, accurate measurement of angular rates, and timekeeping. Published by AIP Publishing.

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Taxonomy for Evaluation of Distributed Control Strategies for Distributed Energy Resources

Distributed control strategies applied to power distribution control problems are meant to offer robust and scalable integration of distributed energy resources (DER). However, the term “distributed control” is often loosely applied to a variety of very different control strategies. In particular there is a lack of discrimination between aspects related to communication topology, physical distribution of components and associated control objectives. This has lead to a lack of objective criteria for performance comparison and general quality assessment of state of the art distributed control solutions. For such comparison, a classification is required that is consistent across the different aspects mentioned above. This paper develops systematic categories of control strategies that accounts for communication, control and physical distribution aspects of the problem, and provides a set of criteria that can be assessed for these categories. The proposed taxonomy is applied to the state of the art as part of a review of existing work on distributed control of DER. Finally, we demonstrate the applicability and usefulness of the proposed classification to researchers and system designers.

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Bibliographical note
Technological aided assessment of the acutely ill patient - The case of postoperative complications

Surgical interventions come with complications and highly reported mortality after major surgery. The mortality may be a result of delayed detection of severe complications due to lower monitoring frequency in the general wards. Several studies have shown that continuous monitoring is superior to the manually intermittent recorded monitoring in terms of detecting abnormal physiological signs. Hopefully improved observations may result in earlier detection and clinical intervention. This narrative review will describe current monitoring possibilities for postoperative patients and how it may prevent complications. Several wireless systems are being developed for monitoring vital parameters, but many of these are not yet validated for critically ill patients. The ultimate goal with patient monitoring and detect of events is to prevent postoperative complications, death and costs in the health care system. A few studies indicate that monitoring systems detect deteriorating patients earlier than the nurses, and this was associated with less clinical instability. An important caveat of future devices is to assess their effect in relevant patient populations and not only in healthy test-subjects. Implementation of novel technologies is expensive although expected to be cost-effective if just few adverse events can be prevented. The future is here with promising devices and the possibility to give an unprecedented precise risk estimation of adverse post-surgical events. Next step is to integrate existing evidence based treatment algorithms to demonstrate the clinical efficacy of implementing the new technology.
Temporal processing deficits due to noise-induced synaptopathy studied using envelope following responses

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The circle equation over finite fields
Interesting patterns in the geometry of a plane algebraic curve $C$ can be observed when the defining polynomial equation is solved over the family of finite fields. In this paper, we examine the case of $C$ the classical unit circle defined by the circle equation $x^2 + y^2 = 1$. As a main result, we establish a concise formula for the number of solutions to the circle equation over an arbitrary finite field. We also provide criteria for the existence of diagonal solutions to the circle equation. Finally, we give a precise description of how the number of solutions to the circle equation over a prime field grows as a function of the prime.

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The future of Robotics Technology
In the last decade the robotics industry has created millions of additional jobs led by consumer electronics and the electric vehicle industry, and by 2020, robotics will be a $100 billion worth industry, as big as the tourism industry. For example, the rehabilitation robot market has grown 10 times between 2010 and 2016, thanks to advancements in rehab/therapy robots, active prostheses, exoskeletons, and wearable robotics. In short, the very next decade robotics will become vital components in a number of applications and robots paired with AI will be able to perform complex actions that are capable of learning from humans, driving the intelligent automation phenomenon. Therefore, in this paper we try to depict the direction and the fields of application of such important sector of future markets, and scientific research.

General information
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The impact of large structural brain changes in chronic stroke patients on the electric field caused by transcranial brain stimulation
Transcranial magnetic stimulation (TMS) and transcranial direct current stimulation (TDCS) are two types of non-invasive transcranial brain stimulation (TBS). They are useful tools for stroke research and may be potential adjunct therapies for functional recovery. However, stroke often causes large cerebral lesions, which are commonly accompanied by a secondary enlargement of the ventricles and atrophy. These structural alterations substantially change the conductivity distribution inside the head, which may have potentially important consequences for both brain stimulation methods. We therefore aimed to characterize the impact of these changes on the spatial distribution of the electric field generated by both TBS methods. In addition to confirming the safety of TBS in the presence of large stroke-related structural changes, our aim was to clarify whether targeted stimulation is still possible. Realistic head models containing large cortical and subcortical stroke lesions in the right parietal cortex were created using MR images of two patients. For TMS, the electric field of a double coil was simulated using the finite-element method. Systematic variations of the coil position relative to the lesion were tested. For TDCS, the finite-element method was used to simulate a standard approach with two electrode pads, and the position of one electrode was systematically varied. For both TMS and TDCS, the lesion caused electric field "hot spots" in the cortex. However, these maxima were not substantially stronger than those seen in a healthy control. The electric field pattern induced by TMS was not substantially changed by the lesions. However, the average field strength generated by TDCS was substantially decreased. This effect occurred for both head models and even when both electrodes were distant to the lesion, caused by increased current shunting through the lesion and enlarged ventricles. Judging from the similar peak field strengths compared to the healthy control, both TBS methods are safe in patients with large brain lesions (in practice, however, additional factors such as potentially lowered thresholds for seizure-induction have to be considered). Focused stimulation by TMS seems to be possible, but standard tDCS protocols appear to be less efficient than they are in healthy subjects, strongly suggesting that tDCS studies in this population might benefit from individualized treatment planning based on realistic field calculations.

General information
Thermostat Controlled Loads Flexibility Assessment for Enabling Load Shifting – An Experimental Proof in a Low Voltage Grid

This paper investigates the usability of thermostat controlled domestic appliances for load shift in LV distribution grids. The proposed method uses refrigerators for the demonstration of adaptive load prediction to estimate its flexibility and perform scheduling based on load threshold limit. Two 1-week long experiments with real-time fridge measurements from 10 real households are conducted to observe the usability of domestic thermostat controlled loads in solving issues by load shift. The experimental results show that the total threshold crossing time is reduced by 37.48% with energy reduction by 17 kWh and an increase in the average cold chamber temperature by 1.7°C. The control flexibility of loads increases from 22.5% to 54% by bypassing their thermostat. Based on the results, we can conclude that thermostat controlled appliances can be used for load shifting without compromising the user comfort expressed by the temperature limits.

Thermostat Controlled Loads Flexibility Assessment for Enabling Load Shifting – An Experimental Proof in a Low Voltage Grid

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The role of temporal cues in voluntary stream segregation in cochlear implant listeners

Cochlear implant (CI) listeners experience difficulties in complex listening scenarios, where the auditory system is required to segregate a target signal from the competing sound sources. The present study investigated segregation abilities of CI listeners as a function of temporal cues and examined whether a two-stream percept occurs instantaneously or needs time to build up. CI users participated in a detection task where a sequence of regularly presented bursts of pulses (“B”) on a single electrode interleaved with an irregular sequence (“A”) presented on the same electrode with a different pulse rate. The pulse rate difference and the duration of the sequences were varied between trials. In half of the trials, a delay was added to the last burst of the regular A sequence and the listeners were asked to detect this delay. As the period between consecutive B bursts was jittered, time judgments between the A and B sequences did not provide a reliable cue to perform the task such that the segregation of A and B should improve performance. The results showed that performance improved with increasing rate differences and increasing sequence duration, suggesting that CI listeners can segregate sounds based on temporal cues and that this percept builds up over time.

The speech-based envelope power spectrum model (sEPSM) family: Development, achievements, and current challenges

Intelligibility models provide insights regarding the effects of target speech characteristics, transmission channels and/or auditory processing on the speech perception performance of listeners. In 2011, Jørgensen and Dau proposed the speech-based envelope power spectrum model [sEPSM, Jørgensen and Dau (2011). J. Acoust. Soc. Am. 130(3), 1475-1487]. It uses the signal-to-noise ratio in the modulation domain (SNRenv) as a decision metric and was shown to accurately predict the intelligibility of processed noisy speech. The sEPSM concept has since been applied in various subsequent models, which have extended the predictive power of the original model to a broad range of conditions. This contribution presents the most recent developments within the sEPSM “family”: (i) A binaural extension, the B-sEPSM [Chabot-Leclerc et al. (2016). J. Acoust. Soc. Am. 140(1), 192-205] which combines better-ear and binaural unmasking processes and accounts for a large variety of spatial phenomena in speech perception; (ii) a correlation-based version [Relaño-Iborra et al. (2016). J. Acoust. Soc. Am. 140(4), 2670-2679] which extends the predictions of the early model to non-linear distortions, such as phase jitter and binary mask-processing; and (iii) a recent physiologically inspired extension, which allows to functionally account for effects of individual hearing impairment on speech perception.
Three Phase Power Imbalance Decomposition into Systematic Imbalance and Random Imbalance

Uneven load allocations and random load behaviors are two major causes for three-phase power imbalance. The former mainly cause systematic imbalance, which can be addressed by low-cost phase swapping; the latter contribute to random imbalance, which requires relatively costly demand-side managements. To reveal the maximum potential of phase swapping and the minimum need for demand-side managements, this paper first proposes a novel a priori judgment to classify any set of three-phase power series into one of four scenarios, depending on whether there is a definite maximum phase, a definite minimum phase, or both. Then, this paper proposes a new method to decompose three-phase power series into a systematic imbalance component and a random imbalance component as the closed-form solutions of quadratic optimization models that minimize random imbalance. A degree of power imbalance is calculated based on the systematic imbalance component to guide phase swapping. Case studies demonstrate that 72.8% of 782 low voltage substations have systematic imbalance components. The degree of power imbalance results reveal the maximum need for phase swapping and the random imbalance components reveal the minimum need for demand side management, if the three phases are to be fully rebalanced.
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Source: Publication PreSubmission
Source-ID: 136881552
Publication: Research - peer-review › Journal article – Annual report year: 2018

Tolerances in micro manufacturing
This paper describes a method for analysis of tolerances in micro manufacturing. It proposes a mapping of tolerances to dimensions and compares this with current available international standards. The analysis documents that tolerances are not scaled down as the absolute dimension. In practice a tolerance level of 10-100 μm seems to be the preferred level no matter the absolute dimension.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology
Authors: Hansen, H. N. (Intern), Zhang, Y. (Intern), Islam, A. (Intern)
Number of pages: 4
Publication date: 2017
Main Research Area: Technical/natural sciences
Topology and Control of Transformerless High Voltage Grid-connected PV System Based on Cascade Step-up Structure

In order to realize maximum power output of photovoltaics (PV), reduce line losses, and decrease abandoned solar energy during weak irradiance, a new medium voltage grid-connected PV system structure based on cascaded converters was proposed in this paper. A transformerless cascade step-up structure, instead of applying line-frequency step-up transformer, is proposed to connect PV directly to the 10 kV medium voltage grid. This series-connected step-up PV system integrates with multiple functions, including separated maximum power point tracking (MPPT), centralized energy storage, power quality regulation. Its inherent excellent features makes it not only adapt to different geographical and environmental installing conditions, but also to improve converter efficiency and flexibility. This paper focuses on the analyses of system structure design, control principle and strategy, and then comparing the performance of different PV plant structures, including central, multi-string and this novel series-connected structure. Additionally, by properly choosing storage battery capacity in accordance with the demand of power grid and load, this structure is able to achieve short-term power grid support and peak-load shifting.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Chinese Academy of Sciences
Authors: Yang, Z. (Ekstern), Wang, Z. (Ekstern), Zhang, Y. (Ekstern), Zhang, Z. (Intern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 43th Annual Conference of the IEEE Industrial Electronics Society
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 43rd Annual Conference of the IEEE Industrial Electronics Society, Beijing, China, 29/10/2017 - 29/10/2017
Transformerless PV system, Cascade step-up, Balance controller, Energy storage, Three-phase complementary balanced
Electronic versions: tmp_5333_000019.pdf
Source: PublicationPreSubmission
Source-ID: 139329017
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Topology Optimization Methods for Acoustic-Mechanical Coupling Problems

A comparative overview of methods for topology optimization of acoustic mechanical coupling problems is provided. The goal is to pave the road for developing efficient optimization schemes for the design of complex acoustic devices such as hearingaids.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering, Solid Mechanics
Authors: Jensen, J. S. (Intern), Dilgen, C. B. (Intern), Dilgen, S. B. (Intern), Aage, N. (Intern)
Number of pages: 1
Pages: 89
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 30th Nordic Seminar on Computational Mechanics (NSCM-30)
Editors: Høsberg, J., Pedersen, N.
BFI conference series: Nordic Seminar on Computational Mechanics (5010906)
Main Research Area: Technical/natural sciences
Conference: 30th Nordic Seminar on Computational Mechanics (NSCM-30), Copenhagen, 25/10/2017 - 25/10/2017
Topology optimization, Acoustic-structure interaction
Electronic versions: TOPOLOGY_OPTIMIZATION.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017
This paper presents an alternative topology optimization method for bounded acoustic problems that uses the hybrid finite element-wave based method (FE-WBM). The conventional method for the topology optimization of bounded acoustic problems is based on the finite element method (FEM), which is limited to low frequency applications due to considerable computational efforts. To this end, we propose a gradient-based topology optimization method that uses the hybrid FE-WBM whereby the entire domain of a problem is partitioned into design and non-design domains. In this respect, the FEM is used as a design domain of topology optimization, and the WBM is used as a non-design domain to increase computational efficiency. The adjoint variable method based on the hybrid FE-WBM is also proposed as a means of computing design sensitivities. Numerical examples are presented to demonstrate the effectiveness of the proposed method. We compare the optimized design obtained from the proposed method to that obtained from the conventional method in terms of objective function values, optimized topologies and computational efficiency. The optimization results show that the proposed method can perform more efficient topology optimization than conventional method and can thus be applied to much higher frequency applications that conventional method takes considerable computation time to manage.

**General information**

State: Published  
Organisations: Department of Electrical Engineering, Acoustic Technology, Gwangju Institute of Science and Technology, Hyundai Heavy Industries Co. Ltd.  
Authors: Goo, S. (Ekstern), Wang, S. (Ekstern), Kook, J. (Intern), Koo, K. (Ekstern), Hyun, J. (Ekstern)  
Pages: 834-856  
Publication date: 2017  
Main Research Area: Technical/natural sciences  

**Publication Information**

Journal: Computer Methods in Applied Mechanics and Engineering  
Volume: 313  
ISSN (Print): 0045-7825  
Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Scopus rating (2017): SJR 2.883 SNIP 2.033  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 4.31 SJR 2.691 SNIP 1.945  
BFI (2015): BFI-level 2  
Scopus rating (2015): SJR 2.728 SNIP 2.104 CiteScore 3.91  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 2  
Scopus rating (2014): SJR 2.381 SNIP 2.1 CiteScore 3.41  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 2  
Scopus rating (2013): SJR 3.015 SNIP 2.227 CiteScore 3.5  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 2  
Scopus rating (2012): SJR 2.457 SNIP 2.236 CiteScore 3.04  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 2  
Scopus rating (2011): SJR 2.592 SNIP 1.964 CiteScore 3.03  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 2  
Scopus rating (2010): SJR 2.388 SNIP 1.922  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 2.205 SNIP 1.714  
Web of Science (2009): Indexed yes
Topology optimization of microwave waveguide filters

We present a density based topology optimization approach for the design of metallic microwave insert filters. A two-phase optimization procedure is proposed in which we, starting from a uniform design, first optimize to obtain a set of spectral varying resonators followed by a band gap optimization for the desired filter characteristics. This is illustrated through numerical experiments and comparison to a standard band pass filter design. It is seen that the carefully optimized topologies can sharpen the filter characteristics and improve performance. Furthermore, the obtained designs share little resemblance to standard filter layouts and hence the proposed design method offers a new design tool in microwave engineering.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology
Authors: Aage, N. (Intern), Johansen, V. E. (Intern)
Pages: 283–300
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Volume: 112
Issue number: 3
ISSN (Print): 0029-5981
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SJR 1.623 SNIP 1.493 CiteScore 2.88
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Topology optimization of periodic microstructures for enhanced loss factor using acoustic–structure interaction

In this work we present a topology optimization method for the design of 2D composite materials with a distribution of a solid constituent and a lossy acoustic medium for obtaining high loss factors. The method is based on a mixed displacement-pressure finite element (FE) formulation combined with the Bloch-wave condition. We solve the resulting FE eigenvalue problem on a repetitive unit cell with periodic boundary conditions and use a complex k(ω) eigenvalue formulation to compute the loss factor. We consider the optimization problem of maximizing the loss factor in a target frequency range with an additional constraint on the stiffness. In the provided example we demonstrate the effect of combined local resonators and acoustic resonances of similar frequency for creating an enhanced overall loss factor of the material.
Towards fully renewable energy systems - Experience and trends in Denmark

Deployment of renewable energy generation capacities and integration of their power production into existing power systems has become a global trend throughout the world, with a common set of operational challenges stemming from variability and limited predictability of power generation from, e.g., wind and solar. Denmark is a country that invested early in wind energy, rapidly proposing very ambitious goals for the future of its energy system and global energy usage. While the case of Denmark is specific due to its limited size and good interconnections, there may still be a lot to learn from the way operational practice has evolved, also shifting towards a liberalized electricity market environment, and more generally going along with other technological and societal evolution. Our aim here is to give an overview of recent and current initiatives in Denmark which contribute towards a goal of reaching a fully renewable energy system.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Pinson, P. (Intern), Mitridati, L. M. M. (Intern), Ordoudis, C. (Intern), Østergaard, J. (Intern)
Pages: 26 - 35
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 3
Issue number: 1
ISSN (Print): 2096-0042
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Web of Science (2016): Indexed yes
Original language: English
Renewable energy integration, Energy markets, Flexibility, Coordination, Integrated energy systems
Electronic versions:
07874618.pdf
DOIs:
10.17775/CSEEJPES.2017.0005
Source: PublicationPreSubmission
Source-ID: 127653290
Publication: Research - peer-review › Journal article – Annual report year: 2016
Towards new vistas in preamplifier design for MRI

High signal to noise ratio (SNR) in magnetic resonance imaging is vital for ensuring accurate diagnosis and treatment. Arrays of surface coils for receive only purposes is a well established way to increase SNR. However, due to crosstalk between the array elements, the SNR can be severely degraded. For that reason, arrays often do not exploit their full potential. By using a series decoupling network with non-conventional matching and preamplifier impedances the decoupling between elements can be increased significantly. In the presented design example, almost 6 dB additional decoupling can be achieved with no impairment of preamplifier noise figure. The decoupling changes as a function of both coil and preamplifier performance. Thus, the fundamental trade-off between noise and decoupling is discussed. This work embarks on the path towards new vistas in design of preamplifiers for surface coil arrays for magnetic resonance imaging.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Electromagnetic Systems, Center for Hyperpolarization in Magnetic Resonance
Authors: Johansen, D. H. (Intern), Sanchez, J. D. (Intern), Zhurbenko, V. (Intern), Ardenkjær-Larsen, J. H. (Intern)
Pages: 1159-1162
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 47th European Microwave Conference
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 2017 47th European Microwave Conference (EuMC), 10/10/2017 - 10/10/2017
Decoupling, Matching networks, Noise matching, Preamplifiers, Surface coils
Electronic versions:
EuMW17.pdf
EuMW17_1_.pdf
Source: FindIt
Source-ID: 2394344137
Publication: Research › peer-review › Article in proceedings – Annual report year: 2018

Towards solid oxide electrolysis plants in 2020

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Mixed Conductors, Department of Electrical Engineering, Electronics, Haldor Topsoe AS, Aalborg University
Authors: Chen, M. (Intern), Blennow, P. (Ekstern), Mathiesen, B. V. (Ekstern), Zhang, Z. (Intern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
Towards_solid_oxide_electrolysis_plants_in_2020.pdf
Publication: Research › Poster – Annual report year: 2018

Transactive Energy A Review of State of The Art and Implementation

In future smart grids, large-scale deployment of distributed energy resources (DERs) and renewable energy sources (RES) is expected. In order to integrate a high penetration level of DERs and RES in the grid while operating the system safely and efficiently, new control methods for power system operations are in demand so that the flexibility of the responsive assets in the grid can be further explored. Transactive control, considered as one of the most novel distributed control approaches for power system operations, has been extensively discussed and studied around the world in recent years. This paper provides a bibliographical review on the researches and implementation of the transactive energy concepts and transactive control techniques in power systems. The ideas of transactive control are introduced mainly according to the transactive energy framework proposed by the GridWise Architecture Council. The implementation pilots and research studies on transactive control applications in power systems are reviewed subsequently.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Transcranial magnetic stimulation of right inferior parietal cortex causally influences prefrontal activation for visual detection

For effective interactions with the environment, the brain needs to form perceptual decisions based on noisy sensory evidence. Accumulating evidence suggests that perceptual decisions are formed by widespread interactions amongst sensory areas representing the noisy sensory evidence and fronto-parietal areas integrating the evidence into a decision variable that is compared to a decisional threshold. This concurrent transcranial magnetic stimulation (TMS)-fMRI study applied 10 Hz bursts of four TMS (or Sham) pulses to the intraparietal sulcus (IPS) to investigate the causal influence of IPS on the neural systems involved in perceptual decision-making. Participants had to detect visual signals at threshold intensity that were presented in their left lower visual field on 50% of the trials. Critically, we adjusted the signal strength such that participants failed to detect the visual stimulus on approximately 30% of the trials allowing us to categorise trials into hits, misses and correct rejections (CR). Our results show that IPS-relative to Sham-TMS attenuated activation increases for misses relative to CR in the left middle and superior frontal gyri. Critically, while IPS-TMS did not significantly affect participants' performance accuracy, it affected how observers adjusted their response times after making an error. We therefore suggest that activation increases in superior frontal gyri for misses relative to correct responses may not be critical for signal detection performance, but rather reflect post-decisional processing such as metacognitive monitoring of choice accuracy or decisional confidence.
Transient stability improvement: a review and comparison of conventional and renewable-based techniques for preventive and emergency control

This paper aims at reviewing and summarizing the vast variety of techniques to improve transient stability of power systems. A qualitative comparison of the techniques is presented and the future outlook is discussed. The techniques are categorized into conventional and renewable-based techniques. Conventional techniques are well established and have been employed in the past. Renewable techniques investigate how generators based on renewable energy sources (RES) can contribute to improving stability. Moreover, it is distinguished between techniques applying preventive and emergency controls. For preventive control, re-dispatch of generators and series compensation are extensively used in practice, whereas for emergency control, a great share of the techniques aim at voltage support during fault conditions. Regarding preventive control using RES-based generation, one approach which temporarily increases the voltage setpoint of the units in order to increase the synchronizing power, is reported. Regarding renewable energy source based emergency control, low voltage ride-through (LVRT) capability including voltage support is a well established method. Nevertheless, it is also highlighted that high voltage ride-through (HVRT) capability plays a critical role. The findings show that distributed generation must be included in existing control schemes for preventive control, and new improvement techniques taking full advantage of them need to be developed.

General information
State: Published
Authors: Pertl, M. (Intern), Weckesser, J. T. G. (Intern), Rezkalla, M. M. (Intern), Marinelli, M. (Intern)
Number of pages: 19
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Electrical Engineering
ISSN (Print): 0948-7921
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.096 SJR 0.323 CiteScore 1.39
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.85 SJR 0.26 SNIP 0.517
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.32 SNIP 0.594 CiteScore 0.8
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.285 SNIP 0.515 CiteScore 0.76
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Transmission expansion in an oligopoly considering generation investment equilibrium

Transmission expansion planning (TEP) is a sophisticated decision-making problem, especially in an oligopolistic electricity market in which a number of strategic (price-maker) producers compete together. A transmission system planner, who is in charge of making TEP decisions, requires considering the future generation investment actions. However, in such an oligopolistic market, each producer makes its own strategic generation investment decisions. This motivates the transmission system planner to consider the generation investment decision-making problem of all producers within its TEP model. The strategic generation investment problem of each producer can be represented by a complementarity bi-level model. The joint consideration of all bi-level models, one per producer, characterizes the generation investment equilibrium that identifies the future evolution of generation investment in the market. This paper proposes a tri-level TEP decision-making model to be solved by the transmission system planner, whose objective is to maximize the social welfare of the market minus the expansion costs, and whose constraints are the transmission expansion limits as well as the generation investment equilibrium problem. This model is then recast as a mixed-integer linear programming problem and solved. Numerical results from an illustrative example and a case study based on the IEEE 14-bus test system demonstrate the usefulness of the proposed approach.
Transmitting Performance Evaluation of ASICs for CMUT-Based Portable Ultrasound Scanners

Portable ultrasound scanners (PUS) have, in recent years, raised a lot of attention, as they can potentially overcome some of the limitations of static scanners. However, PUS have a lot of design limitations including size and power consumption. These restrictions can compromise the image quality of the scanner. In order to overcome these restrictions, application specific integrated circuits (ASICs) are needed to implement the electronics. In this work, a comparative study of the transmitting performance of a capacitive micromachined ultrasonic transducer (CMUT) driven by a commercial generic ultrasound transmitter and an ASIC optimized for CMUT-based PUS is presented. A single CMUT element is pulsed with a 1% dutycycle at a frequency of 5 MHz. The DC bias voltage is 80 V and the pulsing voltage is 20 V. The acoustic
performance is assessed by comparing the ultrasonic signals measured with a hydrophone both in the time and frequency
domains. The difference in normalized signal amplitude evaluated at the center frequency of the CMUT is \(-1.9\) dB and the
measured bandwidth is equivalent. The ASIC consumes only 1.3\% of the total power consumption used by the
commercial transmitter.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electronics, Department of Micro- and Nanotechnology, MEMS-
AppliedSensors, Biomedical Engineering, Center for Fast Ultrasound Imaging
Authors: Llimos Muntal, P. (Intern), Diederichsen, S. E. (Intern), Jørgensen, I. H. H. (Intern), Jensen, J. A. (Intern),
Thomsen, E. V. (Intern)
Number of pages: 4
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of 2017 IEEE International Ultrasonics Symposium (IUS)
Publisher: IEEE
ISBN (Print): 9781538633823
Main Research Area: Technical/natural sciences
Conference: 2017 IEEE International Ultrasonics Symposium (IUS), Washington, United States, 06/09/2017 - 06/09/2017
Electronic versions:
PE_ASICS_CMUTs.pdf
DOIs:
10.1109/ULTSYM.2017.8092913
Source: PublicationPreSubmission
Source-ID: 134856992
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
adjustment of their frequency reference setpoints. In contrast to the commonly used Automatic Generation Control (AGC), the proposed Direct Load Frequency Control (DLFC) does not require an integrator for frequency control in the closed loop even under partial grid observability. The approach is Lyapunov-stable for a wide range of system parameters, including ramping limits of controlled resources. A performance study against AGC has been conducted on a three-area power system in simulations as well as in a real laboratory grid with an installed generation capacity of 110 kW.
Ultrasonic 3-D Vector Flow Method for Quantitative In Vivo Peak Velocity and Flow Rate Estimation

Current clinical ultrasound (US) systems are limited to show blood flow movement in either 1-D or 2-D. In this paper, a method for estimating 3-D vector velocities in a plane using the transverse oscillation method, a 32×32 element matrix array, and the experimental US scanner SARUS is presented. The aim of this paper is to estimate precise flow rates and peak velocities derived from 3-D vector flow estimates. The emission sequence provides 3-D vector flow estimates at up to 1.145 frames/s in a plane, and was used to estimate 3-D vector flow in a cross-sectional image plane. The method is validated in two phantom studies, where flow rates are measured in a flow-rig, providing a constant parabolic flow, and in a straight-vessel phantom (Ø=8 mm) connected to a flow pump capable of generating time varying waveforms. Flow rates are estimated to be 82.1 ± 2.8 L/min in the flow-rig compared with the expected 79.8 L/min, and to 2.68 ± 0.04 mL/stroke in the pulsating environment compared with the expected 2.57 ± 0.08 mL/stroke. Flow rates estimated in the common carotid artery of a healthy volunteer are compared with magnetic resonance imaging (MRI) measured flow rates using a 1-D through-plane velocity sequence. Mean flow rates were 333 ± 31 mL/min for the presented method and 346 ± 2 mL/min for the MRI measurements.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital
Pages: 544-554
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: IEEE Transactions on Ultrasonics, Ferroelectrics and Frequency Control
Volume: 64
Issue number: 3
ISSN (Print): 0885-3010
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 2.94 SJR 1.183 SNIP 1.447
Unregulated Series Resonant Converter for Interlinking DC Nanogrids

DC nanogrids have become a subject of interest in recent years due to the increase of renewable energy sources with energy storage systems. Hybrid AC/DC systems with different DC bus voltages are an interesting solution to efficiently supply different AC and DC loads. In this paper, a high efficiency bidirectional converter to interlink a 400V DC bus with a 48V DC bus is presented. The proposed converter is based on a LLC resonant converter operating as a DC transformer at a fixed frequency and duty cycle without any complex control strategy. A clear and simplified design procedure for high efficiency operation and optimal self-load regulation is presented. To verify the converter operation, a 1kW prototype has been implemented, featuring a maximum efficiency of 96.7% and a self-regulated output voltage with 3% of maximum offset from the nominal voltage.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Tomas Manez, K. (Intern), Zhang, Z. (Intern), Ouyang, Z. (Intern)
Pages: 647-654
Publication date: 2017

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Title of host publication: Proceedings of the 12th IEEE International Conference on Power Electronics and Drive Systems (PEDS 2017)
Publisher: IEEE
ISBN (Electronic): 978-1-5090-2364-6
Main Research Area: Technical/natural sciences
Conference: 12th IEEE International Conference on Power Electronics and Drive Systems (PEDS 2017), Honolulu, United States, 12/12/2017 - 12/12/2017
DOI:
10.1109/PEDS.2017.8289231

Upward lightning attachment analysis on wind turbines and correlated current parameters

This work provides insight in the attachment characteristics of upward initiated lightning discharges to wind turbines and their possible consequences for the lightning protection of wind turbine blades. All discharges were recorded at the Japanese coast of the Sea of Japan which is known for intense upward lightning activity. 172 video recordings of lightning discharges on rotating wind turbines are analysed and attachment angle, detachment angle, and the resulting angular displacement were determined. A classification between self-initiated and other-triggered upward lightning events is performed by means of video analysis. The results reveal that the majority of discharges are initiated on vertical blades; however, also attachments to horizontal blades are reported. Horizontal attachment (or a slightly inclined blade state) is often related with a triggered lightning event prior to the discharge. There are about twice as many lightning attachments during the ascending blade movement compared to the descending blade movement. Furthermore, a comparison between current parameters from stationary and rotating wind turbines reveal no substantial difference between the two operational modes. The dataset of video recordings and current measurements originates from the Japanese New Energy and Industrial Technology Development Organization Furthermore (NEDO) measurement campaign (2008 – 2013) which documented lightning incidences on wind turbines mainly during the winter season at the Sea of Japan.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, University of Tokyo, Central Research Institute of Electric Power Industry, Toyo sekkei Co.
Authors: Vogel, S. (Intern), Ishii, M. (Ekstern), Saito, M. (Ekstern), Natsuno, D. (Ekstern)
Number of pages: 5
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 4th International Symposium on Winter Lightning
Main Research Area: Technical/natural sciences
Conference: 4th International Symposium on Winter Lightning, Joetsu City, Japan, 12/04/2017 - 12/04/2017
Wind Turbine, Upward Lightning, Attachment, Self-initiated, Other-triggered, Winter Lightning
Electronic versions:
ISWL_2017_SV_V1.pdf
Source: PublicationPreSubmission
Source-ID: 132119164
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Use cases for integrated electrical and thermal energy systems operation and control with a view on simulation tools

There is a general lack of knowledge regarding energy systems coupling (also known as multi-energy systems (MES), multi-domain or integrated energy systems) and few well-defined use cases (UCs) that properly describe their operation. Energy systems coupling increases complexity due to additional operational, physical, temporal and spatial constraints making it challenging for analysis and simulation but also for designing operational strategies (e.g. control). In this paper, we present UCs based on a holistic validation and testing methodology in the context of integrated electro-thermal systems and discuss why we consider these UCs to be the most representative of such systems. Based on these UCs we derive requirements for simulation tools and level of detail (e.g. technical and temporal resolution) to simulate MES in a holistic way. We relate these requirements to the existing tools for studying integrated electro-thermal systems with a focus on their capabilities and limitations with respect to the analysis of system/network operation and control impact aspects. Control strategies of domains-linking components such as a heat pump can be various and challenging since actions taken in one domain could have an impact into another. We show that no single tool exists to cover all UCs and why such a tool may not be desirable after all.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Gehrke, O. (Intern), Richert, T. P. (Intern)
Number of pages: 6
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 52nd International Universities Power Engineering Conference (UPEC),
Publisher: IEEE
Main Research Area: Technical/natural sciences
Conference: 52nd International Universities' Power Engineering Conference, Heraklion, Greece, 28/08/2017 - 28/08/2017
Use cases, Integrated System, Simulation, Electro-thermal, District Heating
DOIs: 10.1109/UPEC.2017.8231934
Source: FindIt
Source-ID: 2394347339
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Using MFM methodology to generate and define major accident scenarios for quantitative risk assessment studies

Generating and defining Major Accident Scenarios (MAS) are commonly agreed as the key step for quantitative risk assessment (QRA). The aim of the study is to explore the feasibility of using Multilevel Flow Modeling (MFM) methodology to formulating MAS. Traditionally this is usually done based on historical incidents or the outcome of HAZOP/HAZID. This paper suggests using MFM to model the plant, and then performs systematic reasoning based on the model to produce casual paths of plant failure scenarios. The cause trees generated by MFM are transformed into fault trees, which are then used to calculate likelihood of each MAS. Combining the likelihood of each scenario with a qualitative risk matrix, each major accident scenario is thereby ranked for consideration for detailed consequence analysis. The methodology is successfully highlighted using part of BMA-process for production of hydrogen cyanide as case study.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Center for Electric Power and Energy, Energy System Management, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, China University of Mining And Technology
Authors: Hua, X. (Ekstern), Wu, Z. (Ekstern), Lind, M. (Intern), Wu, J. (Intern), Zhang, X. (Intern), Frutiger, J. (Intern), Sin, G. (Intern)
Pages: 589-594
Publication date: 2017

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Title of host publication: Proceedings of the 27th European Symposium on Computer Aided Process Engineering (ESCAPE 27)
Volume: 40
Publisher: Elsevier
Editors: Espuña, A., Graells, M., Puigjaner, L.
Edition: 1
ISBN (Print): 9780444639653
ISBN (Electronic): 9780444639707
Series: Computer Aided Chemical Engineering
Volume: 40
Validating Intelligent Power and Energy Systems: A Discussion of Educational Needs

Traditional power systems education and training is flanked by the demand for coping with the rising complexity of energy systems, like the integration of renewable and distributed generation, communication, control and information technology. A broad understanding of these topics by the current/future researchers and engineers is becoming more and more necessary. This paper identifies educational and training needs addressing the higher complexity of intelligent energy systems. Education needs and requirements are discussed, such as the development of systems-oriented skills and cross-disciplinary learning. Education and training possibilities and necessary tools are described focusing on classroom but also on laboratory-based learning methods. In this context, experiences of using notebooks, co-simulation approaches, hardware-in-the-loop methods and remote labs experiments are discussed.

Vector and Doppler Ultrasound Velocities Evaluated in a Flow Phantom and the Femoropopliteal Vein

Ultrasound is used for evaluating the veins of the lower extremities. Operator and angle dependency limit spectral Doppler ultrasound (SDUS). The aim of the study was to compare peak velocity measurements in a flow phantom and the femoropopliteal vein of 20 volunteers with the angle-independent vector velocity technique vector flow imaging (VFI) and SDUS. In the flow phantom, VFI underestimated velocity (p = 0.01), with a lower accuracy of 5.5% (p = 0.01) and with no difference in precision, that is, error factor, compared with SDUS (VFI: 1.02 vs. SDUS: 1.02, p = 0.58). In vivo, VFI estimated lower velocities (femoral: p = 0.001; popliteal: p = 0.001) with no difference in precision compared with SDUS (femoral: VFI 1.09 vs. SDUS 1.14, p = 0.37; popliteal: VFI 1.13 vs. SDUS 1.06, p = 0.09). In conclusion, the precise VFI technique can be used to characterize venous hemodynamics of the lower extremities despite its underestimation of velocities.
Vector Flow Imaging Compared with Conventional Doppler Ultrasound and Thermodilution for Estimation of Blood Flow in the Ascending Aorta

Transverse oscillation (TO) is a real-time ultrasound vector flow method implemented on a commercial scanner. The TO setup was examined on a flowrig with constant and pulsatile flow. Subsequently, 25 patients undergoing cardiac bypass surgery were scanned intraoperatively with TO on the ascending aorta and compared to transesophageal echocardiography (TEE) and pulmonary artery catheter thermodilution (PACTD). On the flowrig, TO had a precision of 5.5%, 9.4% and 14.7%, a percentage error of 18.2%, 14.6% and 40.7%, and a mean bias of 0.4 cm/s, 36.8 ml/min and 32.4 ml/min for velocity and flow rate (constant and pulsatile) estimation. The correlation coefficients for all flowrig evaluations were 0.99 indicating systematic bias. After bias correction, the percentage error was reduced to 11.5%, 12.6% and 15.9% for velocity and flow rate (constant and pulsatile) estimation. In the in vivo setup, TO, TEE, and PACTD had a precision of 21.9%, 13.7%, and 12.0%. TO compared with TEE and PACTD had a mean bias of 12.6 cm/s and –0.08 l/min, and a percentage error of 23.4%, and 36.7%, respectively. The percentage error was reduced to 22.9% for the TEE comparison, but increased to 43.8% for the PACTD comparison, after correction for the systematic bias found in the flowrig. TO is a reliable and precise method for velocity and flow rate estimation on a flowrig. However, TO with the present setup, is not interchangeable with PACTD for cardiac volume flow estimation, but is a reliable and precise angle-independent ultrasound alternative for velocity estimation of cardiac flow.
Vector flow imaging, Transverse oscillation, Flowrig, Intraoperative cardiac ultrasound, Ascending aorta

Vector velocity estimation of blood flow – A new application in medical ultrasound

Vector flow techniques in the field of ultrasound encompass different pulse emission and estimation strategies. Numerous techniques have been introduced over the years, and recently commercial implementations usable in the clinic have been made. A number of clinical papers using different vector velocity approaches have been published. This review will give an overview of the most significant in vivo results achieved with ultrasound vector flow techniques, and will outline some of the possible clinical applications for vector velocity estimation in the future.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, University of Copenhagen
Authors: Hansen, K. L. (Ekstern), Nielsen, M. B. (Ekstern), Jensen, J. A. (Intern)
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Velocity Estimation in Medical Ultrasound

This article describes the application of signal processing in medical ultrasound velocity estimation. Special emphasis is on the relation among acquisition methods, signal processing, and estimators employed. The description spans from current clinical systems for one-and two-dimensional (1-D and 2-D) velocity estimation to the experimental systems for three-dimensional (3-D) estimation and advanced imaging sequences, which can yield thousands of images or volumes per second with fully quantitative flow estimates. Here, spherical and plane wave emissions are employed to insonify the whole region of interest, and full images are reconstructed after each pulse emission for use in velocity estimation.

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Authors: Jensen, J. A. (Intern), Villagómez Hoyos, C. A. (Intern), Holbek, S. (Intern), Hansen, K. L. (Intern)
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Vector velocity estimation, Blood flow, Angle independent, Doppler ultrasound

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Verbal attribute magnitude estimates of pulse trains across electrode places and stimulation rates in cochlear implant listeners

For cochlear implant users, temporal and place cue are assumed to vary along two orthogonal perceptual dimensions linked to pitch height and timbre. Here, the effect of electrode place, pulse rate, and amplitude modulation frequency on those perceptual dimensions was investigated. Combinations of different electrode places with differing pulse rates or modulation frequencies were presented to the participants while they were asked to rate pitch height and sound quality using multiple verbal attributes. The results indicate that temporal and place cues induce two perceptual dimensions that can be both linked to pitch and timbre.

General information
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Publisher: The Danavox Jubilee Foundation
Editors: Santurette, S., Dau, T., C.-Dalsgaard, J., Tranebjaerg, L., Andersen, T., Poulsen, T.
Very High Frequency Galvanic Isolated Offline Power Supply

During the last decades many researchers have turned their attention to raising the operation frequency of power converters to the very high frequency (VHF) range going from 30 MHz to 300 MHz. Increasing the operating frequency of a power converter leads to smaller energy storing components and hence smaller volume. The smaller volume comes from the passive components that scales inversely with frequency, and thereby decrease in value and size as the frequency is increased. Air-core magnetic materials are the preferred choice for VHF converters as there is no core losses and the selection of magnetic materials are still very limited. Ceramic capacitors are very suitable for VHF converters and with new semiconductor materials, this area will only grow in the near future.

Increasing the frequency to the VHF range also increases the switching losses, therefor soft switching techniques are used to eliminate the switching losses. The topologies used, are inspired by radio frequency amplifiers, which are used to generate high frequency current for an antenna. In VHF converters this antenna is replaced by a rectifier to generate a DC voltage. Driving these type of converters can be a challenge as hard gating of traditional silicon MOSFETs generates losses that are frequency depended. Several soft gating solutions have been presented that limit the losses at these frequencies. In this thesis, one gate drive solution is described and used for multiple implemented converters. The gate drive is self-oscillating and consists of a few passive components ensuring a low cost. This gate drive is used as both a low side gate driver for an inverter and a synchronous rectifier in a bidirectional converter achieving a peak efficiency of 80% at 37 MHz. This gate drive is also implemented with a coupled inductor to drive a half-bridge based converter achieving 81% efficiency at an input voltage of 80 V.

The subject of this thesis is off line VHF converters, which means input voltages of several hundred volts. As most VHF topologies have relatively high voltage stresses with peak voltages reaching multiple times the input voltage, the resonant currents needed to achieve soft switching will generate high AC losses. A solution to this problem is presented in this thesis where several inverters have their input connected in series to split the high input voltage. An off-line converter build for the US mains is presented build with three inverters with a single combined rectifier. The converter designed to deliver 9 W to a 60 V LED load and is achieving an efficiency of 89.4% and a power density of 2.14 W3. The development of this converter proof that offline VHF converter can be implemented with high efficiencies even for low power applications.

VHF converters are also subject to EMC regulations and the need for galvanic isolation as well as other standards. Galvanic isolation is usually implemented with transformers, however as mentioned earlier there are only limited magnetic materials for the VHF range. In this thesis PCB transformers are described together with the possibility of using capacitors as the power galvanic isolation, both methods of creating galvanic isolation are implemented in converters. Regarding EMC a series of converters with different filter implementations are examined. The results from the conducted measurement from 150 kHz to 30 MHz shows no peaks as the switching frequency is above the measured range. However, the radiated measurements show high peaks with no filter, these peaks are reduced to 6 dB below the limits from EN 55022 with filtering and a EMC shield. The filter component scales with frequency, and therefore the implemented filter were still small compared to a traditional EMC filter.

Due to the high frequencies of VHF converters it is difficult to use traditional pulse width modulation (PWM) control, instead the most used are burst mode (on/off) control which can be implemented with commercial available controllers. A new implementation of burst mode together with a self-oscillating gate drive is presented.

Another approach is frequency control where the switching frequency is controlled in respect to the output or input. A converter topology is analyzed with the first harmonic approach to evaluate the operation, and to create a new frequency control method to ensure a good power factor (PF). A prototype is implemented with the frequency control method, which achieves a PF of 0.99 and a THD of 5.68%. This is for a converter, switching at traditional frequencies, however the same method can be used for VHF converters.

During this Ph.D. thesis, different areas of an offline VHF converters are described, during the project different areas have been investigated such as, gate drive, synchronous rectifiers, PCB transformers, control of a resonant converter, galvanic isolation, EMC performance, power factor and stacking of converters.

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Organisations: Department of Electrical Engineering, Electronics
Authors: Pedersen, J. A. (Intern), Knott, A. (Intern), Andersen, M. A. E. (Intern)
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Publication information
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Publisher: Technical University of Denmark (DTU)
Viscothermal Losses in Double-Negative Acoustic Metamaterials
The influence of losses in double-negative metamaterial slabs recently introduced by Graciá-Salgado et al. [Phys. Rev. B 88, 224305 (2013)] is comprehensively studied. Viscous and thermal losses are considered in the linearized Navier-Stokes equations with no flow. Despite the extremely low thicknesses of boundary layers associated with each type of losses, the double-negative behavior is totally suppressed for the rigid structures under analysis. In other words, almost 100% of the energy transmitted into the slab is dissipated by viscothermal effects, in agreement with experimental data. Simulations undertaken for larger structures, using scale factors of up to 20 times, show that double-negative behavior is never recovered. The huge dissipation obtained by these structures leads us to propose them as interesting alternatives to conventional absorbers for specific situations, e.g., when treating low frequencies or when the excitation is narrow banded.

Vital Signs Monitoring and Interpretation for Critically Ill Patients
In current clinical practice, vital signs such as heart rate, blood pressure, oxygen saturation level, respiratory rate and temperature are continuously measured for critically ill patients. Monitored by medical devices, each vital sign provides information about basic body functions and allows medical staff to intervene if health deteriorates. It has been documented that most of the alarms provided by the devices do not require actions, and that this occurs mainly because the signals are...
treated individually without context. The overload in alarms forces medical staff to make priority decisions, and can cause critical scenarios leading to a patient’s death be overseen. The focus of this project was investigating clinical applicability of combining vital signs for critically ill patients. Several approaches were developed and tested with increasingly homogeneous patient groups. The first study presents a data-driven approach to representation of a patient’s physiological condition by combining vital signs into Early Warning Scores (EWS). Data were collected for 57 critically ill patients who had each been admitted to the intensive care unit at Bispebjerg Hospital for several days. To evaluate the estimation of physiological condition, text-based electronic health records (EHR) were collected, and time-labeled entries were extracted through algorithms from Natural Language Processing (NLP). The combination of EWS and NLP enabled the development of a system which could present and quantify a physiological condition timeline for patients. Promising results were obtained with EWS as measure, in which patients with EWS ≥ 8.5 passed away while all patients who were admitted for over 53 hours with EWS < 6.5 survived. The second study focused on ischemic stroke patients at Zealand University Hospital. Since all patients had same cause of admission and similar comorbidities, they were a more homogeneous critical patient group than in the first study. To predict the degree of disability after one day of admission, features based on vital signs and medical history were used in two prediction models. An introduced queue-based multiple linear regression (qMLR) model achieved best results with a root mean square error (RMSE) of RMSE = 3.11 on a Scandinavian Stroke Scale (SSS) where degree of disability ranged from 0 - 46. Worse outcomes were observed in patients who had pulse > 80 and a negative correlation between systolic and diastolic blood pressures during the first two hours of admission. The final study dealt with classification of diabetes mellitus (DM) in ischemic stroke patients, where current findings indicate that one third of patients have unrecognized DM. A support vector machine was trained using vital signs and medical history, and correctly classified whether patients had DM with an accuracy of 87.5%. The overall conclusion is that vital signs have high potential in applications for critically ill patients. Context-awareness through grouping with existing admission data is a prerequisite, unless vital signs are used to detect a specifically defined pathological events.

**General information**
- **State**: Published
- **Organisations**: Department of Electrical Engineering, Biomedical Engineering, Bispebjerg University Hospital, Copenhagen University Hospital
- **Authors**: Vilic, A. (Intern), Sørensen, H. B. D. (Intern), Kjaer, T. W. (Ekstern), Petersen, J. A. (Ekstern)
- **Number of pages**: 133
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**Volumetric 3-D Vector Flow Measurements using a 62×62 Row-Column Addressed Array**
Experimental results from volumetric 3-D vector flow measurements using a 62×62 row-column addressed (RCA) array are presented. A plane-by-plane steered transmit sequence and its post processing steps are described for obtaining 3-D vector flow in a volume. A modified version of the transverse oscillation (TO) velocity estimator is used, which exploits the focal lines generated with the tall elements of a RCA array. Validation of the method is made in a flow-rig system where circulating blood mimicking fluid produced a steady parabolic flow profile with a flow rate of 13.7 mL/s, translating to a peak velocity of 24.1 cm/s. A volume rate of 16.4 volumes per second is obtained, and estimated flow rates based on nine steered planes within the volume are investigated. A positive bias is found for all investigated planes lying in the range from 6.5% to 21.2% with the standard deviation being less than 4% for all cases. It is concluded that volumetric 3-D vector flow estimation is feasible with an RCA array with only 124 elements.

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- **Organisations**: Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging
- **Authors**: Holbek, S. (Intern), Stuart, M. B. (Intern), Jensen, J. A. (Intern)
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- **Publisher**: IEEE
AC electric locomotives that use a number of interleaved four-quadrant converters generate high-frequency switching harmonics which may stimulate certain resonances in traction power supply systems (TPSSs). A windowed selective harmonic elimination pulse-width modulation (SHE-PWM) method is proposed to suppress such resonances. Owing to the windowed design and the precalculated solutions, the proposed method covers the wide potential resonant frequency range and addresses the resonant frequency variation while keeping the low switching frequency of the traction converters. The proposed windowed SHE-PWM is fully tested with a closed-loop controller in a simulation model with the TPSS and the ac electric locomotive. Comparative simulation results show that the windowed SHE-PWM is an effective alternative that overcomes the resonance suppression limitations of the conventional phase-shifted PWM (PS-PWM). The performance of proposed windowed SHE-PWM on an experimental equivalent resonant circuit is further evaluated and compared with PS-PWM. Both simulation and experimental results verify the effectiveness and feasibility of the proposed method.
Wind Power Plant Voltage Control Optimization with Embedded Application of Wind Turbines and Statcom

Increasing wind power penetration and the size of wind power plants (WPPs) brings challenges to the operation and control of power systems. Most of WPPs are located far from load centers and the short circuit ratio at the point of common coupling (PCC) is low. The fluctuations of wind power will cause voltage variations. An optimal voltage control scheme for WPPs with STATCOMs is presented in the paper. It ensures that the voltages within the WPPs and at the high voltage side of the WPPs are within the limits and maximizes the dynamic Var reserve of the WPPs. Case studies were conducted with the simplified Anholt offshore WPP and the case study results demonstrate the efficacy of the proposed optimal voltage control scheme.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark, DONG Energy A/S
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丹麦区域能源互联网发展综述
区域能源互联网作为加速促进世界向可持续能源转变的重要手段之一，在近期倍受关注。丹麦是世界上较早使用以区域供暖为主的区域能源手段来解决能源问题的国家，目前正在积极推动向具有综合能源特性和以灵活性交易为互联手段的区域能源互联网的转型。文章对丹麦区域能源互联网的发展历史和现状作了简要介绍，对相关理念和示范经验给出了具体描述；指出了当前区域能源互联网在技术上所遇到的瓶颈。文章将会为中国的区域能源互联网发展提供国际上的经验与参考。

以用户为中心的新兴电力市场模式
随着可再生能源在现代能源产业中的占比不断提高，其对现行电力系统和电力市场的运行机制所带来的影响也日趋明显；同时，通过与数字信息产业深度结合，分布式能量管理手段也处于飞速发展阶段。在这二者的驱动下，一种以用户为中心的新兴电力市场模式正以不同的表现形式出现在世界各地。文章以高度概括的方式介绍了这一新兴电力市场模式，浅析了其在不同表现形式下的机理和特征。基于这一新兴电力市场模式在短期内所取得的发展成就，有理由相信此类新兴电力市场模式将逐步成为未来电力市场中的重要组成部分。

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
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A three-port direct current converter
The three-port direct current converter comprising: at least one input direct current source; at least one storage battery; a primary side circuit; a secondary side circuit; a first single magnetic component shared by the primary side circuit and the secondary side circuit, wherein the primary side circuit comprises a connection between the at least one input direct current source and the at least one storage battery, the primary side circuit configured for operating as a buck converter; a second magnetic component serially coupled to the first single magnetic component, wherein the first and second magnetic components are configured to perform a voltage step-up, wherein the secondary side circuit comprises a connection between the at least one storage battery and at least one load, the secondary side configured for operating as a tapped boost converter; wherein the three-port direct current converter is configured to operate in two mutually exclusive power flow configurations.

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Organisations: Technical University of Denmark, Department of Electrical Engineering, Electronics
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Publication: Research › Patent – Annual report year: 2016

A microwave powered sensor assembly for microwave ovens
The present invention relates to a microwave powered sensor assembly for microwave ovens. The microwave powered sensor assembly comprises a microwave antenna for generating an RF antenna signal in response to microwave radiation at a predetermined excitation frequency. A dc power supply circuit of the microwave powered sensor assembly is operatively coupled to the RF antenna signal for extracting energy from the RF antenna signal and produce a power supply voltage. A sensor is connected to the power supply voltage and configured to measure a physical or chemical property of a food item under heating in a microwave oven chamber.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Lindberg-Poulsen, K. (Intern), Schneider, H. (Intern), Andersen, T. (Intern)
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Publication: Research › Patent – Annual report year: 2016
Medical preparation container comprising microwave powered sensor assembly
The present invention relates to a medical preparation container which comprises a microwave powered sensor assembly. The microwave powered sensor assembly comprises a sensor configured to measure a physical property or chemical property of a medical preparation during its heating in a microwave oven. The microwave powered sensor assembly is configured for harvesting energy from microwave radiation emitted by the microwave oven and energize the sensor by the harvested microwave energy.

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Organisations: Department of Electrical Engineering, Electronics
Authors: Schneider, H. (Intern), Lindberg-Poulsen, K. (Intern)
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Electric vehicle battery charging controller
The present invention provides an electric vehicle charging controller. The charging controller comprises a first interface connectable to an electric vehicle charge source for receiving a charging current, a second interface connectable to an electric vehicle for providing the charging current to a battery management system in the electric vehicle to charge a battery therein, a first communication unit for receiving a charging message via a communication network, and a control unit for controlling a charging current provided from the charge source to the electric vehicle, the controlling at least in part being performed in response to a first information associated with a charging message received by the first communication unit.

General information
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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Pedersen, A. B. (Intern), Andersen, P. B. (Intern), Sørensen, T. M. (Intern), Martinenas, S. (Intern)
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Hyperpolarized 1-13C-1,1-bis(acetoxy(methyl))-2,2'-cyclopropane as metabolic marker for mr
1-13C-1,1-Bis(acetoxy(methyl))-2,2'-cyclopropane of formula (I): The compound can be hyperpolarized and used as a contrast agent in 13C Magnetic Resonance diagnostic technique (13C-MR) for the diagnosis of tumor.
Methodology and apparatus for determining psychoacoustical threshold curves

The present invention relates in a first aspect to a method of determining a psychoacoustical threshold curve by selectively varying a first parameter and a second parameter of an auditory stimulus signal applied to a test subject/listener. The methodology comprises steps of determining a two-dimensional boundary region surrounding an a priori estimated placement of the psychoacoustical threshold curve to form a predetermined two-dimensional response space comprising a positive response region at a first side of the a priori estimated psychoacoustical threshold curve and a negative response region at a second and opposite side of the a priori estimated psychoacoustical threshold curve. A series of auditory stimulus signals in accordance with the respective parameter pairs are presented to the listener through a sound reproduction device and the listener's detection of a predetermined attribute/feature of the auditory stimulus signals is recorded such that a stimuli path through the predetermined two-dimensional response space is traversed. The psychoacoustical threshold curve is computed based on at least a subset of the recorded parameter pairs.

100G shortwave wavelength division multiplexing solutions for multimode fiber data links

We investigate an alternative 100G solution for optical short-range data center links. The presented solution adopts wavelength division multiplexing technology to transmit four channels of 25G over a multimode fiber. A comparative performance analysis of the wavelength-grid selection for the wavelength division multiplexing data link is reported. The analysis includes transmissions over standard optical multimode fiber (OM): OM2, OM3 and OM4.
16-Channel surface coil for 13C-hyperpolarized spectroscopic imaging of cardiac metabolism in pig heart

Magnetic resonance spectroscopy (MRS) of hyperpolarized 13C pyruvate and its metabolites in large animal models is a powerful tool for assessing cardiac metabolism in pathological conditions. In 13C studies, a high signal-to-noise ratio (SNR) is crucial to overcome the intrinsic data quality limitation due to the low molar concentration of certain metabolites as well as the low flux of conversion. Since 13C-MRS is essentially a semi-quantitative technique, the SNR of the spectra acquired in different myocardial segments should be homogeneous. MRS coil design plays an important role in achieving both targets. In this study, a 16-channel receive surface coil was designed for 13C hyperpolarized studies of the pig heart with a clinical 3-T scanner. The coil performance was characterized by phantom experiments and compared with that of a birdcage coil used in transmit/receive mode. Segmental signal distribution in the left ventricle (LV) was assessed by experiments on six healthy mini pigs. The proposed coil showed a significant increase in SNR for the LV wall close to the coil surface with respect to that for the birdcage but also significant segmental inhomogeneity. Hence, the use of the 16-channel coil is recommended for studies of septal and anterior LV walls.
3-D Imaging using Row–Column-Addressed 2-D Arrays with a Diverging Lens

It has been shown that row–column-addressed (RCA) 2-D arrays can be an inexpensive alternative to fully addressed 2-D arrays. Generally imaging with an RCA 2-D array is limited to its forward-looking volume region. Constructing a double-curved RCA 2-D array or applying a diverging lens over the flat RCA 2-D array, can extend the imaging field-of-view (FOV) to a curvilinear volume without increasing the aperture size, which is necessary for applications such as abdominal and cardiac imaging. Extended FOV and low channel count of doublecurved RCA 2-D arrays make it possible to have 3-D imaging with equipment in the price range of conventional 2-D imaging. This study proposes a delay-and-sum (DAS) beamformation scheme specific to double-curved RCA 2-D arrays and validates its focusing ability based on simulations. A synthetic aperture imaging (SAI) sequence with single element transmissions at a time, is designed for imaging down to 14 cm at a volume rate of 88 Hz. The curvilinear imaging performance of a λ/2-pitch 3 MHz 62+62 RCA 2-D array is investigated as a function of depth, using a diverging lens with f-number of -1. The results of this study demonstrate that the proposed beamforming approach is accurate for achieving correct time-of-flight calculations, and hence avoids geometrical distortions.

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3-D Vector Flow Estimation With Row–Column-Addressed Arrays
Simulation and experimental results from 3-D vector flow estimations for a 62 + 62 RC array with integrated apodization are presented. A method for implementing a 3-D transverse oscillation (TO) velocity estimator on a 3-MHz RC array is developed and validated. First, a parametric simulation study is conducted, where flow direction, ensemble length, number of pulse cycles, steering angles, transmit/receive apodization, and TO apodization profiles and spacing are varied, to find the optimal parameter configuration. The performance of the estimator is evaluated with respect to relative mean bias $\bar{B}$ and mean standard deviation $\bar{\sigma}$. Second, the optimal parameter configuration is implemented on the prototype RC probe connected to the experimental ultrasound scanner SARUS. Results from measurements conducted in a flow-rig system containing a constant laminar flow and a straight-vessel phantom with a pulsating flow are presented. Both an M-mode and a steered transmit sequence are applied. The 3-D vector flow is estimated in the flow rig for four representative flow directions. In the setup with 90° beam-to-flow angle, the relative mean bias across the entire velocity profile is $(4.7, -0.9, 0.4)\%$ with a relative standard deviation of $(8.7, 5.1, 0.8)\%$ for ($v_x$, $v_y$, $v_z$). The estimated peak velocity is 48.5 ± 3 cm/s giving a ~3% bias. The out-of-plane velocity component perpendicular to the cross section is used to estimate volumetric flow rates in the flow rig at a 90° beam-to-flow angle. The estimated mean flow rate in this setup is 91.2 ± 3.1 L/h corresponding to a bias of ~11.1%. In a pulsating flow setup, flow rate measured during five cycles is $2.3 \pm 0.1$ mL/stroke giving a negative 9.7% bias. It is concluded that accurate 3-D vector flow estimation can be obtained using a 2-D RC-addressed array.

General information
3-D Vector Flow Imaging

For the last decade, the field of ultrasonic vector flow imaging has gotten an increasingly attention, as the technique offers a variety of new applications for screening and diagnostics of cardiovascular pathologies. The main purpose of this PhD project was therefore to advance the field of 3-D ultrasonic vector flow estimation and bring it a step closer to a clinical application. A method for high frame rate 3-D vector flow estimation in a plane using the transverse oscillation method combined with a 1024 channel 2-D matrix array is presented. The proposed method is validated both through phantom studies and in vivo. Phantom measurements are compared with their corresponding reference value, whereas the in vivo measurement is validated against the current golden standard for non-invasive blood velocity estimates, based on magnetic resonance imaging (MRI). The study concludes, that a high precision was achieved and that estimates were comparable with MRI derived results. However, the large channel count of the applied transducer hinders a commercial implementation of the 3-D method for two main reasons: The large and heavy connection cable is impractical for clinical use, and the high channel count hampers the task of real-time processing. In a second study, some of the issue with the 2-D matrix array are solved by introducing a 2-D row-column (RC) addressing array with only 62 + 62 elements. It is investigated both through simulations and via experimental setups in various flow conditions, if this significant reduction in the element count can still provide precise and robust 3-D vector flow estimates in a plane. The study concludes that the RC array is capable of estimating precise 3-D vector flow both in a plane and in a volume, despite the low channel count. However, some inherent new challenges are introduced with the array. The major disadvantage with an RC transducer, is the limited field-of-view, which is restricted to the forward looking array. It is discussed, that this drawback may be solved with a diverging lens, providing a larger field-of-view, due the the dispersion of the energy. Based on the presented results it is concluded that 3-D vector flow using TO is a feasible method for obtaining angle-independent estimates of e.g. peak velocities and flow rates at a high frame rate for clinical applications. Moreover, the RC array offers a setup allowing for real-time processing.

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3-D Vector Flow Using a Row-Column Addressed CMUT Array
This paper presents an in-house developed 2-D capacitive micromachined ultrasonic transducer (CMUT) applied for 3-D blood flow estimation. The probe breaks with conventional transducers in two ways; first, the ultrasonic pressure field is generated from thousands of small vibrating micromachined cells, and second, elements are accessed by row and column indices. The 62×62 2-D row-column addressed prototype CMUT probe was used for vector flow estimation by transmitting focused ultrasound into a flow-rig with a fully developed parabolic flow. The beam-to-flow angle was 90°. The received data was beamformed and processed offline. A transverse oscillation (TO) velocity estimator was used to estimate the 3-D vector flow along a line originating from the center of the transducer. The estimated velocities in the lateral and axial direction were close to zero as expected. In the transverse direction a characteristic parabolic velocity profile was estimated with a peak velocity of 0.48 m/s ± 0.02 m/s in reference to the expected 0.54 m/s. The results presented are the first 3-D vector flow estimates obtained with a row-column CMUT probe, which demonstrates that the CMUT technology is feasible for 3-D flow estimation.

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A 10 MHz Bandwidth Continuous-Time Delta-Sigma Modulator for Portable Ultrasound Scanners
A fourth-order 1-bit continuous-time delta-sigma modulator designed in a 65 nm process for portable ultrasound scanners is presented in this paper. The loop filter consists of RC integrators, with programmable capacitor arrays and resistors, and the quantizer is implemented with a high-speed clocked comparator and a pull-down clocked latch. The feedback signal is generated with voltage DACs based on transmission gates. Using this implementation, a small and low-power solution required for portable ultrasound scanner applications is achieved. The modulator has a bandwidth of 10 MHz with an oversampling ratio of 16 leading to an operating frequency of 320 MHz. The design occupies an area of 0.0175 mm² and achieves a SNR of 45 dB consuming 489 µA at a supply voltage of 1.2 V; the resulting FoM is 197 fJ/conversion. The results are based on simulations with extracted parasitics including process and mismatch variations.

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Accelerometer Based Motional Feedback Integrated in a 2 3/4" Loudspeaker

It is a well known fact that loudspeakers produce distortion when they are driven into large diaphragm displacements. Various methods exist to reduce distortion using forward compensation and feedback methods. Acceleration based motional feedback is one of these methods and was already thoroughly described in the 1960s showing good results at low frequencies. In spite of this, the technique has mainly been used for closed box subwoofers to a limited extent. In this paper, design and experimental results for a 2 3/4" acceleration based motional feedback loudspeaker are shown to extend this feedback method to a small full range loudspeaker. Furthermore, the audio quality from the system with feedback is discussed based on measurements of harmonic distortion, intermodulation distortion and subjective evaluation.

Accountability for Uncertainty in Electricity Markets

This paper presents a novel approach for estimating 2-D flow angles using a high-frame-rate ultrasound method. The angle estimator features high accuracy and low standard deviation (SD) over the full 360° range. The method is validated on Field II simulations and phantom measurements using the experimental ultrasound scanner SARUS and a flow rig before being tested in vivo. An 8-MHz linear array transducer is used with defocused beam emissions. In the simulations of a spinning disk phantom, a 360° uniform behavior on the angle estimation is observed with a median angle bias of 1.01° and a median angle SD of 1.8°. Similar results are obtained on a straight vessel for both simulations and measurements, where the obtained angle biases are below 1.5° with SDs around 1°. Estimated velocity magnitudes are also kept under 10% bias and 5% relative SD in both simulations and measurements. An in vivo measurement is performed on a carotid bifurcation of a healthy individual. A 3-s acquisition during three heart cycles is captured. A consistent and repetitive vortex is observed in the carotid bulb during systoles.
AC Losses and Their Thermal Effect in High-Temperature Superconducting Machines

In transient operations or fault conditions, high-temperature superconducting (HTS) machines suffer ac losses, which have an influence on the thermal stability of superconducting windings. In this paper, a method to calculate ac losses and their thermal effect in HTS machines is presented. The method consists of three submodels that are coupled only in one direction. The magnetic field distribution is first solved in a machine model, assuming a uniform current distribution in HTS windings. The magnetic fields on the boundaries are then used as inputs for an ac loss model that has a homogeneous approximation and solves the H formulation. Afterward, the computed ac losses are considered as the heat source in a thermal model to study the temperature profile in HTS windings. The method proposed is able to evaluate ac losses and their thermal effect, thus providing a reference to design an HTS machine and its cooling system.

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A comparative study of pseudorandom sequences used in a c-VEP based BCI for online wheelchair control

In this study, a c-VEP based BCI system was developed to run on three distinctive pseudorandom sequences, namely the m-code, the Gold-code, and the Barker-code. The Visual Evoked Potentials (VEPs) were provoked using these codes. In the online session, subjects controlled a LEGO® Mindstorms® robot around a fixed track. Choosing the optimal code proved a significant increase in accuracy (p

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A comprehensive performance analysis of EEMD-BLMS and DWT-NN hybrid algorithms for ECG denoising

Electrocardiogram (ECG) is a widely used non-invasive method to study the rhythmic activity of the heart. These signals, however, are often obscured by artifacts/noises from various sources and minimization of these artifacts is of paramount importance for detecting anomalies. This paper presents a thorough analysis of the performance of two hybrid signal processing schemes (i) Ensemble Empirical Mode Decomposition (EEMD) based method in conjunction with the Block Least Mean Square (BLMS) adaptive algorithm (EEMD-BLMS), and (ii) Discrete Wavelet Transform (DWT) combined with the Neural Network (NN), named the Wavelet NN (WNN)) for denoising the ECG signals. These methods are compared to the conventional EMD (C-EMD), C-EEMD, EEMD-LMS as well as the DWT thresholding (DWT-Th) based methods through extensive simulation studies on real as well as noise corrupted ECG signals. Results clearly show the superiority of the proposed methods.

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A conceptual framework for designing micro electrical connectors for hearing aid instruments

Electrical connectors play vital roles in modern electronic instruments. Hearing aid devices as advanced combinations of micro mechanics and electronics comprise various electrical connectors for different purposes. However, the current trend in the miniaturization along with the sharp technological advancements have urged them to incorporate increased number of electrical contacts. The current paper presents a conceptual framework for designing and manufacturing novel plug and socket systems for hearing aid instruments by using the state of art manufacturing technologies for micro components. These concepts have the capability of using as different connectors like RIC (Receiver In the Canal), programming and FM connection either individually or together. Various conceptual designs are provided for flexible connectors and their advantages and disadvantages are discussed in detail through different computer simulations and experiments on the 3-D printed prototypes. In fact, the presented designs not only are able to provide a range of functions for other similar micro products, but also depict an outline for the challenges in this area and the possible approach and solutions in the design of micro electrical connectors.

A correlation metric in the envelope power spectrum domain for speech intelligibility prediction

The current paper presents a correlation metric in the envelope power spectrum (EPS) domain for predicting speech intelligibility in noisy environments. The EPS is a non-linear measure of the energy distribution over frequency, which captures the fine structure of the speech signal. The correlation metric is based on the cross-correlation between the EPS of the original speech signal and the EPS of the noisy speech signal. This metric is shown to be effective in predicting speech intelligibility in various noise conditions. The proposed method is simple to implement and can be extended to be used in real-time applications.
Active Fault Detection Based on a Statistical Test
In this paper active fault detection of closed loop systems using dual Youla-Jabr-Bongiorno-Kucera (YJBK) parameters is presented. Until now all detector design for active fault detection using the dual YJBK parameters has been based on CUSUM detectors. Here a method for design of a matched filter detector is proposed instead, based upon the Neyman-Pearson criterion for optimal detector design. Furthermore alternative ways to design the excitation signal which relates to indirect identification methods are presented. Examples are given on detection of actuator faults using a simulated gas bearing for both one and multiple possible parametric faults.

Adaptive FTC based on Control Allocation and Fault Accommodation for Satellite Reaction Wheels
This paper proposes an active fault tolerant control scheme to cope with faults or failures affecting the flywheel spin rate sensors or satellite reaction wheel motors. The active fault tolerant control system consists of a fault detection and diagnosis module along with a control allocation and fault accommodation module directly exploiting the on-line fault estimates. The use of the nonlinear geometric approach and radial basis function neural networks allows to obtain a precise fault isolation, independently from the knowledge of aerodynamic disturbance parameters, and to design generalised estimation filters, which do not need a priori information about the internal model of the signal to be estimated. The adaptive control allocation and sensor fault accommodation can handle both temporal faults and failures. Simulation results illustrate the convincing fault correction and attitude control performances of the proposed system.
Adaptive gaze stabilization through cerebellar internal models in a humanoid robot

Two main classes of reflexes relying on the vestibular system are involved in the stabilization of the human gaze: The vestibulocollic reflex (VCR), which stabilizes the head in space and the vestibulo-ocular reflex (VOR), which stabilizes the visual axis to minimize retinal image motion. The VOR works in conjunction with the opto-kinetic reflex (OKR), which is a visual feedback mechanism for moving the eye at the same speed as the observed scene. Together they keep the image stationary on the retina. In this work we present the first complete model of gaze stabilization based on the coordination of VCR and VOR and OKR. The model, inspired on neuroscientific cerebellar theories, is provided with learning and adaptation capabilities based on internal models. Tests on a simulated humanoid platform confirm the effectiveness of our approach.

Adaptive Portfolio Optimization for Multiple Electricity Markets Participation

The increase of distributed energy resources, mainly based on renewable sources, requires new solutions that are able to deal with this type of resources' particular characteristics (namely, the renewable energy sources intermittent nature). The smart grid concept is increasing its consensus as the most suitable solution to facilitate the small players' participation in electric power negotiations while improving energy efficiency. The opportunity for players' participation in multiple energy negotiation environments (smart grid negotiation in addition to the already implemented market types, such as day-ahead spot markets, balancing markets, intraday negotiations, bilateral contracts, forward and futures negotiations, and among other) requires players to take suitable decisions on whether to, and how to participate in each market type. This paper proposes a portfolio optimization methodology, which provides the best investment profile for a market player, considering different market opportunities. The amount of power that each supported player should negotiate in each available market type in order to maximize its profits, considers the prices that are expected to be achieved in each market, in different contexts. The price forecasts are performed using artificial neural networks, providing a specific database with the expected prices in the different market types, at each time. This database is then used as input by an evolutionary particle swarm optimization process, which originates the most advantage participation portfolio for the market player. The proposed approach is tested and validated with simulations performed in multiagent simulator of competitive electricity markets, using real electricity markets data from the Iberian operator-MIBEL.
Adaptive robust polynomial regression for power curve modeling with application to wind power forecasting

Wind farm power curve modeling, which characterizes the relationship between meteorological variables and power production, is a crucial procedure for wind power forecasting. In many cases, power curve modeling is more impacted by the limited quality of input data rather than the stochastic nature of the energy conversion process. Such nature may be due the varying wind conditions, aging and state of the turbines, etc. And, an equivalent steady-state power curve, estimated under normal operating conditions with the intention to filter abnormal data, is not sufficient to solve the problem because of the lack of time adaptivity. In this paper, a refined local polynomial regression algorithm is proposed to yield an adaptive robust model of the time-varying scattered power curve for forecasting applications. The time adaptivity of the algorithm is considered with a new data-driven bandwidth selection method, which is a combination of pilot estimation based on blockwise least-squares parabolic fitting and the probability integral transform. The regression model is then extended to a more robust one, in which a new dynamic forgetting factor is defined to make the estimator forget the out-of-date data swiftly and also achieve a better trade-off between robustness against noisy data and time adaptivity. A case study based on a real-world dataset validates the properties of the proposed regression method. Results show that the new method could flexibly respond to abnormal data at different lead times and has better performance than common benchmarks for short-term forecasting.
Adaptive ultra-short-term wind power prediction based on risk assessment

A risk assessment based adaptive ultra-short-term wind power prediction (USTWPP) method is proposed in this paper. The method first extracts features from the historical data, and split every wind power time series (WPTS) into several subsets defined by their stationary patterns. A WPTS that does not match with any of the stationary patterns is then included into a subset of non-stationary patterns. Every WPTS subset is then related to a USTWPP model which is specially selected and optimized offline based on the proposed risk assessment index. For on-line applications, the pattern of the last short WPTS is first recognized, and the relevant prediction model is applied for USTWPP. Experimental results confirm the efficacy of the proposed method.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, State Grid Electric Power System Research Institute, Queen's University Belfast, Zhejiang University
Advanced Control of Active Bearings - Modelling, Design and Experiments

In all rotating machines relative movements between the stationary parts and the rotating parts imply energy loss and, in many critical cases, vibration problems. This energy loss leads to higher overall energy consumption of the system. Research activities towards the reduction of friction, the enhancement of damping, the extension of operating range and the minimisation of critical vibrations in machine elements are of fundamental importance. The main component to tackle the energy-loss-related problems is the bearing. The area of design of active bearings, while very promising, is still in its early development mainly because of its high complexity and its multiphysics nature. The state-of-the-art models derived from first principles and axioms of mechanics are complex and often subject to significant parameter uncertainties. They are challenging to develop and not easily used for feedback control design. One example is the controllable radial gas bearing, where the lubricant air is injected through controllable injectors to levitate the rotor on an air film. Feedback control of the injection can improve upon the poor damping to reduce the disturbance sensitivity and vibrations near the critical speeds. The feedback control law is preferably designed from a simple model, which captures the dominant dynamics of the machine in the frequency range of interest. This thesis offers two main original contributions in the field of active bearings. First, an experimental technique is proposed for “in situ” identification of low complexity models of the entire rotor-bearing-actuator-sensor system. The approach employs grey-box identification techniques and is easily applied to industrial rotating machinery with controllable bearings. The approach is applied for identification of a linear parameter-varying model of a rotor supported by an active gas bearing. Second, is the application of model-based control techniques for controllable gas bearings. The parameter-varying model is shown to suit the design of classical and modern control including observer and state-feedback, H1, LPV and gain-scheduled H2 control designs to improve upon the dynamic properties of the gas bearing test rig. Experimental results using the control designs show that the controllers can increase the damping significantly. The damping enhancing controllers are shown to extend the range of safe operation by a 70% increase in shaft angular velocity, thereby allowing safe operation in and above the regions of the first and second critical speeds.
Advances in Piezoelectric Systems: An Application-Based Approach.

Piezoelectricity is a fascinating research topic with wide-ranging applications due to the unique property of bidirectional energy transfer. Piezoceramics can be used as both actuators and sensors without imposing any constraints on their supporting circuitry. This property, coupled with their low manufacturing costs and high robustness has enabled widespread usage in applications ranging from simple spark lighters or pressure sensors to much more complicated energy harvesting systems and piezoelectric transformers. One governing property of piezoelectric devices is the existence of a mechanical frequency of resonance, or the natural frequency of the device paired with an antiresonance, which are material and size-dependent. From an electrical standpoint, the equivalent behavior of a piezoelectric device depends on how close or far from its natural resonance the device is excited in terms of frequency. Based on this classification, three distinct, useful electrical behaviors can be identified: a capacitive behavior prominent at frequencies far from resonance, a resistive behavior encountered at resonance and antiresonance peaks and an inductive behavior, encountered at frequencies between the two. These three distinct behaviors encountered in any piezoelectric device represents the basis of discussion in the thesis. Therefore the present PhD dissertation is an application-based approach to researching all three behaviors individually, while solving solutions to the challenges encountered along the way. First, the capacitive behavior is studied, with the Piezoelectric Actuator Drive motor as a direct application. At low frequencies, piezoelectric devices are ideal as micro-and nanoscale positioning actuators but they are plagued by high levels of hysteretic nonlinearities. A model is developed to estimate this behavior, followed by a low-cost forward compensation method which achieves a positioning error reduction by a factor 20. Next, the characteristics of the PAD motor are researched and a method of extracting mechanical quality information and predict overload through feedback signal analysis is demonstrated. The next behavior studied is the inductive behavior, specifically dealing with a bidirectional dc-dc power converter employing a piezoelectric transformer as major component. The main contribution here is achieving optimum tracking, hard-switching minimization and power ow control during bidirectional operation of a self-oscillating converter. Feasibility of using the converter in an MRI scanner is demonstrated. The third and nal behavior researched is the resistive behavior. This is widely encountered since most piezoelectric motors, ultrasonic baths and some energy harvesting systems operate at resonance. Friction control through squeeze- lm application is achieved in an electrostatic surface actuator for the rst time ever. This enables system functionality without glass gap material and concomitantly reduces minimum electrostatic operating voltage by 70%.

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A Framework for Semi-Automated Generation of a Virtual Combine Harvester

This paper describes a generic data-driven model of the threshing, separation and cleaning process in a combine harvester. The aim is a model that describes the actual material flow and sensor values for relevant actuator configurations and measured environmental disturbances in order to facilitate Hardware In the Loop (HIL) simulation and sensor based material flow estimation. A modular data-driven model structure is chosen as it maintains the actual steady-state values and facilitates verification and debugging using laboratory and field data. The overall model structure, model generation procedure, and estimation of parameters from field data are described, as well as simulation results are presented.

General information
A framework for simulating ultrasound imaging based on first order nonlinear pressure–velocity relations.

An ultrasound imaging framework modeled with the first order nonlinear pressure–velocity relations (NPVR) based simulation and implemented by a half-time staggered solution and pseudospectral method is presented in this paper. The framework is capable of simulating linear and nonlinear ultrasound propagation and reflections in a heterogeneous medium with different sound speeds and densities. It can be initialized with arbitrary focus, excitation and apodization for multiple individual channels in both 2D and 3D spatial fields. The simulated channel data can be generated using this framework, and ultrasound image can be obtained by beamforming the simulated channel data. Various results simulated by different algorithms are illustrated for comparisons. The root mean square (RMS) errors for each compared pulses are calculated. The linear propagation is validated by an angular spectrum approach (ASA) with a RMS error of 3% at the focal point for a 2D field, and Field II with RMS errors of 0.8% and 1.5% at the electronic and the elevation focuses for 3D fields, respectively. The accuracy for the NPVR based nonlinear propagation is investigated by comparing with the Abersim simulation for pulsed fields and with the nonlinear ASA for monochromatic fields. The RMS errors of the nonlinear pulses calculated by the NPVR and Abersim are respectively 2.4%, 7.4%, 17.6% and 36.6% corresponding to initial pressure amplitudes of 50 kPa, 200 kPa, 500 kPa and 1 MPa at the transducer. By increasing the sampling frequency for the strong nonlinearity, the RMS error for 1 MPa initial pressure amplitude is reduced from 36.6% to 27.3%.
Nonlinear pressure–velocity relation, Nonlinear wave propagation, Channel data simulation

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A Full-size High Temperature Superconducting Coil Employed in a Wind Turbine Generator Set-up

A full-size stationary experimental set-up, which is a pole pair segment of a 2 MW high temperature superconducting (HTS) wind turbine generator, has been built and tested under the HTS-GEN project in Denmark. The performance of the HTS coil is crucial to the set-up, and further to the development of the full generator. This paper deals with the HTS coil employed in the set-up. The coil utilizing YBCO tapes is double-layered with 152 turns per layer and is wound on a FeNi9 iron core. Several sensors are installed to monitor the operating status of the coil, e.g., temperature, field, voltage. The coil is tested in LN2 first, and then tested in the set-up so that the magnetic environment in a real generator is reflected. The experimental results are reported, followed by a finite element simulation and a discussion on the deviation of the results. The tested and estimated Ic in LN2 are 148 A and 143 A, respectively. When tested in the set-up, the maximum temperature of the coil is controlled at 77 K and 40 K, and the I-V curves under both conditions are presented. It is found that the lower half coil that is closer to the stator has a smaller Ic due to a higher field level. The study is of significance to the development of HTS generators.

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Algebraic Varieties and System Design
Design and analysis of networks have many applications in the engineering sciences. This dissertation seeks to contribute to the methods used in the analysis of networks with a view towards assisting decision making processes. Networks are initially considered as objects in the category of graphs and later as objects in the category of hypergraphs. The connection with the category of simplicial pairs become apparent when the topology is analyzed using homological algebra. A topological ranking is developed that measures the ability of the network to stay path-connected. Combined with the analysis of cover ideals of hypergraphs, the topological ranking demonstrates the non-trivial decisions that needs to be considered in system design. All the methods developed here have an underlying common structure, namely that they all appear at solution sets for systems of polynomials. These solution sets are called algebraic varieties.

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A low-loss, continuously tunable microwave notch filter

The development in high-end microwave transceiver systems toward the software defined radio has brought about the need for tunable frontend filters. Although the problem is being tackled by the microwave community, there still appears to be an unmet demand for practical tunable filter technologies. With this motivation, this work presents a tuning method that delivers a resonator Q of 2000–3621 within a minimum tuning ratio of 1:1.42. A continuously tunable notch filter based on this tuning method is presented. The design is manufactured, measured, and verified. It is shown that the tuning technology compares favorably to other selected technologies.

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A Method for Remote Control of EV Charging by Modifying IEC61851 Compliant EVSE Based PWM Signal

The Electric Vehicle (EV) has properties that can not only load but can elevate its value as a resource to the power system. An EV represents a high-power, fast-responding flexible demand unit, with an attached energy storage (battery) and the potential for bi-directional capabilities (V2G). These properties can be used in a number of power and energy services, which can support power system operation while lowering the cost of EV ownership. Such services depend on the support from the communications technologies and standards that connect controllers and logic in the EVs with those in the charging infrastructure- and back-end systems. To date, there is still no widely adopted standard that supports EV grid services, such as smart charging. This work proposes a solution that would allow any combination of charging spot and EV - individually lacking the logic, communication and controllability required for smart charging - to gain this ability by simply adhering to the widely supported IEC61851 standard. This paper describes the solution, demonstrates the implementation and discusses the potential it has for unlocking EV power- and energy services.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
A modular guitar for teaching musical acoustics

In order to keep students activated in a course on musical acoustics, they were asked to build a modular guitar, designed to be updated throughout the course. In the first stage, dedicated to the physics of strings, a guitar was made out of three strings attached to a long piece of wood. The students measured the effect of the place of plucking on the mode of the vibrations of the strings. The second stage was dedicated to the acoustic resonances. Using a laser cutter, the students built a wooden box that was coupled to their guitar using straps. New acoustical measurements were made to study the effect of the shape of the resonator on the spectrum of the sound. In the third stage, as the different tuning systems were learned, the students built a fingerboard with the appropriated positions of the frets. In the last stage, the students have implemented some digital effects and tested them on their guitar using a piezo-electrical pickup. As nothing was glued, the students were able to easily change each part of the guitar (resonator, sound hole, fret positions, microphone, …) in order to experience their direct effect and their interactions.
A Mouse Positron Emission Tomography Study of the Biodistribution of Gold Nanoparticles with Different Surface Coatings Using Embedded Copper-64

By taking advantage of the ability of (64)Cu to bind non-specifically to gold surfaces, we have developed a new methodology to embed this radionuclide inside gold nanoparticles (AuNPs). (64)Cu enables the in vivo imaging of AuNPs by positron emission tomography (PET). AuNPs have a multitude of uses within health technology and are useful tools for general nanoparticle research. (64)Cu-AuNPs were prepared by incubating AuNP seeds with (64)Cu(2+), followed by the entrapment of the radionuclide by grafting a second layer of gold on the surface. This resulted in radiolabeling efficiencies of 53 ± 6%. The radiolabel showed excellent stability when challenging with EDTA for two days (>95% radioactivity retention) and showed no loss of (64)Cu when incubated with 50% mouse serum for two days. The methodology was chelator-free, and circumvents traditional concerns over chelator instability and altered AuNP properties due to surface modification. Radiolabeled (64)Cu-AuNP cores were prepared in a biomedically relevant size of 30 nm and used to investigate the in vivo stability of three different AuNP coatings by PET imaging in a murine xenograft tumor model. We found the longest plasma half-life (T½ = 9 hours) and highest tumor accumulation (3.9 %ID/g) by using polyethylene glycol (PEG) coating, while faster elimination from the bloodstream was observed with both a Tween 20-stabilized coating and a
zwitterionic coating based on a mixture of sulfonic acids and quaternary amines, which has previously been reported to be superior to PEG. The new embedding method provides the utilization of PET imaging in combination with the multitude of uses that AuNPs have found in health technology, and the method can equally well be utilized for therapeutic copper radioisotopes for use in radiotherapy.
A Multi-Model Reduction Technique for Optimization of Coupled Structural-Acoustic Problems

Finite Element models of structural-acoustic coupled systems can become very large for complex structures with multiple connected parts. Optimization of the performance of the structure based on harmonic analysis of the system requires solving the coupled problem iteratively and for several frequencies, which can become highly time consuming. Several modal-based model reduction techniques for structure-acoustic interaction problems have been developed in the literature. The unsymmetric nature of the pressure-displacement formulation of the problem poses the question of how the reduction modal base should be formed, given that the modal vectors are not orthogonal due to the asymmetry of the system matrices. In this paper, a multi-model reduction (MMR) technique for structure-acoustic interaction problems is developed. In MMR, the reduction base is formed with the modal vectors of a family of models that sample the design domain of the optimization parameters. The orthogonalization of the resulting reduction base is therefore a key point in the method. The use of the different reduction approaches found in the literature for developing an efficient and robust MMR technique is investigated. Several methods are compared in terms of accuracy and size of the reduced systems for optimization of simple models.

An algorithm for reduction of extracted power from photovoltaic strings in grid-tied photovoltaic power plants during voltage sags

Due to the high penetration of the installed distributed generation units in the power system, the injection of reactive power is required for the medium-scale and large-scale grid-connected photovoltaic power plants (PVPPs). Because of the current limitation of the grid-connected inverter, the injected active power should be reduced during voltage sags. In order to obtain a constant dc-link voltage in a multi-string PVPP, the extracted power from PV strings should be equal to the injected power to the grid in all operating conditions (excluding power losses). Therefore, the extracted power of PV strings should be reduced during voltage sags. In this paper, an algorithm is proposed for determining the reference voltage of the PV string which results in a reduction of the output power to a certain amount. The proposed algorithm calculates the reference voltage for the dc/dc converter controller, based on the characteristics of the power-voltage curve of the PV string and therefore, no modification is required in the the controller of the dc/dc converter. Simulation results on a 50-kW PV string verified the effectiveness of the proposed algorithm in reducing the power from PV strings under different irradiation and reference power values.
Analog Gradient Beamformer for a Wireless Ultrasound Scanner.
This paper presents a novel beamformer architecture for a low-cost receiver front-end, and investigates if the image quality can be maintained. The system is oriented to the development of a hand-held wireless ultrasound probe based on Synthetic Aperture Sequential Beamforming, and has the advantage of effectively reducing circuit complexity and power dissipation. The array of transducers is divided into sub-apertures, in which the signals from the single channels are aligned through a network of cascaded gradient delays, and summed in the analog domain before A/D conversion. The delay values are quantized to simplify the shifting unit, and a single A/D converter is needed for each sub-aperture yielding a compact, low-power architecture that can be integrated in a single chip. A simulation study was performed using a 3.75 MHz convex array, and the point spread function (PSF) for different configurations was evaluated in terms of lateral full-width-at-half-maximum (FWHM) and −20 dB cystic resolution (CR). Several setups were simulated varying the sub-aperture size N and the quantization step, and design constraints were obtained comparing the PSF to that of an ideal non-quantized system. The PSF is shown for N = 32 with a quantization step of 12 ns. For this configuration, the FWHM is degraded by 0.25% and the CR is 8.70% lower compared to the ideal situation. The results demonstrate that the gradient beamformer provides an adequate image quality, and open the way to a fully-integrated chip for a compact, low-cost, wireless ultrasound probe.

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Analysis and Comparison of Voltage Dependent Charging Strategies for Single-Phase Electric Vehicles in an Unbalanced Danish Distribution Grid
This paper studies four voltage dependent solutions for modulating the charging of multiple Electric Vehicles (EVs) in a real Danish network. Uncontrolled EV charging, especially in grid with high EV penetration, can result in overloaded lines and transformers, low-voltages and other performance degradations which lead to poor quality of supply. Therefore, a decentralized control for modulating the EVs' charging current is developed, which sets the EV reference current based on the phase-to-neutral voltage at the EV connection node. Due to the controller's decentralised feature, EVs plugged-in on phases with lower voltages are constrained during the charging period. In order to solve instability issues which may occur due to lack of communication between the controllers, several improvements are applied to the aforementioned droop control. Simulation results demonstrate the performance of the voltage dependent controls for a real Danish distribution grid.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Technical University of Denmark
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Analysis of bi-directional piezoelectric-based converters for zero-voltage switching operation
This paper deals with a thorough analysis of zero-voltage switching especially for bi-directional, inductorless, piezoelectric transformer-based switch-mode power supplies with a half-bridge topology. Practically, obtaining zero-voltage switching for all of the switches in a bi-directional piezoelectric power converter is a difficult task. However, the analysis in this work will be convenient for overcoming this challenge. The analysis defines the zero-voltage region indicating the operating points whether or not soft switching can be met over the switching frequency and load range. For the first time, a comprehensive analysis is provided, which can be used as a design guideline for applying control techniques in order to drive switches in piezoelectric transformer-based converters. This study further conveys the proposed method to the region where all the switches can obtain soft switching. Moreover, the analysis can be applied to other types of resonant converters with or without piezoelectric transformers. Experimental and simulation results are provided, verifying the performed analysis.
Resonant converter, Zero-voltage switching, Piezoelectric transformer, Optimum dead time, Phase shift control

Analysis of Systolic Backflow and Secondary Helical Blood Flow in the Ascending Aorta Using Vector Flow Imaging

Secondary rotational flow and systolic backflow are seen in the ascending aorta and, in this study, were analyzed with the vector velocity method transverse oscillation. Twenty-five patients were scanned intra-operatively, and the vector velocities were related to estimates of transesophageal echocardiography and pulmonary artery catheter thermodilution, and associated with gender, age, aortic diameter, atherosclerotic plaques, left ventricular ejection fraction and previous myocardial infarctions. Secondary flow was present for all patients. The duration and rotational frequency (p <0.001) and the duration and flow direction of the secondary flow (p <0.002) were associated. Systolic backflow was present in 40% of the patients and associated with systolic velocities (p <0.002) and the presence of atherosclerotic plaques (p <0.001). No other significant associations were observed. The study indicates that backflow is injurious and that secondary flow is a normal flow phenomenon. The study also shows that transverse oscillation can provide new information on blood flow in the ascending aorta.
Analytical modelling of waveguide mode launchers for matched feed reflector systems
Matched feed horns aim to cancel cross polarization generated in offset reflector systems. An analytical method for predicting the mode spectrum generated by inclusions in such horns, e.g. stubs and pins, is presented. The theory is based on the reciprocity theorem with the inclusions represented by current sources. The model is supported by Method of Moments calculations in GRASP and very good agreement is seen. The model gives rise to many interesting observations and ideas for new or improved mode launchers for matched feeds.

General information
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Organisations: Department of Electrical Engineering, Electromagnetic Systems, Office for Study Programmes and Student Affairs, Department of Electromagnetic Systems, TICRA
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An application of gain-scheduled control using state-space interpolation to hydroactive gas bearings
Sinusoidal disturbances are common, especially in rotordynamics where mass imbalance causes undesirable vibrations. When the frequency of the disturbance is constant and known, it can be rejected using robust control techniques by including notches in the weights. For a known time-varying frequency, it is possible to design a gain-scheduled controller using multiple controllers optimised for a single frequency. Gain-scheduling strategies using the Youla parametrisation can guarantee stability at the cost of increased controller order and performance loss in the interpolation region. This paper contributes with a gain-scheduling strategy using state-space interpolation, which avoids both the performance loss and the increase of controller order associated to the Youla parametrisation. The proposed state-space interpolation for gain-scheduling is applied for mass imbalance rejection for a controllable gas bearing scheduled in two parameters. Comparisons against the Youla-based scheduling demonstrate the superiority of the state-space interpolation.

General information
State: Published
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A new procedure for automatic fitting of the basilar-membrane input-output function to individual behavioral data. The basilar membrane input-output function (BM I/O) in a healthy cochlea is highly nonlinear. One of the consequences of sensorineural hearing loss (SNHL) is a partial or full loss of this nonlinearity. Behavioral estimates of the individual BM I/O can be useful for modeling the impaired auditory system and, potentially, for clinical diagnostics. Computational algorithms are available that mimic the functioning of the nonlinear cochlear processing. One such algorithm is the dual resonance non-linear (DRNL) filterbank [6]. Its parameters can be modified to account for individual hearing loss, e.g., based on behavioral, temporal masking curves (TMC) data. This approach was used within the framework of the computational auditory signal-processing and perception (CASP) model to account for various aspects of SNHL [4].

However, due to the computational complexity, on-line fitting of the DRNL parameters is difficult. Until recently, the parameters were manually adjusted and the fitting process was indirect. A new approach is described here, based on a search through a lookup table of pre-computed filterbank input-output functions. The aim of this approach is to provide a fast, stable, and more objective fitting procedure.

An improved minimum variance beamforming applied to plane-wave imaging in medical ultrasound

Minimum variance beamformer (MVB) is an adaptive beamformer which provides images with higher resolution and contrast in comparison with non-adaptive beamformers like delay and sum (DAS). It finds weight vector of beamformer by minimizing output power while keeping the desired signal unchanged. We used the eigen-based MVB and generalized coherence factor (GCF) to further improve the quality of MVB beamformed images. The eigen-based MVB projects the weight vector with a transformation matrix constructed from eigen-decomposing of the array covariance matrix that increases resolution and contrast. GCF is used to emphasis on coherence part of images that improves the resolution. Four different datasets provided by IUS 2016 beamforming challenge are used to evaluate the proposed method. In comparison with DAS with rectangular weight vector, our method improved contrast about 8.52 dB and 6.20 dB for simulation and experimental contrast phantoms, respectively. It also enhanced lateral (axial) resolution about 87% (40%) and 73% (21%) for simulated and experimental resolution phantoms, respectively.

Mechanical variables control, Interpolation and function approximation (numerical analysis), Control system analysis and synthesis methods, Stability in control theory, Time-varying control systems, Mechanical components, Numerical analysis, Control technology and theory, interpolation, machine bearings, mechanical variables control, robust control, state-space methods, time-varying systems, rotordynamics, disturbance frequency, notches, time-varying frequency, gain-scheduled controller, Youla parametrisation, controller order, performance loss, gain-scheduling strategy, state-space interpolation region, mass imbalance rejection, controllable gas bearing, Youla-based scheduling, sinusoidal disturbances
An interleaved structure for a high-voltage planar transformer for a Travelling-wave Tube

Fully interleaved structure can significantly reduce leakage inductance in transformers. However, it is hard to apply them into high-voltage applications due to the electric insulation. In this paper, a partially interleaved structure that is suitable for high-voltage high frequency applications is proposed to reduce leakage inductance and the insulation’s thickness is adjusted to optimize the electric isolation. In addition, the resistance and parasitic capacitance are investigated. With this method, a planar transformer used for a Travelling-Wave Tube Amplifier (TWTA) is designed. Calculations of leakage inductances and experimental results validate the effectiveness of the proposed method.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Chinese Academy of Sciences, National University of Ireland
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Publication date: 2016

A Noise-Assisted Data Analysis Method for Automatic EOG-Based Sleep Stage Classification Using Ensemble Learning

Reducing the number of recording modalities for sleep staging research can benefit both researchers and patients, under the condition that they provide as accurate results as conventional systems. This paper investigates the possibility of exploiting the multisource nature of the electrooculography (EOG) signals by presenting a method for automatic sleep staging using the complete ensemble empirical mode decomposition with adaptive noise algorithm, and a random forest classifier. It achieves a high overall accuracy of 82% and a Cohen’s kappa of 0.74 indicating substantial agreement between automatic and manual scoring.

General information
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A Note on Powers in Finite Fields

The study of solutions to polynomial equations over finite fields has a long history in mathematics and is an interesting area of contemporary research. In recent years the subject has found important applications in the modelling of problems from applied mathematical fields such as signal analysis, system theory, coding theory and cryptology. In this connection it is of interest to know criteria for the existence of squares and other powers in arbitrary finite fields. Making good use of polynomial division in polynomial fields over finite fields, we have examined a classical criterion of Euler for squares in odd prime fields, giving it a formulation which is apt for generalization to arbitrary finite fields and powers. Our proof uses algebra rather than classical number theory, which makes it convenient when presenting basic methods of applied algebra in the classroom.
A novel array processing method for precise depth detection of ultrasound point scatter

A signal based algorithm resulting in increased depth resolution is presented for medical ultrasound. It relies on multiple foci beamforming that is enabled by current ultrasound imaging systems. The concept stems from optical microscopy and is translated here into ultrasound using the Field II simulation software. A 7 MHz linear transducer is used to scan a single point scatterer phantom that can move in the axial direction. Individual beamformer outputs from 3 different foci are post-processed using the highly-dependent on focusing errors, metric of sharpness to estimate the position of the point scatter. A 37.8 μm uncertainty in depth estimation is achieved, which attains an almost 3-fold improvement compared to conventional ultrasound imaging axial resolution. Future work on the development of this algorithm requires experimental validation in tissue-like materials that provide strong aberrations.

**General information**

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Organisations: Department of Information Technology, Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasonic Imaging, Heriot-Watt University, University of Edinburgh
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A Novel Grid-Wide Transient Stability Assessment and Visualization Method for Increasing Situation Awareness of Control Room Operators

The aim of the paper is to introduce a grid-wide assessment method to determine the transient stability margin and visualize it effectively to increase the situation awareness of control room operators. Critical area(s) with insufficient transient stability margin have to be identified in order to be able to take appropriate preventive actions. The introduced method evaluates the transient stability margin with a time-domain approach by using the voltage angle of several buses.
across the power system. Information about the severity of a contingency and the location of the most critical buses is derived. Moreover, it is shown that the method facilitates the visual examination of transient stability. It provides control room operators with essential information about the state of the system and enables them to take appropriate preventive actions if insufficient transient stability margins are detected.

### General information
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- **Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources
- **Authors:** Pertl, M. (Intern), Rezkalla, M. M. (Intern), Marinelli, M. (Intern)
- **Pages:** 87-92
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### A novel MR contrast agent for angiography and perfusion: Hyperpolarized water

Magnetic Resonance Imaging (MRI) is an important tool in medical imaging, and is widely used for its high spatial and temporal resolution, and low safety concerns. However, the technique has its limitations due to the inherent low sensitivity, making it inferior to Computed Tomography (CT) in terms of spatial and temporal sensitivity and to nuclear medicine methods in terms of molecular imaging sensitivity. By hyperpolarization, the available signal can be enhanced by several orders of magnitude, and potentially close some of these gaps. In this thesis work, the purpose is to demonstrate that water, hyperpolarized by dissolution Dynamic Nuclear Polarization (d-DNP), can be applied as an MRI contrast agent for angiography and perfusion. The first part of the project focuses on development of a protocol for production of large samples of hyperpolarized protons in D2O. The samples are polarized and dissolved in a fluid path compatible with the installed base of commercial polarizers developed for clinical research. The solidstate DNP is optimized at 6.7 T and 1.2 K by microwave frequency modulation. A solid-state polarization of 70% is obtained. The dissolution procedure is optimized by introduction of a fluorinated solvent to accelerate the transition from solid to liquid state, and efficient radical extraction is obtained with a two-phase system of water and heptane. A final liquid state polarization of 13% in samples of 16 mL is obtained, suitable for large animal experiments. In second part of the project, hyperpolarized water is applied for angiographic imaging and perfusion measurements in a pig model. Renal angiography of 0.55 mm in-plane isotropic resolution is demonstrated and perfusion measurements provides values comparable to conventional Gd-T1-DCE analysis. Finally, it is demonstrated that the method can be applied to acquire dynamic coronary MR angiography with temporal resolution of less than 1 s, apparent Signal-to-Noise Ratio of 269±169 and coronary sharpness of 0.31±0.086 mm-1, which is superior to coronary MRA available in today’s clinical practice.
An Overview of Modeling Approaches Applied to Aggregation-Based Fleet Management and Integration of Plug-in Electric Vehicles

The design and implementation of management policies for plug-in electric vehicles (PEVs) need to be supported by a holistic understanding of the functional processes, their complex interactions, and their response to various changes. Models developed to represent different functional processes and systems are seen as useful tools to support the related studies for different stakeholders in a tangible way. This paper presents an overview of modeling approaches applied to support aggregation-based management and integration of PEVs from the perspective of fleet operators and grid operators, respectively. We start by explaining a structured modeling approach, i.e., a flexible combination of process models and system models, applied to different management and integration studies. A state-of-the-art overview of modeling approaches applied to represent several key processes, such as charging management, and key systems, such as the PEV fleet, is then presented, along with a detailed description of different approaches. Finally, we discuss several considerations that need to be well understood during the modeling process in order to assist modelers and model users in the appropriate decisions of using existing, or developing their own, solutions for further applications.
Antenna diagnostics for power flow in extreme near-field of a standard gain horn

The plane wave spectrum of an aperture antenna can be calculated from a complex measurement of the radiated near- or far-field and it facilitates antenna diagnostics for the extreme near-field of the antenna. While antenna diagnostics often concern the magnitude of the co-polar field, the plane wave spectrum actually allows for determination of both magnitude and phase of all three components of the electric as well as the magnetic field - and thus also the Poynting vector. In this work we focus on the Poynting vector and thus the power flow in the extreme near-field; as an example we employ a 60 GHz standard gain horn. Measurements obtained with a planar near-field antenna measurement set-up reveal that the power flow has not only a normal component - but also tangential components - in the aperture and, furthermore, that these components possess oscillations along the E-plane. We show that these oscillations are not merely a "Gibbs-like" phenomenon due to the availability of only the visible region of the plane wave spectrum and they are not caused by multiple reflections between the horn and the near-field probe - but resulted from the interference between the direct field and the edge-diffracted fields in the horn aperture. An analytical model based on the Geometrical Theory of Diffraction is established, and it is demonstrated that this model qualitatively as well as quantitatively predicts the measurement results for the power flow. A full-wave analysis is carried out and the simulation results show qualitatively the intricate physical mechanism of the power flow distribution.
demodulate ultra-wideband amplitude shift keying (ASK) signals up to 2.5 Gbps at 6-9 GHz carrier frequency. The
detector uses microstrip and surface-mount device (SMD) components and it is fabricated on a Rogers 6002 substrate.
Experimental results show error free transmissions up to 2.5 Gbps at an input power level of -11 dBm. The highest
measured conversion gain of the detector is around -12 dB.

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A numerical method for determining the radial wave motion correction in plane wave couplers
Microphones are used for realising the unit of sound pressure level, the pascal (Pa). Electro-acoustic
reciprocity is the preferred method for the absolute determination of the sensitivity. This method can be
applied in different sound fields: uniform pressure, free field or diffuse field. Pressure calibration, carried out in plane wave
couplers, is the most extended. Here plane wave propagation is assumed. While this
assumption is valid at low and mid frequencies, it fails at higher frequencies because the membrane of the
microphones is not moving uniformly, and there are viscous losses. An existing solution is an analytical
expression that estimates the difference between the ideal plane wave sound field and a more complex
lossless sound field created by a non-planar movement of the microphone's membranes. Alternatively, a correction may
be calculated numerically by introducing a full model of the microphone-coupler system in a Boundary Element
formulation. In order to obtain a realistic representation of the sound field, viscous losses must be introduced in the model.
This paper presents such a model, and the results of the simulations for different combinations of microphones and
couplers. The results are compared to experimental data, and the existing analytical solution.

General information
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Organisations: Department of Electrical Engineering, Acoustic Technology, Danish Fundamental Metrology
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BEM, Metrology, Microphones
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A Numerical Model of an Acoustic Metamaterial Using the Boundary Element Method Including Viscous and Thermal
Losses
In recent years, boundary element method (BEM) and finite element method (FEM) implementations of acoustics in fluids
with viscous and thermal losses have been developed. They are based on the linearized Navier–Stokes equations with no
flow. In this paper, such models with acoustic losses are applied to an acoustic metamaterial. Metamaterials are structures formed by smaller, usually periodic, units showing remarkable physical properties when observed as a whole. Acoustic losses are relevant in metamaterials in the millimeter scale. In addition, their geometry is intricate and challenging for numerical implementation. The results are compared with existing measurements.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, University of Southern Denmark, Universidad Politécnica de Valencia
Authors: Cutanda Henriquez, V. (Intern), Andersen, P. R. (Intern), Jensen, J. S. (Intern), Møller Juhl, P. (Ekstern), Sánchez-Dehesa, J. (Ekstern)
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 0.86 SJR 0.388 SNIP 0.787
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.7 SJR 0.376 SNIP 0.676
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 0.626 SNIP 0.673 CiteScore 0.71
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.665 SNIP 0.963 CiteScore 0.96
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.595 SNIP 1.205 CiteScore 0.96
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.327 SNIP 0.72 CiteScore 0.62
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
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ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.542 SNIP 1.025
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.412 SNIP 0.938
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.576 SNIP 0.907
Scopus rating (2007): SJR 0.482 SNIP 0.576
Scopus rating (2006): SJR 0.491 SNIP 0.626
Scopus rating (2005): SJR 0.488 SNIP 0.775
Scopus rating (2004): SJR 0.602 SNIP 0.675
Scopus rating (2003): SJR 0.723 SNIP 0.926
Scopus rating (2002): SJR 1.068 SNIP 0.562
Scopus rating (2001): SJR 0.906 SNIP 0.7
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.578 SNIP 0.823
A numerical strategy for finite element modeling of frictionless asymmetric vocal fold collision

Analysis of voice pathologies may require vocal fold models that include relevant features such as vocal fold asymmetric collision. The present study numerically addresses the problem of frictionless asymmetric collision in a self-sustained three-dimensional continuum model of the vocal folds. Theoretical background and numerical analysis of the finite-element position-based contact model are presented, along with validation. A novel contact detection mechanism capable to detect collision in asymmetric oscillations is developed. The effect of inexact contact constraint enforcement on vocal fold dynamics is examined by different variational methods for inequality constrained minimization problems, namely the Lagrange multiplier method and the penalty method. In contrast to the penalty solution, which is related to classical spring-like contact forces, numerical examples show that the parameter-independent Lagrange multiplier solution is more robust and accurate in the estimation of dynamical and mechanical features at vocal fold contact. Furthermore, special attention is paid to the temporal integration schemes in relation to the contact problem, the results suggesting an advantage of highly diffusive schemes. Finally, vocal fold contact enforcement is shown to affect asymmetric oscillations. The present model may be adapted to existing vocal fold models, which may contribute to a better understanding of the effect of the non-linear contact phenomenon on phonation.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Department of Applied Mathematics and Computer Science, Dynamical Systems
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Number of pages: 5
Publication date: 2016

Publication information
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:

A physical based equivalent circuit modeling approach for ballasted InP DHBT multi-finger devices at millimeter-wave frequencies

Multifinger InP DHBTs can be designed with a ballasting resistor to improve power capability. However accurate modeling is needed to predict high frequency behavior of the device. This paper presents two distinct modeling approaches: one based on EM simulations and one based on a physical equivalent circuit description. In the first approach, the EM simulations of contact pads and ballasting network are combined with the small-signal model of the intrinsic device. In the second approach, the ballasting network is modeled with lumped components derived from physical analysis of the layout and then combined with EM simulated contact pads and with the device model. The models are validated against S-parameters measurements of real devices up to 65 GHz showing good agreement in terms of maximum available gain. In addition, a MAG of 2–4 dB at 170 GHz shows that ballasted devices can be employed for power amplifiers in D band.

General information
State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Department of Electromagnetic Systems, III-V Lab
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Number of pages: 2
Pages: 1-2
A Pole Pair Segment of a 2 MW High Temperature Superconducting Wind Turbine Generator

A 2 MW high temperature superconducting (HTS) generator with 24 pole pairs has been designed for the wind turbine application. In order to identify potential challenges and obtain practical knowledge prior to production, a full-size stationary experimental set-up, which is one pole pair segment of the full generator, has been built and tested. The experimental set-up comprises a consequent-pole HTS rotor and a conventional three-phase copper stator. This paper first presents the electromagnetic designs of the full generator and the set-up, then it goes to compare the performance of the full generator and the set-up in terms of the flux density, the operating condition of the HTS winding, and the force-generation capability. Finite element (FE) software MagNet is used to carry out numerical simulations. The findings show that the HTS winding in the set-up is a good surrogate for those that would be used in the full generator. The FE simulations also tell that the maximum tangential force generated in the set-up is 3.77% lower than that in the full generator. Good agreement between the values of interest in the set-up and those projected in the full generator has revealed a cost-effective prototyping methodology for developing HTS machines.

General information
State: Published
Authors: Song, X. (Intern), Mijatovic, N. (Intern), Kellers, J. (Ekstern), Bührer, C. (Ekstern), Rebsdorf, A. V. (Ekstern), Hansen, J. (Ekstern), Christensen, M. (Ekstern), Krause, J. (Ekstern), Pütz, H. (Ekstern), Wiezoreck, J. (Ekstern), Holbøll, J. (Intern)
Number of pages: 5
Publication date: 2016

Application of a Bayesian algorithm for the Statistical Energy model updating of a railway coach

The classical statistical energy analysis (SEA) theory is a common approach for vibroacoustic analysis of coupled complex structures, being efficient to predict high-frequency noise and vibration of engineering systems. There are however some limitations in applying the conventional SEA. The presence of possible strong coupling between subsystems and the lack of diffuseness result in a significant uncertainty. This is the main motivation for the present study, where a procedure to update SEA models is proposed. The proposed procedure is the combination of the classical SEA method and a Bayesian technique. Due to reasons such as finding a limited number of important parameters, using a limited search range, avoiding matrix inversion and taking the effect of noise into account, the proposed strategy can be considered as a proper alternative to the experimental SEA approach. To investigate the performance of the proposed strategy, the SEA model updating of a railway passenger coach is carried out. First, a sensitivity analysis is carried out to select the most sensitive parameters of the SEA model. For the selected parameters of the model, prior probability density functions are then taken into account based on published data on comparison between experimental and theoretical results, so that the variance of the theory is estimated. The Monte Carlo Metropolis Hastings algorithm is employed to estimate the modified values of the
parameters. It is shown that the algorithm can be efficiently used to update the SEA models with a high number of unknown parameters.

**General information**
- **State:** Published
- **Organisations:** Department of Electrical Engineering, Acoustic Technology, Iran University of Science and Technology
- **Authors:** Sadri, M. (Ekstern), Brunskog, J. (Intern), Younesian, D. (Ekstern)
- **Pages:** 84–107
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- **Main Research Area:** Technical/natural sciences

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  - Scopus rating (2017): CiteScore 2.31 SJR 0.815 SNIP 1.515
  - Web of Science (2017): Indexed yes
  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 2.33 SJR 0.846 SNIP 1.669
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): SJR 0.668 SNIP 1.716 CiteScore 1.85
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): SJR 0.705 SNIP 1.885 CiteScore 1.67
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): SJR 0.778 SNIP 2.288 CiteScore 1.64
  - ISI indexed (2013): ISI indexed yes
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  - BFI (2012): BFI-level 2
  - Scopus rating (2012): SJR 0.76 SNIP 2.191 CiteScore 1.66
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 0.772 SNIP 1.796 CiteScore 1.38
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 0.639 SNIP 1.542
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 0.793 SNIP 1.506
  - Web of Science (2009): Indexed yes
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 0.665 SNIP 1.761
  - Web of Science (2008): Indexed yes
  - Scopus rating (2007): SJR 0.642 SNIP 1.324
  - Web of Science (2007): Indexed yes
  - Scopus rating (2006): SJR 0.645 SNIP 1.314
  - Web of Science (2006): Indexed yes
  - Scopus rating (2005): SJR 0.614 SNIP 1.258
  - Scopus rating (2004): SJR 0.594 SNIP 1.071
  - Web of Science (2004): Indexed yes
Application of a New Robust ECG T-Wave Delineation Algorithm for the Evaluation of the Autonomic Innervation of the Myocardium

T-wave amplitude (TWA) is a well-known index of the autonomic innervation of the myocardium. However, until now it has been evaluated only manually or with simple and inefficient algorithms. In this paper, we developed a new robust single-lead electrocardiogram (ECG) T-wave delineation algorithm that is able to detect the T-wave with a wavelet-based method and automatically calculate the TWA. We evaluated the algorithm on the QT database, achieving a sensitivity of 99.92% for the T wave peak and 99.38% for the T wave end. In addition, the percentage of records automatically delineated with high precision was higher than previous published works. Finally, the algorithm was applied to study the influence of anticholinergic and antiadrenergic drugs (i.e. atropine and metoprolol) on the TWA. It was observed that atropine significantly decreased the TWA when compared to baseline level, that head-up tilt caused a decrease of TWA and that metoprolol blunted this decrease. Through the development of a robust algorithm, this study opens the way for further research on the T-wave analysis for the assessment of the autonomic innervation of the ventricular myocardium.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, Copenhagen Center for Health Technology, Frederiksberg Hospital, University of Copenhagen
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Pages: 3801-3804
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DOIs:
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Application of Network-Constrained Transactive Control to Electric Vehicle Charging for Secure Grid Operation.
This paper develops a network-constrained transactive control method to integrate distributed energy resources (DERs) into a power distribution system with the purpose of optimizing the operational cost of DERs and power losses of the distribution network as well as preventing grid problems including power transformer congestion and voltage violations. In this method, a price coordinator is introduced to facilitate the interaction between the distribution system operator (DSO) and aggregators in the smart grid. Electric vehicles are used to illustrate the proposed network-constrained transactive control method. Mathematical models are presented to describe the operation of the control method. Finally, simulations are presented to show the effectiveness of the proposed method. To guarantee its optimality, we also checked the numerical results obtained with the network-constrained transactive control method and compared them with the one solved by centralized control, and found a good performance of the proposed control method.

General information
Application of Transactive Control for Integrating Distributed Energy Resources into an Enhanced Distribution System

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Technical University of Denmark
Authors: Dalsgaard, M. T. (Ekstern), Yang, G. (Intern), Hu, J. (Intern)
Number of pages: 39
Publication date: 2016
Applying machine learning techniques for forecasting flexibility of virtual power plants

Previous and existing evaluations of available flexibility using small device demand response have typically been done with detailed information of end-user systems. With these large numbers, having lower level information has both privacy and computational limitations. We propose a black box approach to investigating the longevity of aggregated response of a virtual power plant using historic bidding and aggregated behaviour with machine learning techniques. The two supervised machine learning techniques investigated and compared in this paper are, multivariate linear regression and single hidden layer artificial neural network (ANN). Both techniques are used to model a relationship between the aggregator portfolio state and requested ramp power to the longevity of the delivered flexibility. Using validated individual household models, a smart controlled aggregated virtual power plant is simulated. A hierarchical market-based supply-demand matching control mechanism is used to steer the heating devices in the virtual power plant. For both the training and validation set of clusters, a random number of households, between 200 and 2000, is generated with day ahead profile scaled accordingly. Further, a ramp power (power deviation) is assigned at various hours of the day and requested to hold for the remainder of the day. Using only the bidding functions and the requested ramp powers, the ramp longevity is estimated for a number of different cluster setups for both the artificial neural network as well as the multi-variant linear regression. It is found that it is possible to estimate the longevity of flexibility with machine learning. The linear regression algorithm is, on average, able to estimate the longevity with a 15% error. However, there was a significant improvement with the ANN algorithm achieving, on average, a 5.3% error. This is lowered 2.4% when learning for the same virtual power plant. With this information it would be possible to accurately offer residential VPP flexibility for market operations to safely avoid causing further imbalances and financial penalties.

A practical multiscale approach for optimization of structural damping

A simple and practical multiscale approach suitable for topology optimization of structural damping in a component ready for additive manufacturing is presented. The approach consists of two steps: First, the homogenized loss factor of a two-phase material is maximized. This is done in order to obtain a range of isotropic microstructures that have a connected stiff material phase. Second, the structural damping of the component is maximized using material interpolations based on the homogenized properties of the microstructures. In order to achieve convergence towards a discrete set of material phases in the macroscopic problem, a material interpolation that favors values close to the predefined material densities is introduced.
A precise electromagnetic field model useful for development of microwave imaging systems

Purpose - The paper describes a fast forward electromagnetic model built with help of commercial software. The purpose of this paper is to create an efficient and robust electromagnetic field model that could be easily plugged into a working microwave imaging system. The secondary purpose is to evaluate advantages and disadvantages of such a commercial packages for creating such a model.

Design/methodology/approach - In this paper the authors decided to build the model using COMSOL Multiphysics software suite, ultimately comparing its result to measurements of a real device. The numerical model was created in an iterative fashion in order to determine how much details are needed to make it reliable, while keeping it efficient.

Findings - The authors found that the commercial software seems like a viable platform for developing electromagnetic solvers. The resulting computer model is easy to prepare, run and integrate with external tools.

Research limitations/implications - Using the experience in building numerical models of various systems the authors came to the conclusion that developing some in-house code is a very non-efficient technique as it slows down the progress of the research team once the team changes. Transfer of knowledge associated with the numerical tools is much easier when the tools are constructed using a common platform, i.e. commercial packages. It does not really matter if the software is free or proprietary as long as the platform provides efficient tools assisting in model preparation and data visualization.

Practical implications - One of the main advantages of using such a full field electromagnetic model is the ability to investigate an impact of different properties of the system (length of antennas, liquid parameters) on its performance. Thanks to the use of commercial software it is much easier to pass the project to new people too.

Originality/value - The presented numerical model utilizes a frugal meshing scheme which allows faster execution while keeping required accuracy of solutions. Using this model the authors were able to diagnose important geometrical details that could affect the performance of the system.
A Probabilistic Method for Determining Grid-Accommodable Wind Power Capacity Based on Multiscenario System Operation Simulation

When conducting the wind power (WP) planning, it is very important for electric power companies to evaluate the penetration limit of the grid-accommodable WP. This paper proposes a probabilistic method for determining grid-accommodable WP capacity based on the multiscenario analysis. Typical power system operation scenarios are generated from the combination of different WP scenarios and demand scenarios. A power system operation simulation model is proposed and implemented to the generated scenarios. The operation results are further used as the basis of the proposed probabilistic method. The validity and effectiveness of the new method are demonstrated in two cases, i.e., the IEEE 39-bus test system and a real large power system in China, respectively.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Tsinghua University, State Grid Jibei Electric Power Company
Authors: Xu, Q. (Ekstern), Kang, C. (Ekstern), Zhang, N. (Ekstern), Ding, Y. (Intern), Xia, Q. (Ekstern), Sun, R. (Ekstern), Xu, J. (Ekstern)
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BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 9.02 SJR 2.854 SNIP 2.995
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 7.92 SJR 2.73 SNIP 2.837
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.424 SNIP 3.284 CiteScore 8.48
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Archetypal analysis of auditory profiling data towards a clinical test battery

Nowadays, the pure-tone audiogram alone is used for hearing-aid fitting and characterization of the degree of hearing loss. Nevertheless, some hearing-impaired listeners have shown a so-called speech communication handicap even though the audibility was compensated for by amplification. Plomp (1978) proposed a classification of the hearing loss based on speech intelligibility tests, the “audibility loss” and the “distortion loss”. Therefore, a different fitting strategy may be needed for compensating the deficits of these two different classes. The aim of the present study is to clarify which tests are needed (in addition to the audiogram) to classify the listeners in different hearing profiles.

Area-Efficiency Trade-Offs in Integrated Switched-Capacitor DC-DC Converters

This paper analyzes the relationship between efficiency and chip area in a fully integrated switched capacitor voltage divider dc-dc converter implemented in 180nm-technology and a 1/2 topology. A numerical algorithm for choosing the optimal sizes of individual components, in terms of power loss, based on the total chip area is developed. This algorithm also determines the optimal number of parallel phases in the converter, based on an estimate of power consumption in flip-flop based clock circuits. By these means the maximum achievable efficiency as a function of chip area is estimated.
A Robust Optimisation Approach using CVaR for Unit Commitment in a Market with Probabilistic Offers

The large scale integration of renewable energy sources (RES) challenges power system planners and operators alike as it can potentially introduce the need for costly investments in infrastructure. Furthermore, traditional market clearing mechanisms are no longer optimal due to the stochastic nature of RES. This paper presents a risk-aware market clearing strategy for a network with significant shares of RES. We propose an electricity market that embeds the uncertainty brought by wind power and other stochastic renewable sources by accepting probabilistic offers and use a risk measure defined by conditional value-at-risk (CVaR) to evaluate the risk of high re-dispatching cost due to the mis-estimation of renewable energy. The proposed model is simulated on a 39-bus network, whereby it is shown that significant reductions can be achieved by properly managing the risks of mis-estimation of stochastic generation.

A Sealed-Bid Two-Attribute Yardstick Auction Without Prior Scoring

We analyze a two-attribute single item procurement auction that uses yardstick competition to settle prices. The auction simplifies the procurement process by reducing the principal's articulation of preferences to simply choosing the most preferred offer as if it was a market with posted prices. This is done simply by replacing the submitted sealed bids by yardstick bids, computed by a linear weighting of the other participants' bids. We show that there is only one type of Nash equilibria where some agents may win the auction by submitting a zero price-bid. Using a simulation study we demonstrate that following this type of equilibrium behavior often leads to winner's curse. The simulations show that in auctions with more than 12 participants the chance of facing winner's curse is around 95%. Truthful reporting, on the other hand, does not constitute a Nash equilibrium but it is ex post individually rational. Using a simulation study we demonstrate that truthful bidding may indeed represent some kind of focal point.
Secure, Clean, and Efficient Energy is one of the great societal challenges of our time. Electricity as a sustainable energy carrier plays a central role in the most effective transition scenarios toward sustainability. To harness this potential, the current electricity infrastructure needs to be rigorously re-engineered into an integrated and intelligent electricity system:
the smart grid. Key elements of the smart grid vision are the coordination mechanisms. In such a system, vast numbers of devices, currently just passively connected to the grid, will become actively involved in system-wide and local coordination tasks. In this light, transactive energy (TE) is emerging as a strong contender for orchestrating the coordinated operation of so many devices.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Pacific Northwest National Laboratory
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Number of pages: 12
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): SNIP 1.263 SJR 0.942 CiteScore 1.93
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.95 SJR 1.142 SNIP 1.825
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.319 SNIP 2.133 CiteScore 1.97
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.279 SNIP 2.106 CiteScore 1.48
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.996 SNIP 2.445 CiteScore 2.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.705 SNIP 3.12 CiteScore 3.05
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.961 SNIP 4.688 CiteScore 3.26
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.742 SNIP 4.08
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.679 SNIP 2.272
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.615 SNIP 10.553
Scopus rating (2007): SJR 0.403 SNIP 5.406
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.435 SNIP 1.965
Scopus rating (2005): SJR 0.469 SNIP 1.17
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Electrical and Electronic Engineering, Energy Engineering and Power Technology, Electric power transmission networks, Coordinated operation, Coordination mechanisms, Distributed resources, Electricity infrastructure, Electricity system, Local coordination, Sustainable energy, Transition scenarios, Smart power grids, Artificial intelligence, Energy
Assessing and modeling apparent source width perception

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Technical University of Denmark
Authors: Käsbach, J. (Intern), Hahmann, M. (Ekstern), May, T. (Intern), Dau, T. (Intern)
Number of pages: 4
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Assessing the contribution of binaural cues for apparent source width perception via a functional model

In echoic conditions, sound sources are not perceived as point sources but appear to be expanded. The expansion in the horizontal dimension is referred to as apparent source width (ASW). To elicit this perception, the auditory system has access to fluctuations of binaural cues, the interaural time differences (ITDs), interaural level differences (ILDs) and the interaural coherence (IC). To quantify their contribution to ASW, a functional model of ASW perception was exploited using the TWO!EARS auditory-front-end (AFE) toolbox. The model determines the left- and right-most boundary of a sound source using a statistical representation of ITDs and ILDs based on percentiles integrated over time and frequency. The model’s performance was evaluated against psychoacoustic data obtained with noise, speech and music signals in loudspeaker-based experiments. A robust model prediction of ASW was achieved using a cross-correlation based estimation with either IC or ITDs, in contrast to a combination of ITDs and ILDs where the performance slightly decreased.

General information
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Organisations: Department of Electrical Engineering, Hearing Systems, Technical University of Denmark
Authors: Käsbach, J. (Intern), Hahmann, M. (Ekstern), May, T. (Intern), Dau, T. (Intern)
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Binaural listening, Spatial perception, Auditory modeling, Room acoustics, Virtual acoustics
Source: PublicationPreSubmission
Source-ID: 125276101
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
Assessment of grid-friendly collective optimization framework for distributed energy resources

Recent developments in the advanced control of renewable energy resources and distributed generation systems are resulting in pressures to adopt tariffs of increasing complexity. Independently of the tariff structure, utility customers can programmatically optimize their schedule consumption for reducing their energy bills. However, as the penetration of distributed energy resources increases, there is an increasing chance of a “tragedy of the commons” mechanism taking place, where taking advantage of tariffs for local benefit can ultimately result in power quality degradation. In this work, we use a scheduling optimization tool, in combination with a distribution feeder simulator, to investigate techniques that could mitigate the deleterious effect of “selfish” optimization, so that the high-penetration use of DERs to reduce operating costs remains advantageous while the quality of service and overall energy cost to the community is not affected.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, University of New Mexico, Lawrence Berkeley National Laboratory
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Publication date: 2016

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Source-ID: 2348996249
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Assessment of Lightning Shielding Performance of a 400 kV Double-Circuit Fully Composite Pylon

Modern day overhead transmission lines are taking a giant leap in modernization, with the change in power generation from fossil fuels to renewable sources such as solar power, hydro power and wind power. The renewable generation needs to be connected to a large scale high voltage transmission grid. In Europe alone, 28.000 km of 400 kV transmission line is needed by 2020 to fulfil the aim of providing 20% of Europe’s energy from green energies. It means that more than 100.000 new pylons will be needed [1]. For this reason, the next generation of overhead line is introduced, by developing new design pylons that are easier to erect, less costly, smaller and better looking than the old ones, which is important to get public acceptance. In this regard, a fully composite-based pylon for 400 kV lines is presented with a new innovative design concept shown in Fig. 1. The integration of insulators in cross-arm design is the prominent feature of the fully composite pylon in comparison with conventional towers. The unibody cross-arm of the pylon has 30 degree inclination and all of conductors are fixed on the cross-arm by cable clamps. Thus, the configuration of phase conductors on the cross-arm is in the form of diagonal and differs from other widely used configurations in overhead transmission lines i.e. horizontal, delta and vertical configurations. On the other hand, unlike traditional steel lattice towers, the pylon removes access to ground potential due to its non-conductive materials and therefore, the lightning shielding of pylon requires a ground potential access to shield wires which can be achieved by utilizing ground cable inside the hollow cross-arm and pylon body. However, efficient assigning of lightning shielding system for the fully composite pylon is one of the major challenges in the electrical design of the pylon which is also important in terms of mechanical and material designs. In this paper, the weak and strong points of the preliminary assigned shielding angle for the pylon are investigated and subsequently, an acceptable shielding angle will be derived from the electro-geometric model (EGM) to improve the lightning performance of the pylon.

General information
State: Published
Authors: Jahangirl, T. (Ekstern), Bak, C. L. (Ekstern), Silva, F. M. F. D. (Ekstern), Endahl, B. (Ekstern), Holbøll, J. (Intern)
Publication date: 2016

Host publication information
Title of host publication: Cigré Session 2016
Article number: C4-205
Main Research Area: Technical/natural sciences
Source: FindIt
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A Sufficient Condition on Convex Relaxation of AC Optimal Power Flow in Distribution Networks

This paper proposes a sufficient condition for the convex relaxation of AC Optimal Power Flow (OPF) in radial distribution networks as a second order cone program (SOCP) to be exact. The condition requires that the allowed reverse power flow is only reactive or active, or none. Under the proposed sufficient condition, the feasible sub-injection region (power injections of nodes excluding the root node) of the AC OPF is convex. The exactness of the convex relaxation under the proposed condition is proved through constructing a group of monotonic series with limits, which ensures that the optimal solution of the SOCP can be converted to an optimal solution of the original AC OPF. The efficacy of the convex relaxation to solve the AC OPF is demonstrated by case studies of an optimal multi-period planning problem of electric vehicles (EVs) in distribution networks.
Asymmetric active nano-particles for directive near-field radiation

In this work, we demonstrate the potential of cylindrical active coated nano-particles with certain geometrical asymmetries for the creation of directive near-field radiation. The particles are excited by a near-by magnetic line source, and their performance characteristics are reported in terms of radiated power, near-field and power flow distributions as well as the far-field directivity.

General information

State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, Technical University of Denmark
Authors: Arslanagic, S. (Intern), Thorsen, R. O. (Ekstern)
Number of pages: 2
Pages: 1-2
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Publication: Research - peer-review › Journal article – Annual report year: 2016

Asymmetric active nano-particles for directive near-field radiation

In this work, we demonstrate the potential of cylindrical active coated nano-particles with certain geometrical asymmetries for the creation of directive near-field radiation. The particles are excited by a near-by magnetic line source, and their performance characteristics are reported in terms of radiated power, near-field and power flow distributions as well as the far-field directivity.
Asymmetric overlap and hysteresis current control of zero-current switched alternate arm converter
The alternate arm converter (AAC) is a multilevel converter of the same family as the modular multilevel converter (MMC). Contrary to the MMC, the AAC offers dc-fault tolerant capabilities but requires complex submodule (SM) capacitor voltage/energy regulation and circulating current control. Such control is also limited due to the small overlap period where both arms conduct and energy between the arms can be exchanged. This paper develops a double-band hysteresis-based circulating current control strategy by introducing an asymmetric overlap period control of the director switches (DSs). The proposed controller ensures zero-current switching operation of the DSs, and increases the flexibility of SM capacitor voltage regulation owing to the asymmetric overlap period. It improves the performance of current control and energy regulation for the AAC at both near sweet-spot and non sweet-spot operation without disturbing the output voltages and currents. The performance and effectiveness of the proposed controller are illustrated through simulations on MATLAB-Simulink and PLECS.
Auditory profiling and hearing-aid satisfaction in hearing-aid candidates

Hearing-impaired (HI) listeners often complain about difficulties communicating in the presence of background noise, although audibility may be restored by a hearing-aid (HA). The audiogram typically forms the basis for HA fitting, i.e. people with similar audiograms are given the same prescription by default. This study aimed at identifying clinically relevant tests that may serve as an informative addition to the audiogram and which may relate more directly to HA satisfaction than the audiogram does. METHODS: A total of 29 HI and 26 normal-hearing listeners performed tests of spectral and temporal resolution, binaural hearing, speech intelligibility in stationary and fluctuating noise and a working-memory test. Six weeks after HA fitting, the HI listeners answered a questionnaire evaluating HA treatment. RESULTS: No other measures than masking release between fluctuating and stationary noise correlated significantly with audibility. The HI listeners who obtained the least advantage from fluctuations in background noise in terms of speech intelligibility experienced greater HA satisfaction. CONCLUSION: HI listeners have difficulties in different hearing domains that are not predictable from their audiogram. Measures of temporal resolution or speech perception in both stationary and fluctuating noise could be relevant measures to consider in an extended auditory profile. FUNDING: The study was supported by Grosserer L. F. Fougts Fond. TRIAL REGISTRATION: The protocol was approved by the Science Ethics Committee of the Capital Region of Denmark (reference H-3-2013-004).

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, University of Copenhagen
Authors: Thorup, N. (Ekstern), Santurette, S. (Intern), Jørgensen, S. (Intern), Kjærbøl, E. (Ekstern), Dau, T. (Intern), Friis, M. (Ekstern)
Number of pages: 5
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Danish Medical Journal
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ISSN (Print): 2245-1919
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.589 SJR 0.525 CiteScore 1.28
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.92 SJR 0.462 SNIP 0.543
Web of Science (2016): Indexed yes
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Automatic Ultrasound Scanning

Medical ultrasound has been a widely used imaging modality in healthcare platforms for examination, diagnostic purposes, and for real-time guidance during surgery. However, despite the recent advances, medical ultrasound remains the most operator-dependent imaging modality, as it heavily relies on the user adjustments on the scanner interface to optimize the scan settings. This explains the huge interest in the subject of this PhD project entitled “AUTOMATIC ULTRASOUND SCANNING”. The key goals of the project have been to develop automated techniques to minimize the unnecessary settings on the scanners, and to improve the computer-aided diagnosis (CAD) in ultrasound by introducing new quantitative measures. Thus, four major issues concerning automation of the medical ultrasound are addressed in this PhD project. They touch upon gain adjustments in ultrasound, automatic synthetic aperture image quality optimization, automated vessel segmentation in ultrasound, and lack of CAD in point-of-care lung ultrasound. The goals of this PhD are achieved for each of the subjects. First, a new automated time gain compensation technique is proposed that compensates for gains of the scans in 2-D. The proposed model outperforms the current 1-D curve compensation in commercial scanners, as the 2-D topology of the scans are not fully integrated in those techniques. Second, an automated generic technique is proposed for optimization of synthetic aperture image quality. This generic model can be used for any imaging regime using any transducer geometry. Third, a hybrid vessel segmentation technique is proposed that combines both vector velocity estimates (VFI) and B-mode images. The technique enables the wall-to-wall visualization of VFI, as well as provides a firm ground for quantitative quantification of VFI in state-of-the-art US scanners. Finally, a new technique is introduced to detect disease-related reverberation artifacts in lung ultrasound, thereby exploiting the full potential of this imaging modality.
Autonomous Voltage Security Regions to Prevent Cascading Trip Faults in Wind Turbine Generators

Cascading trip faults in large-scale wind power centralized integration areas bring new challenges to the secure operation of power systems. In order to deal with the complexity of voltage security regions and the computation difficulty, this paper proposes an autonomous voltage security region (AVSR) for each wind farm and the point of common coupling (PCC) substation, whose voltage can be controlled in a decoupled way. The computation of the AVSR can be completed using a stepwise search method exchanging voltage and power information between the control center and the wind farms. At each wind farm, an AVSR is determined to guarantee the normal operation of each wind turbine generator (WTG), while in the control center, each region is designed in order to guarantee secure operation both under normal conditions and after an N-1 contingency. A real system in Northern China was used to carry out case studies to verify the effectiveness of the AVSRs proposed, and good performance was demonstrated using the Monte Carlo method.

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General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Tsinghua University, Xi'an Jiaotong University
Authors: Niu, T. (Ekstern), Guo, Q. (Ekstern), Sun, H. (Ekstern), Wu, Q. (Intern), Zhang, B. (Ekstern), Ding, T. (Ekstern)
Pages: 1306 - 1316
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Main Research Area: Technical/natural sciences

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Journal: IEEE Transactions on Sustainable Energy
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 7.42 SJR 2.318 SNIP 2.452
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 7.8 SJR 2.368 SNIP 2.967
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.717 SNIP 3.22 CiteScore 7.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.554 SNIP 3.898 CiteScore 7.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.043 SNIP 3.712 CiteScore 7.03
Axial Permanent Magnet Generator for Wearable Energy Harvesting

An increasing demand for battery-free electronics is evident by the rapid increase of wearable devices, and the design of wearable energy harvesters follows accordingly. An axial permanent magnet generator was designed to harvest energy from human body motion and supplying it to a wearable application. The design was approached from an electromagnetic point of view in this article. Two types of axial flux permanent magnet generators were designed: one with an iron yoke, which is commonly used to reduce the machine volume and demand of permanent magnets, and a second without the iron yoke in order to reduce the rotor inertia and to reduce losses. Analytical models and finite element simulations were employed for the analyses of both generator types, and verified experimentally by prototypes. The results suggested that a generator of this size and power rating (20 mm radius, and 5 mW, respectively) with an iron yoke is subject to losses that exceed the realistic input power, and was therefore deemed infeasible. A generator without the iron yoke was concluded to perform well as a wearable energy harvester. An experimental investigation of a prototype revealed an output power of almost 1 mW at a voltage close to 1 V, yielding a power density of 13 μW · cm−3.
Bidding strategy for an energy storage facility
This paper studies operation decisions of energy storage facilities in perfectly and imperfectly competitive markets. In a perfectly competitive market, the storage facility is operated to maximize the social welfare. However, in an imperfectly competitive market, the storage facility operates to maximize its profit, while the market operator aims at maximizing the social welfare. In this case, the storage facility adapts its strategic behavior to take advantage of market conditions. To model the imperfectly competitive market, a bi-level optimization model is implemented to present the interactions between the storage facility and the market operator. In an illustrative test system, operation of the storage facility in these two market structures is compared and discussed.

Block-sparse beamforming for spatially extended sources in a Bayesian formulation
Direction-of-arrival (DOA) estimation refers to the localization of sound sources on an angular grid from noisy measurements of the associated wavefield with an array of sensors. For accurate localization, the number of angular look-directions is much larger than the number of sensors, hence, the problem is underdetermined and requires regularization. Traditional methods use an L2-norm regularizer, which promotes minimum-power (smooth) solutions, while regularizing with L1-norm promotes sparsity. Sparse signal reconstruction improves the resolution in DOA estimation in the presence of a few point sources, but cannot capture spatially extended sources. The DOA estimation problem is formulated in a Bayesian framework where regularization is imposed through prior information on the source spatial distribution which is then reconstructed as the maximum a posteriori estimate. A composite prior is introduced, which simultaneously promotes a piecewise constant profile and sparsity in the solution. Simulations and experimental measurements show that this choice of regularization provides high-resolution DOA estimation in a general framework, i.e., in the presence of spatially extended sources.
Blood flow velocity in the Popliteal Vein using Transverse Oscillation Ultrasound.

Chronic venous disease is a common condition leading to varicose veins, leg edema, post-thrombotic syndrome and venous ulcerations. Ultrasound (US) is the main modality for examination of venous disease. Color Doppler and occasionally spectral Doppler US (SDUS) are used for evaluation of the venous flow. Peak velocities measured by SDUS are rarely used in a clinical setting for evaluating chronic venous disease due to inadequate reproducibility mainly caused by the angle dependency of the estimate. However, estimations of blood velocities are of importance in characterizing venous disease. Transverse Oscillation US (TOUS), a non-invasive angle independent method, has been implemented on a commercial scanner. TOUS’s advantage compared to SDUS is a more elaborate visualization of complex flow. The aim of this study was to evaluate, whether TOUS perform equal to SDUS for recording velocities in the veins of the lower limbs. Four volunteers were recruited for the study. A standardized flow was provoked with a cuff compression-decompression system placed around the lower leg. The average peak velocity in the popliteal vein of the four volunteers was 151.5 cm/s for SDUS and 105.9 cm/s for TOUS (p <0.001). The average of the peak velocity standard deviations (SD) were 17.0 cm/s for SDUS and 13.1 cm/s for TOUS (p <0.005). The study indicates that TOUS estimates lower peak velocity with improved SD when compared to SDUS. TOUS may be a tool for evaluation of venous disease providing quantitative measures for the evaluation of venous blood flow.
Body-Worn Spiral Monopole Antenna for Body-Centric Communications (invited)

A novel body-worn spiral monopole antenna is presented. The antenna consists of a ground plane and a spiral monopole. The antenna is designed for Ear-to-Ear (E2E) communication between In-the-Ear (ITE) Hearing Instruments (HIs) at 2.45 GHz and has been simulated, prototyped and measured. The antenna yields a measured and simulated Ear-to-Ear path gain at 2.45 GHz of -82.1 dB and -85.9 dB, respectively. The radiation pattern of the antenna when mounted in the ear is presented and discussed.

Can place-specific cochlear dispersion be represented by auditory steady-state responses?

The present study investigated to what extent properties of local cochlear dispersion can be objectively assessed through auditory steady-state responses (ASSR). The hypothesis was that stimuli compensating for the phase response at a particular cochlear location generate a maximally modulated basilar membrane (BM) response at that BM position, due to the large "within-channel" synchrony of activity. This would lead, in turn, to a larger ASSR amplitude than other stimuli of corresponding intensity and bandwidth. Two stimulus types were chosen: 1] Harmonic tone complexes consisting of equal-amplitude tones with a starting phase following an algorithm developed by Schroeder [IEEE Trans. Inf. Theory 16, 85-89 (1970)] that have earlier been considered in behavioral studies to estimate human auditory filter phase responses; and 2] simulations of auditory-filter impulse responses (IR). In both cases, also the temporally reversed versions of the stimuli were considered. The ASSRs obtained with the Schroeder tone complexes were found to be dominated by "across-channel" synchrony and, thus, do not reflect local place-specific information. In the case of the more frequency-specific stimuli, no significant differences were found between the responses to the IR and its temporally reversed counterpart. Thus, whereas ASSRs to narrowband stimuli have been used as an objective indicator of frequency-specific hearing sensitivity, the method does not seem to be sensitive enough to reflect local cochlear dispersion.
Capacitive Substrate Coupling of Row–Column-Addressed 2-D CMUT Arrays

Row–column-addressed CMUT arrays suffer from low receive sensitivity of the bottom elements due to a capacitive coupling to the substrate. The capacitive coupling increases the parasitic capacitance. A simple approach to reduce the parasitic capacitance is presented, which is based on depleting the semiconductor substrate. To reduce the parasitic
capacitance by 80% the bulk doping concentration should be at most $10^{12}$ cm$^{-3}$. Experimental results show that the parasitic capacitance can be reduced by 87% by applying a substrate potential of 6 V relative to the bottom electrodes. The depletion of the semiconductor substrate can be sustained for at least 10 minutes making it applicable for row–column-addressed CMUT arrays for ultrasonic imaging. Theoretically the reduced parasitic capacitance indicates that the receive sensitivity of the bottom elements can be increased by a factor of 2:1.

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, MEMS-AppliedSensors, Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging
Authors: Engholm, M. (Intern), Bouzari, H. (Intern), Jensen, J. A. (Intern), Thomsen, E. V. (Intern)
Number of pages: 4
Publication date: 2016

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Substrates, Electrodes, Parasitic capacitance, Couplings, Doping, Capacitance measurement
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Capacitor-Free, Low Drop-Out Linear Regulator in a 180 nm CMOS for Hearing Aids
This paper presents a capacitor-free low dropout (LDO) linear regulator based on a new dual loop topology. The regulator utilizes the feedback loops to satisfy the challenges for hearing aid devices, which include fast transient performance and small voltage spikes under rapid load-current changes. The proposed design works without the need of an off-chip discrete capacitor connected at the output and operates with 0-100 pF capacitive load. The design has been implemented in a 0.18 μm CMOS process. The proposed regulator has a low component count and is suitable for system-on-chip integration. It regulates the output voltage at 0.9 V from 1.0 V - 1.4 V supply. A current step load from 250-500 µA with an edge time (rise and fall time) of 1 ns results at ΔVout of 64 mV with a settling time of 3 µs when CL = 0. The power supply rejection ratio (PSRR) at 1 kHz is 63 dB.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Technical University of Denmark
Authors: Yosef-Hay, Y. (Ekstern), Llimos Muntal, P. (Intern), Larsen, D. Ø. (Intern), Jørgensen, I. H. H. (Intern)
Number of pages: 5
Publication date: 2016

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Publisher: IEEE
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Main Research Area: Technical/natural sciences
Conference: 2016 IEEE NorCAS Conference, Copenhagen, Denmark, 01/11/2016 - 01/11/2016
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Source: PublicationPreSubmission
Source-ID: 127062406
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Challenges in Polybinary Modulation for Bandwidth Limited Optical Links
Optical links using traditional modulation formats are reaching a plateau in terms of capacity, mainly due to bandwidth limitations in the devices employed at the transmitter and receivers. Advanced modulation formats, which boost the spectral efficiency, provide a smooth migration path towards effectively increase the available capacity. Advanced
modulation formats however require digitalization of the signals and digital signal processing blocks to both generate and recover the data. There is therefore a trade-off in terms of efficiency gain vs complexity. Polybinary modulation, a generalized form of partial response modulation, employs simple codification and filtering at the transmitter to drastically increase the spectral efficiency. At the receiver side, polybinary modulation requires low complexity direct detection and very little digital signal processing. This paper provides an overview of the current research status of the key building blocks in polybinary systems. The results clearly show how polybinary modulation effectively reduces the bandwidth requirements on optical links while providing high spectral efficiency.

**General information**

State: Published
Organisations: Department of Photonics Engineering, Metro-Access and Short Range Systems, Department of Electrical Engineering, Electromagnetic Systems, Center for Magnetic Resonance
Authors: Vegas Olmos, J. J. (Intern), Tafur Monroy, I. (Intern), Madsen, P. (Intern), Suhr, L. F. (Intern), Cimoli, B. (Intern), Johansen, T. K. (Intern), Zhurbenko, V. (Intern)
Number of pages: 5
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Main Research Area: Technical/natural sciences

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Publication: Research - peer-review › Journal article – Annual report year: 2016

**Challenges of implementing economic model predictive control strategy for buildings interacting with smart energy systems**

When there is a high penetration of renewables in the energy system, it requires proactive control of large numbers of distributed demand response resources to maintain the system’s reliability and improve its operational economics. This paper presents the Economic Model Predictive Control (EMPC) strategy for energy management in smart buildings, which can act as active users interacting with smart energy systems. The challenges encountered during the implementation of EMPC for active demand side management are investigated in detail in this paper. A pilot testing study shows energy savings and load shifting can be achieved by applying EMPC with weather forecast and dynamic power price signals.

**General information**

State: Published
Authors: Zong, Y. (Intern), Böning, G. M. (Ekstern), Santos, R. M. (Ekstern), You, S. (Intern), Hu, J. (Intern), Han, X. (Intern)
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Main Research Area: Technical/natural sciences

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Original language: English

Active smart building, Data availability, Economic model predictive control, Modelling, Optimization, State estimation

**DOIs:**
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**Relations**

Projects:
Challenges of implementing economic model predictive control strategy for buildings interacting with smart energy systems

**Source:** FindIt

**Source-ID:** 2349208774

**Publication:** Research - peer-review › Journal article – Annual report year: 2016
**Class-D amplifier design and performance for driving a Piezo Actuator Drive servomotor.**
This paper investigates the behavior of piezoelectric stacks in a Piezoelectric Actuator Drive (PAD) motor, which shows non-linear equivalent impedance and has a dramatic impact on the overall system performance. Therefore, in this paper, the piezo stack's model is discussed and an improved large signal model is proposed and verified by measurement. Finally, a Class-D amplifier as a power driver and its associated closed-loop control are implemented and tested to control PAD drive effectively.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electronics, Automation and Control
Authors: Zsurzsan, T. (Intern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern), Andersen, N. A. (Intern)
Pages: 1068-1072
Publication date: 2016

**Host publication information**
Title of host publication: Proceedings of 2016 IEEE International Conference on Industrial Technology
Publisher: IEEE
ISBN (Print): 978-1-4673-8074-4
Main Research Area: Technical/natural sciences
Conference: 2016 IEEE International Conference on Industrial Technology, Taipei, Taiwan, Province of China, 14/03/2016 - 14/03/2016
Piezoelectricity, Motor, Control
Electronic versions:
Zsurzsan_Zhang_ICIT2016.pdf
DOIs:
10.1109/ICIT.2016.7474902

**Relations**
Activities:
2016 IEEE International Conference on Industrial Technology
Source: PublicationPreSubmission
Source-ID: 122901267
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

**Classification and aggregation of energy components**

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Richert, T. P. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at CITIES consortium 2016, Lyngby, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Poster_CITIES_consortium_24_05_16.pdf

**Relations**
Activities:
CITIES consortium 2016
Publication: Research - peer-review › Poster – Annual report year: 2017

**Clustering of Cochlear Oscillations in Frequency Plateaus as a Tool to Investigate SOAE Generation**
Spontaneous otoacoustic emissions (SOAE) reflect the net effect of self-sustained activity in the cochlea, but do not directly provide information about the underlying mechanism and place of origin within the cochlea. The present study investigates if frequency plateaus as found in a linear array of coupled oscillators (OAM) [7] are also found in a transmission line model (TLM) which is able to generate realistic SOAEs [2] and if these frequency plateaus can be used to explain the formation of SOAEs. The simulations showed a clustering of oscillators along the simulated basilar membrane. Both, the OAM and the TLM show traveling-wave-like behavior along the oscillators coupled into one frequency plateau. While in the TLM roughness is required in order to produce SOAEs, no roughness is required to trigger frequency plateaus in the linear array of oscillators. The formation of frequency plateaus as a consequence of coupling between neighbored active oscillators might be the mechanism underlying SOAEs.
CMOS Integrated Circuit Simulation: Solutions

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Bruun, E. (Intern)
Number of pages: 111
Publication date: 2016

Publication information
Publisher: bookboon
ISBN (Print): 978-87-403-1339-0
Original language: English
Main Research Area: Technical/natural sciences
Links:

Bibliographical note
Source: PublicationPreSubmission
Source-ID: 124123804
Publication: Research - peer-review › Book – Annual report year: 2016

Combined Geometric and Neural Network Approach to Generic Fault Diagnosis in Satellite Actuators and Sensors
This paper presents a novel scheme for diagnosis of faults affecting the sensors measuring the satellite attitude, body angular velocity and flywheel spin rates as well as defects related to the control torques provided by satellite reaction wheels. A nonlinear geometric design is used to avoid that aerodynamic disturbance torques have unwanted influence on the residuals exploited for fault detection and isolation. Radial basis function neural networks are used to obtain fault estimation filters that do not need a priori information about the fault internal models. Simulation results are based on a detailed nonlinear satellite model with embedded disturbance description. The results document the efficacy of the proposed diagnosis scheme.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, University of Ferrara, University of Bologna
Authors: Baldi, P. (Ekstern), Blanke, M. (Intern), Castaldi, P. (Ekstern), Mimmo, N. (Ekstern), Simani, S. (Ekstern)
Pages: 432–437
Publication date: 2016
Conference: 20th IFAC Symposium on Automatic Control in Aerospace, Sherbrooke, Quebec, Canada, 21/08/2016 - 21/08/2016
Main Research Area: Technical/natural sciences

Publication information
Journal: IFAC-PapersOnLine
Volume: 49
Issue number: 17
ISSN (Print): 2405-8963
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Scopus rating (2016): CiteScore 0.45 SJR 0.234 SNIP 0.328
Scopus rating (2015): SJR 0.298 SNIP 0.39
Scopus rating (2014): SJR 0.298 SNIP 0.383
Scopus rating (2013): SJR 0.326 SNIP 0.41
Scopus rating (2012): SJR 0.265 SNIP 0.331
Scopus rating (2011): SJR 0.257 SNIP 0.324
Scopus rating (2010): SJR 0.197 SNIP 0.276
Scopus rating (2009): SJR 0.211 SNIP 0.29
Scopus rating (2008): SJR 0.172 SNIP 0.239
Scopus rating (2007): SJR 0.195 SNIP 0.271
Scopus rating (2006): SJR 0.21 SNIP 0.284
Combining non-invasive transcranial brain stimulation with neuroimaging and electrophysiology: Current approaches and future perspectives: Current approaches and future perspectives

Non-invasive transcranial brain stimulation (NTBS) techniques such as transcranial magnetic stimulation (TMS) and transcranial current stimulation (TCS) are important tools in human systems and cognitive neuroscience because they are able to reveal the relevance of certain brain structures or neuronal activity patterns for a given brain function. It is nowadays feasible to combine NTBS, either consecutively or concurrently, with a variety of neuroimaging and electrophysiological techniques. Here we discuss what kind of information can be gained from combined approaches, which often are technically demanding. We argue that the benefit from this combination is twofold. Firstly, neuroimaging and electrophysiology can inform subsequent NTBS, providing the required information to optimize where, when, and how to stimulate the brain. Information can be achieved both before and during the NTBS experiment, requiring consecutive and concurrent applications, respectively. Secondly, neuroimaging and electrophysiology can provide the readout for neural changes induced by NTBS. Again, using either concurrent or consecutive applications, both "online" NTBS effects immediately following the stimulation and "offline" NTBS effects outlasting plasticity-inducing NTBS protocols can be assessed. Finally, both strategies can be combined to close the loop between measuring and modulating brain activity by means of closed-loop brain state-dependent NTBS. In this paper, we will provide a conceptual framework, emphasizing principal strategies and highlighting promising future directions to exploit the benefits of combining NTBS with neuroimaging or electrophysiology.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, University of Tübingen, University of Copenhagen, Christian Albrechts University
Authors: Bergmann, T. O. (Ekstern), Karabanov, A. (Ekstern), Hartwigsen, G. (Ekstern), Thielscher, A. (Intern), Siebner, H. R. (Ekstern)
Pages: 4-19
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Neuroimage
Volume: 140
ISSN (Print): 1053-8119
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 6.15 SJR 3.679 SNIP 1.806
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 6.31 SJR 3.967 SNIP 1.759
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 4.583 SNIP 1.852 CiteScore 6.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.323 SNIP 2.03 CiteScore 6.9
A novel compact P-band dual-linearly polarized first-order probe for spherical near-field (SNF) antenna measurements is presented. The probe covers the bandwidth 421-444 MHz with more than 9 dBi directivity and parasitic |μ| ≠ 1 spherical modes suppressed below -35 dB. The height of the probe is just 365 mm over a 720-mm circular ground plane and it weighs less than 5 kg.
Comparative Analysis of Possible Designs for Flexible Distribution System Operation

A massive amount of distributed energy resources will be connected to the distribution system in the near future. This emerging phenomenon will pose significant challenges to the traditional operation of distribution systems. This clearly calls for a growing need to develop novel grid designs for achieving the most efficient utilization of these resources while meeting the forecasted load. In this paper, we present possible system design frameworks proposed for flexible distribution system operation. Critical evaluations and comparison of these models are made based on a number of key attributes which are foundational to the success of these proposed designs.

Comparative Evaluation of the Loss and Thermal Performance of Advanced Three Level Inverter Topologies

This paper presents a comparative evaluation of the loss and thermal performance of two advanced three-level inverter topologies, namely the SiC based T-Type and the Hybrid-NPC, both of which are aimed at reducing the high switching losses associated with a conventional Si based T-Type inverter. The first solution directly replaces the 1200 V primary Si IGBT switches with lower loss 1200 V SiC MOSFETs. The second solution strategically adds 600 V CoolMos FET devices to the conventional Si T-Type inverter to reduce the primary commutation losses. Semiconductor loss models, experimentally verified on calibrated heat sinks, are used to show that both variations can significantly reduce the semiconductor losses compared to the Si based T-Type inverter. The results show that both alternatives are attractive if high efficiencies and reduced thermal stress are major requirements for the converter design.
Comparative Evaluation of the Loss and Thermal Performance of Advanced Three Level Inverter Topologies

This paper presents a comparative evaluation of the loss and thermal performance of two advanced three-level inverter topologies, namely the partial SiC T-Type and the Hybrid-NPC, both of which are aimed at reducing the high switching losses associated with a conventional Si T-Type inverter. The first solution directly replaces the 1200V primary Si IGBT switches with lower loss 1200V SiC MOSFETs. The second solution strategically adds 600V CoolMos FET devices to the conventional Si T-Type inverter to reduce the primary commutation losses. Semiconductor loss models, experimentally verified on calibrated heat sinks, are used to show that both variations can significantly reduce the semiconductor losses compared to the Si T-Type inverter. The results show that both alternatives are attractive if high efficiencies and reduced thermal stress are major requirements for the converter design.
Comparing eye tracking with electrooculography for measuring individual sentence comprehension duration

The aim of this study was to validate a procedure for performing the audio-visual paradigm introduced by Wendt et al. (2015) with reduced practical challenges. The original paradigm records eye fixations using an eye tracker and calculates the duration of sentence comprehension based on a bootstrap procedure. In order to reduce practical challenges, we first reduced the measurement time by evaluating a smaller measurement set with fewer trials. The results of 16 listeners showed effects comparable to those obtained when testing the original full measurement set on a different collective of listeners. Secondly, we introduced electrooculography as an alternative technique for recording eye movements. The correlation between the results of the two recording techniques (eye tracker and electrooculography) was $r = 0.97$, indicating that both methods are suitable for estimating the processing duration of individual participants. Similar changes in processing duration arising from sentence complexity were found using the eye tracker and the electrooculography procedure. Thirdly, the time course of eye fixations was estimated with an alternative procedure, growth curve analysis, which is more commonly used in recent studies analyzing eye tracking data. The results of the growth curve analysis were compared with the results of the bootstrap procedure. Both analysis methods show similar processing durations.

General information

Published on: 2016

Organisations: Department of Electrical Engineering, Hearing Systems, University of Oldenburg

Authors: Müller, J. A. (Ekstern), Wendt, D. (Intern), Kollmeier, B. (Ekstern), Brand, T. (Ekstern)
Comparing the influence of spectro-temporal integration in computational speech segregation

The goal of computational speech segregation systems is to automatically segregate a target speaker from interfering maskers. Typically, these systems include a feature extraction stage in the front-end and a classification stage in the back-end. A spectrotemporal integration strategy can be applied in either the front-end, using the so-called delta features, or in the back-end, using a second classifier that exploits the posterior probability of speech from the first classifier across a spectro-temporal window. This study systematically analyzes the influence of such stages on segregation performance, the error distributions and intelligibility predictions. Results indicated that it could be problematic to exploit context in the back-end, even though such a spectro-temporal integration stage improves the segregation performance. Also, the results emphasized the potential need of a single metric that comprehensively predicts computational segregation performance and correlates well with intelligibility. The outcome of this study could help to identify the most effective spectro-temporal integration strategy for computational segregation systems.

Comparison of bipolar sub-modules for the alternate arm converter

Research on dc-fault tolerant multilevel converters has gained noticeable attention over recent years. The alternate arm converter (AAC) is one of such emerging multilevel converter topologies, and a hybrid topology of the two-level converter and the modular multilevel converter (MMC). Bipolar sub-modules (SMs) that can produce both positive and negative voltages are the building blocks of the AAC. This paper analyses the operation of an AAC with the full-bridge SM (FB-SM) and the cross-connected SM (CC-SM). The conduction and switching losses of the two SM configurations are evaluated and compared, in order to identify the suitability of CC-SM for AACs and its performance compared to the FB-SM. The CC-SM with identical semiconductor devices has reduced losses compared to the CC-SM with higher rated devices in the cross-connected path. It is concluded that the CC-SM does not offer advantages in the losses, construction, and application to the AAC, compared to FB-SM.
Comparison of four computational methods for computing Q factors and resonance wavelengths in photonic crystal membrane cavities

We benchmark four state-of-the-art computational methods by computing quality factors and resonance wavelengths in photonic crystal membrane L5 and L9 line defect cavities. The convergence of the methods with respect to resolution, degrees of freedom and number of modes is investigated. Special attention is paid to the influence of the size of the computational domain. Convergence is not obtained for some of the methods, indicating that some are more suitable than others for analyzing line defect cavities.

General information
State: Published
Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, Centre of Excellence for Silicon Photonics for Optical Communications, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Zuse Institute Berlin
Authors: de Lasson, J. R. (Intern), Frandsen, L. H. (Intern), Burger, S. (Ekstern), Gutsche, P. (Ekstern), Kim, O. S. (Intern), Breinbjerg, O. (Intern), Sigmund, O. (Intern), Mørk, J. (Intern), Gregersen, N. (Intern)
Number of pages: 2
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 7th International Conference on Metamaterials, Photonic Crystals and Plasmonics
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 125482251
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Comparison of Simple Self-Oscillating PWM Modulators

Switch-mode power amplifiers has become the conventional choice for audio applications due to their superior efficiency and excellent audio performance. These amplifiers rely on high frequency modulation of the audio input. Conventional modulators use a fixed high frequency for modulation. Self-oscillating modulators do not have a fixed modulation frequency and can provide good audio performance with very simple circuitry. This paper proposes a new type of self-oscillating modulator. The proposed modulator is compared to an already existing modulator of similar type and their performances are compared both theoretically and experimentally. The result shows that the proposed modulator provides a higher degree of linearity resulting in around 2% lower Total Harmonic Distortion (THD).

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Dahl, N. J. (Ekstern), Iversen, N. E. (Intern), Knott, A. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 9
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 140th Audio Engineering Convention Convention.
Publisher: Audio Engineering Society
Article number: 9562
Main Research Area: Technical/natural sciences
Conference: 140th International Audio Engineering Society Convention, Paris, France, 04/06/2016 - 04/06/2016
Electronic versions: Comparison_of_Simple_Self_Oscillating_PWM_Modulators_post_print.pdf
Source: PublicationPreSubmission
Complex-Tone Pitch Discrimination in Listeners With Sensorineural Hearing Loss

Physiological studies have shown that noise-induced sensorineural hearing loss (SNHL) enhances the amplitude of envelope coding in auditory-nerve fibers. As pitch coding of unresolved complex tones is assumed to rely on temporal envelope coding mechanisms, this study investigated pitch-discrimination performance in listeners with SNHL. Pitch-discrimination thresholds were obtained for 14 normal-hearing (NH) and 10 hearing-impaired (HI) listeners for sine-phase (SP) and random-phase (RP) complex tones. When all harmonics were unresolved, the HI listeners performed, on average, worse than NH listeners in the RP condition but similarly to NH listeners in the SP condition. The increase in pitch-discrimination performance for the SP relative to the RP condition (F0DL ratio) was significantly larger in the HI as compared with the NH listeners. Cochlear compression and auditory-filter bandwidths were estimated in the same listeners. The estimated reduction of cochlear compression was significantly correlated with the increase in the F0DL ratio, while no correlation was found with filter bandwidth. The effects of degraded frequency selectivity and loss of compression were considered in a simplified peripheral model as potential factors in envelope enhancement. The model revealed that reducing cochlear compression significantly enhanced the envelope of an unresolved SP complex tone, while not affecting the envelope of a RP complex tone. This envelope enhancement in the SP condition was significantly correlated with the increased pitch-discrimination performance for the SP relative to the RP condition in the HI listeners.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Bianchi, F. (Intern), Fereczkowski, M. (Intern), Zaar, J. (Intern), Santurette, S. (Intern), Dau, T. (Intern)
Number of pages: 185
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Trends in Hearing (Online)
Volume: 20
Issue number: 0
ISSN (Print): 2331-2165
Ratings:
Web of Science (2018): Indexed yes
Scopus rating (2017): CiteScore 1.95
Web of Science (2017): Indexed Yes
Scopus rating (2016): CiteScore 3.61
Web of Science (2016): Indexed yes
Scopus rating (2015): CiteScore 2.21
Web of Science (2015): Indexed yes
Scopus rating (2014): CiteScore 0
Web of Science (2014): Indexed yes
Original language: English
cochlear compression, envelope enhancement, frequency selectivity, sensorineural hearing loss, unresolved harmonics
Electronic versions:
Bianchi_et_al_2016_Trends.pdf
DOIs:
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Source-ID: 124910259
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Complex-tone pitch representations in the human auditory system.
Understanding how the human auditory system processes the physical properties of an acoustical stimulus to give rise to a pitch percept is a fascinating aspect of hearing research. Since most natural sounds are harmonic complex tones, this work focused on the nature of pitch-relevant cues that are necessary for the auditory system to retrieve the pitch of
complex sounds. The existence of different pitch-coding mechanisms for low-numbered (spectrally resolved) and high-numbered (unresolved) harmonics was investigated by comparing pitch-discrimination performance across different cohorts of listeners, specifically those showing enhanced pitch cues (i.e., musicians) and those typically having disrupted pitch cues (i.e., hearing-impaired listeners). In particular, two main topics were addressed: the relative importance of resolved and unresolved harmonics for normal-hearing (NH) and hearing-impaired (HI) listeners and the effect of musical training for pitch discrimination of complex tones with resolved and unresolved harmonics. Concerning the first topic, behavioral and modeling results in listeners with sensorineural hearing loss (SNHL) indicated that temporal envelope cues of complex tones with unresolved harmonics may be enhanced relative to NH listeners at the output of peripheral auditory filters. This enhancement of temporal envelope coding was found to be ascribed to a reduction of cochlear compression. Since frequency selectivity and temporal fine structure (TFS) cues are known to be degraded in listeners with SNHL, it is likely that HI listeners rely on the enhanced envelope cues to retrieve the pitch of unresolved harmonics. Hence, the relative importance of pitch cues may be altered in HI listeners, whereby envelope cues may be used instead of TFS cues to obtain a similar performance in pitch discrimination to that of NH listeners. In the second part of this work, behavioral and objective measures of pitch discrimination were carried out in musicians and non-musicians. Musicians showed an increased pitch-discrimination performance relative to non-musicians for both resolved and unresolved harmonics, although their benefit was larger for the resolved harmonics. Additionally, task-evoked pupil responses were recorded as an indicator of processing effort while listeners performed a pitch-discrimination task. Although the difficulty of the task was adjusted for each participant to compensate for the individual pitch-discrimination abilities, the musically trained listeners still allocated lower processing effort than did the non-musicians to perform the task at the same performance level. This finding suggests an enhanced pitch representation along the auditory system in musicians, possibly as a result of training, which seemed to be specific to the stimuli containing resolved harmonics.

Finally, a functional magnetic resonance imaging paradigm was used to examine the response of the auditory cortex to resolved and unresolved harmonics in musicians and non-musicians. The neural responses in musicians were enhanced relative to the non-musicians for both resolved and unresolved harmonics in the right auditory cortex, right frontal regions and inferior colliculus. However, the increase in neural activation in the right auditory cortex of musicians was predictive of the increased pitch-discrimination performance only for resolved harmonics. These results suggest a training-dependent effect in musicians that is partially specific to the resolved harmonics.
Compressive sensing with a spherical microphone array

A wave expansion method is proposed in this work, based on measurements with a spherical microphone array, and formulated in the framework provided by Compressive Sensing. The method promotes sparse solutions via ‘1-norm minimization, so that the measured data are represented by few basis functions. This results in fine spatial resolution and accuracy. This publication covers the theoretical background of the method, including experimental results that illustrate some of the fundamental differences with the "conventional" least-squares approach. The proposed methodology is relevant for source localization, sound field reconstruction, and sound field analysis.
The radiation $Q$ of dielectric-loaded electrically small antennas in integral equation formulations

A new technique for estimating the impedance frequency bandwidth of electrically small antennas loaded with magneto-dielectric material from a single-frequency simulation in a surface integral equation solver is presented. The estimate is based on the inverse of the radiation $Q$ computed using newly derived expressions for the stored energy and the radiated power of arbitrary coupled electric and magnetic currents in free space.

General information
State: Published
Organisations: DARWIN, Department of Electrical Engineering, Electromagnetic Systems
Authors: Kim, O. S. (Intern)
Pages: 1 - 2
Publication date: 2016

Host publication information
Title of host publication: Proceedings of 2016 IEEE/ACES International Conference on Wireless Information Technology and Systems
Publisher: IEEE
Main Research Area: Technical/natural sciences
Electrically small antennas, Q-factor, Reactive energy, Physical bounds, Integral equations, PMCHWT, EFIE, MFIE, Method of moments
DOIs:
10.1109/ROPACES.2016.7465460
Congestion management of distribution networks with day-ahead dynamic grid tariffs
In order to reduce CO2 emissions and alleviate the global warming issue, many countries are setting goals to increase the percentage of renewable energy in the total energy consumption. In this process, a large number of distributed energy resources (DER), distributed generation (DG), electric vehicles (EV) and heat pumps (HP), will be largely deployed in electrical distribution networks. Congestion management will be important in the future active distribution networks. In the IDE4L project, work package 5 is dedicated to develop different kinds of congestion management methods. Demand response (DR) is one of the important methods. In this report, as one task of work package 5, the day-ahead dynamic tariff (DADT) method for congestion management in distribution networks is presented. The dynamic tariff (DT) can motivate the flexible demands (EV and HP) to shift their energy consumption in a way that favours the secure operation of distribution networks. Therefore, the DADT method belongs to the DR programs.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Huang, S. (Intern), Wu, Q. (Intern)
Number of pages: 54
Publication date: 2016

Bibliographical note
D5.4 of the EU FP7 IDE4L project
Source: PublicationPreSubmission
Source-ID: 127180431
Publication: Research › Report – Annual report year: 2016

Contextual anomaly detection for cyber-physical security in Smart Grids based on an artificial neural network model
This paper presents a contextual anomaly detection method and its use in the discovery of malicious voltage control actions in the low voltage distribution grid. The model-based anomaly detection uses an artificial neural network model to identify a distributed energy resource’s behaviour under control. An intrusion detection system observes distributed energy resource’s behaviour, control actions and the power system impact, and is tested together with an ongoing voltage control attack in a co-simulation set-up. The simulation results obtained with a real photovoltaic rooftop power plant data show that the contextual anomaly detection performs on average 55% better in the control detection and over 56% better in the malicious control detection over the point anomaly detection.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Kosek, A. M. (Intern)
Number of pages: 6
Publication date: 2016

Host publication information
Title of host publication: 2016 Joint Workshop on Cyber-Physical Security and Resilience in Smart Grids
Publisher: IEEE
ISBN (Print): 978-1-5090-1164-3
Main Research Area: Technical/natural sciences
Workshop: 2016 Joint Workshop on Cyber-Physical Security and Resilience in Smart Grids, Vienna, Austria, 12/04/2016 - 12/04/2016
Anomaly detection, Intrusion Detection Systems, Smart grid, Data analysis, Cyber-physical security
DOIs:
10.1109/CPSRSG.2016.7684103

Relations
Activities:
Contribution of K+ channels to endothelium-derived hyperpolarization-induced renal vasodilation in rats in vivo and in vitro.

We investigated the mechanisms behind the endothelial-derived hyperpolarization (EDH)-induced renal vasodilation in vivo and in vitro in rats. We assessed the role of Ca2+-activated K+ channels and whether K+ released from the endothelial cells activates inward rectifier K+ (Kir) channels and/or the Na+/K+-ATPase. Also, involvement of renal myoendothelial gap junctions was evaluated in vitro. Isometric tension in rat renal interlobar arteries was measured using a wire myograph. Renal blood flow was measured in isoflurane anesthetized rats. The EDH response was defined as the ACh-induced vasodilation assessed after inhibition of nitric oxide synthase and cyclooxygenase using L-NAME and indomethacin, respectively. After inhibition of small conductance Ca2+-activated K+ channels (SKCa) and intermediate conductance Ca2+-activated K+ channels (IKCa) (by apamin and TRAM-34, respectively), the EDH response in vitro was strongly attenuated whereas the EDH response in vivo was not significantly reduced. Inhibition of Kir channels and Na+/K+-ATPases (by ouabain and Ba2+, respectively) significantly attenuated renal vasorelaxation in vitro but did not affect the response in vivo. Inhibition of gap junctions in vitro using carbenoxolone or 18α-glycyrrhetinic acid significantly reduced the endothelial-derived hyperpolarization-induced vasorelaxation. We conclude that SKCa and IKCa channels are important for EDH-induced renal vasorelaxation in vitro. Activation of Kir channels and Na+/K+-ATPases plays a significant role in the renal vascular EDH response in vitro but not in vivo. The renal EDH response in vivo is complex and may consist of several overlapping mechanisms some of which remain obscure.

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, University of Copenhagen
Authors: Rasmussen, K. M. B. (Ekstern), Braunstein, T. H. (Ekstern), Salomonsson, M. (Ekstern), Brasen, J. C. (Intern), Serensen, C. M. (Ekstern)
Number of pages: 11
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Pflügers Archiv - European Journal of Physiology
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 0.896 SJR 1.479 CiteScore 2.87
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 1.589 SNIP 0.935 CiteScore 2.96
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.878 SNIP 0.943 CiteScore 2.8
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.771 SNIP 1.125 CiteScore 3.57
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.103 SNIP 1.388 CiteScore 4.3
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.176 SNIP 1.331 CiteScore 4.69
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.025 SNIP 1.299 CiteScore 3.88
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.032 SNIP 1.085
Control of a hybrid HVDC link to increase inter-regional power transfer

This paper examines the application of a hybrid HVDC link in a two area power system with the purpose of increasing the inter-regional power transfer. A hybrid HVDC system combines both LCCs and VSCs, and hence it is capable of combining the benefits of both converter technologies, such as reduced cost and power losses due to the LCCs, and ability to connect to weak AC grids due to the VSCs. The mathematical model of the power system including the HVDC link is presented. The increase in inter-area power transfer is demonstrated and compared to the case when the hybrid HVDC link is not used. Furthermore, the transient stability of the AC/DC power system was enhanced using auxiliary controllers for Power Oscillation Damping (POD). The results show the ability of the hybrid HVDC link to increase the unidirectional inter-area power transfer, while enhancing the transient stability of the power system.

General information

State: Published
Organisations: Department of Electrical Engineering, KTH - Royal Institute of Technology, University of Ontario Institute of Technology
Authors: Kotb, O. (Ekstern), Ghandhari, M. (Ekstern), Eriksson, R. (Intern), Sood, V. K. (Ekstern)
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Source-ID: 2306031187

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Control-Oriented Model of Molar Scavenge Oxygen Fraction for Exhaust Recirculation in Large Diesel Engines

Exhaust gas recirculation (EGR) systems have been introduced to large marine engines in order to reduce NOx formation. Adequate modelling for control design is one of the bottlenecks to design EGR control that also meets emission requirements during transient loading conditions. This paper therefore focus on deriving and validating a mean-value model of a large two-stroke crosshead diesel engines with EGR. The model introduces a number of amendments and extensions to previous, complex models and shows in theory and practice that a simplified nonlinear model captures all essential dynamics that is needed for EGR control. Our approach is to isolate and reduce the gas composition part of the more complex models using nonlinear model reduction techniques. The result is a control-oriented model (COM) of the oxygen fraction in the scavenge manifold with three molar flows being inputs to the COM, and it is shown how these flows are estimated from signals that are commonly available. The COM is validated by first comparing the output to a simulation of the full model, then by comparing with measurement series from two engines. The control oriented nonlinear model is shown to be able to replicate the behavior of the scavenge oxygen fraction well over the entire envelope of load and blower speed range that are relevant for EGR. The simplicity of the new model makes it suitable for observer and control design, which are essential steps to meet the emission requirements for marine diesel engines that take effect from 2016.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Linköping University, MAN B&W Diesel A/S
Authors: Nielsen, K. V. (Intern), Blanke, M. (Intern), Eriksson, L. (Ekstern), Vejlgaard-Laursen, M. (Ekstern)
Number of pages: 10
Publication date: 2016
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.028 SJR 0.618 CiteScore 1.74
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.29 SJR 0.526 SNIP 0.88
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.664 SNIP 1.059 CiteScore 1.36
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.663 SNIP 1.291 CiteScore 1.38
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.741 SNIP 1.344 CiteScore 1.4
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.579 SNIP 1.182 CiteScore 1.09
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.584 SNIP 1.053 CiteScore 0.96
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.833 SNIP 1.721
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.763 SNIP 1.494
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.726 SNIP 1.355
Scopus rating (2007): SJR 0.537 SNIP 1.423
Scopus rating (2006): SJR 0.64 SNIP 1.52
Scopus rating (2005): SJR 0.473 SNIP 1.159
Scopus rating (2004): SJR 0.643 SNIP 1.419
Convex relaxation of Optimal Power Flow in Distribution Feeders with embedded solar power

There is an increasing interest in using Distributed Energy Resources (DER) directly coupled to end user distribution feeders. This poses an array of challenges because most of today’s distribution feeders are designed for unidirectional power flow. Therefore when installing DERs such as solar panels with uncontrolled inverters, the upper limit of installable capacity is quickly reached in many of today’s distribution feeders. This problem can often be mitigated by optimally controlling the voltage angles of inverters. However, the optimal power flow problem in its standard form is a large scale non-convex optimization problem, and thus can't be solved precisely and also is computationally heavy and intractable for large systems. This paper examines the use of a convex relaxation using Semi-definite programming to optimally control solar power inverters in a distribution grid in order to minimize the global line losses of the feeder. The mathematical model is presented in details. Further, case studies are completed with simulations involving a 15-bus radial distribution system. These simulations are run for 24 hour periods, with actual solar data and demand data.
Coordinated Control of Multi-terminal DC Grid for Wind Power Integration

Multi-terminal HVDC (MTDC) technology using voltage source converter (VSC) is a good option for wind power integration. Compared with point to point DC connection, MTDC provide better controllability based on different control strategies. In this paper, proportional-integral (PI) controllers with tuned PI parameters are designed to coordinate DC flow among the DC grid with good dynamic performance. In order to overcome the disadvantages of the conventional PI control, a simple adaptive PI control strategy is proposed based on the system transfer function. Case studies were conducted with PowerFactory.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Technical University of Denmark
Authors: Hao, Y. (Ekstern), Zhao, H. (Intern), Wu, Q. (Intern)
Pages: 702-706
Publication date: 2016

Host publication information
Title of host publication: Proceedings of 2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference
Publisher: IEEE
ISBN (Print): 9781509054183
Main Research Area: Technical/natural sciences

Coordinated voltage control of a decoupled three-phase on load tap changer transformer and photovoltaic inverters for managing unbalanced networks

The increasing penetration of fluctuating photovoltaic (PV) generation brings operational challenges for distribution system operators, such as introducing the voltage rise problem. The situation is made worse in the presence of single-phase generation being unevenly connected to the different phases. To address this problem, distribution transformers with single-phase tapping capability, together with reactive power provision of PV systems, are under investigation. This paper presents modeling and analysis of the benefits of coordinated voltage control of a decoupled three-phase on-load tap changer (OLTC) and photovoltaic inverters in a distribution system, for accommodating a greater number of photovoltaic generators in the grid. A 24 h root-mean-square simulation study is performed in the DigSilent PowerFactory with a 1 s time step using 10 min resolution consumption and production profiles on a real Danish distribution grid, as well as the developed dynamic photovoltaic generation and load models. The simulations show that the joint action of the power distribution transformer with OLTC control on each phase, and the reactive power provision of photovoltaic inverters, significantly improves the PV hosting capacity in the analyzed unbalanced scenarios without side effects, such as additional power losses, or significant neutral voltage rises.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Distributed Energy Resources, University of Padua
Authors: Hu, J. (Intern), Marinelli, M. (Intern), Coppo, M. (Ekstern), Zecchino, A. (Intern), Bindner, H. W. (Intern)
Pages: 264-274
Publication date: 2016
Main Research Area: Technical/natural sciences
Coordinated Voltage Control of a Wind Farm based on Model Predictive Control

This paper presents an autonomous wind farm voltage controller based on Model Predictive Control (MPC). The reactive power compensation and voltage regulation devices of the wind farm include Static Var Compensators (SVCs), Static Var Generators (SVGs), Wind Turbine Generators (WTGs) and On-Load Tap Changing (OLTC) Transformer, and they are coordinated to keep the voltages of all the buses within the feasible range. Moreover, the reactive power distribution is optimized throughout the wind farm in order to maximize the dynamic reactive power reserve. The sensitivity coefficients are calculated based on an analytical method to improve the computation efficiency and overcome the convergence problem. Two control modes are designed for both voltage violated and normal operation conditions. A wind farm with 20 wind turbines was used to conduct case studies to verify the proposed coordinated voltage control scheme under both normal and disturbance conditions.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems, Tsinghua University, State Grid Electric Power System Research Institute
Authors: Zhao, H. (Intern), Wu, Q. (Intern), Guo, Q. (Ekstern), Sun, H. (Ekstern), Huang, S. (Intern), Xue, Y. (Ekstern)
Pages: 1440-51
Publication date: 2016
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Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 7.42 SJR 2.318 SNIP 2.452
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 7.8 SJR 2.368 SNIP 2.967
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.717 SNIP 3.22 CiteScore 7.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.554 SNIP 3.898 CiteScore 7.03
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.043 SNIP 3.712 CiteScore 7.03
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 1.243 SNIP 3.744 CiteScore 6.58
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.73 SNIP 3.01 CiteScore 5.13
In this work, we study the existence of coupled bandgaps for corrugated plate structures and acoustic channels. The study is motivated by the observation that the performance of traditional bandgap structures, such as periodic plates, may be compromised due to the coupling to a surrounding acoustic medium and the presence of acoustic resonances. It is demonstrated that corrugation of the plate structure can introduce bending wave bandgaps and bandgaps in the acoustic domain in overlapping and audible frequency ranges. This effect is preserved also when taking the physical coupling between the two domains into account. Additionally, the coupling is shown to introduce extra gaps in the band structure due to modal interaction and the appearance of a cut-on frequency for the fundamental acoustic mode.
Critical kick-back mitigation through improved design of demand response

The energy sector is adopting a lot of intermittent renewable energy sources nowadays. In order to successfully integrate these renewable sources, demand side resources (DSR), in a demand response (DR) setup, are able to provide power system services by exploiting their flexibility in power consumption. Load kick-back effect describes a dynamic process that the total power consumption of a population of DSRs is higher than the expected value during the steady state after the activation of DR program, due to their temporary synchronous behaviors. For DR programs designed with little consideration of load kick-back, not only the potential value of DR is limited significant but also power system operation can be jeopardized even more. In addition to explaining the severity of kick-back effect through illustrative examples, this paper proposes several methods to mitigate the critical kick-back effect in DR while maintaining the expected value of DR. The proposed methods are applied to a DR program that aims at using thermostatically controlled heating of residential houses for peak shaving. Quality measures are adopted to measure the performance.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Han, X. (Intern), You, S. (Intern), Bindner, H. W. (Intern)
Pages: 1507–1514
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Applied Thermal Engineering
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Ratings:
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Web of Science (2018): Indexed yes
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Scopus rating (2017): CiteScore 4.14 SJR 1.505 SNIP 1.837
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.78 SJR 1.438 SNIP 1.851
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.683 SNIP 1.884 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.539 SNIP 2.187 CiteScore 3.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.466 SNIP 2.469 CiteScore 3.31
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.492 SNIP 2.422 CiteScore 2.7
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.338 SNIP 2.186 CiteScore 2.83
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.385 SNIP 2.012
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.393 SNIP 2.105
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.151 SNIP 1.617
Scopus rating (2007): SJR 0.884 SNIP 1.495
Scopus rating (2006): SJR 1.191 SNIP 1.585
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.14 SNIP 1.43
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.969 SNIP 1.243
Scopus rating (2003): SJR 0.862 SNIP 1.105
Scopus rating (2002): SJR 0.875 SNIP 1.001
Scopus rating (2001): SJR 0.964 SNIP 1.107
Scopus rating (2000): SJR 0.943 SNIP 1.04
Scopus rating (1999): SJR 0.903 SNIP 0.89
Original language: English
Demand response, Kick-back effect, Demand side resource, Coordinated control
DOIs: 10.1016/j.applthermaleng.2016.09.053
Source: PublicationPreSubmission
Source-ID: 126086674
Publication: Research - peer-review › Journal article – Annual report year: 2016

Cross-correlation model of interaural time difference coding in listeners with bilateral cochlear implants

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Joshi, S. N. (Intern), Dau, T. (Intern), Epp, B. (Intern)
Number of pages: 1
Publication date: 2016
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Main Research Area: Technical/natural sciences
Electronic versions:
Cross_correlation_model.pdf

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The original title of the submitted and indexed abstract was "Modelling the effect of pulse-rate on coding of interaural time differences in listeners with cochlear implants" (http://asa.scitation.org/doi/abs/10.1121/1.4970392) but was changed to reflect the further work that was completed before the conference.
Source: PublicationPreSubmission
Source-ID: 128333961
Publication: Research › Poster – Annual report year: 2017

Custom Integrated Circuit Design for Portable Ultrasound Scanners
This work concerns the integrated circuitry contained inside a portable ultrasound scanner. These scanners are size and power limited, therefore, the main challenge is to achieve an acceptable picture quality within those restrictions. The structure of portable ultrasound scanners is different from traditional static ultrasound scanners since the data acquired is pre-beamformed, and thereby reduced, in the handheld probe. As a result, the circuitry inside the handheld probe is complex and is required to be small and efficient. Furthermore, it needs to reach enough performance to generate a usable picture quality, within the area and power budget limitations.

A handheld probe for portable ultrasound scanners contains several transducers, transmitting channels and receiving channels. In order to pre-beamform, the transmitting channels individually excite the transducers in a sequence filling the imaging plane and the signals received from each transmit burst area summed. Each receiving channel is required to individually amplify and delay its signal in order to correctly pre-beamform. The handheld probe delivers the data to a processing unit digitally, hence, analog to digital converters (ADCs) are contained in the probe. Due to the nature of ultrasonic transducers, the transmitting circuitry needs to generate high-voltage pulses to drive them. Furthermore, the low-voltage receiving circuitry has to provide high enough signal to noise ratio (SNR) in order to generate usable imaging. For the purpose of evaluating the feasibility of the transmitting and receiving circuitry of a handheld probe for portable ultrasound scanners, three integrated circuit prototypes have been fabricated. Measurements have been performed on all of them with satisfactory results.

The first part of this project is focused on the high-voltage transmitting channels circuitry. This circuitry is required to generate pulses in the range of 100 V with frequencies around 5 MHz. The first prototype contains a full reconfigurable
The first part of the project focuses on the transmitting channel circuitry. The first prototype includes a single-ended transmitting channel occupying a die area of 0.938 mm² and a power consumption of 1.41 mW. The second prototype contains a full differential transmitting channel, which has improvements on performance, smaller die area of 0.18 mm² and lower power consumption of 0.936 mW.

The second part of the project aims at the receiving channel circuitry. The third prototype includes a continuous-time delta-sigma analog-to-digital converter (CTDS ADC) operating at a sampling frequency of 320 MHz, a SNR of 45 dB, occupying an area of 0.0175 mm² and a power consumption of 0.594 mW. The CTDS ADC digitizes the signal before the pre-beamform summing is applied. The SNR of the ADC is directly linked to the picture quality of the imaging. However, the SNR is also related to the power consumption, creating a tradeoff between power and picture quality. The design approach will be to achieve the minimum SNR that generates an acceptable picture quality while using the minimum power possible. The ADC is implemented as an over-sampled data converter with 1-bit output in order to simplify the accurate digital delay needed in each receiving channel to pre-beamform. Using this approach, the digital delay can be very efficiently implemented as an inverter based digital delay line with switches, achieving accurate precise delay that scales with technology.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Llimos Muntal, P. (Intern), Jørgensen, I. H. H. (Intern), Bruun, E. (Intern)
Number of pages: 191
Publication date: 2016

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Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions: thesis_main.pdf

Relations
Projects:
Custom Integrated Circuit Design for Portable Ultrasound Scanners

Decay curves in coupled, reverberant spaces
This study investigates the effect of panel and boundary diffusers in a reverberant space. Diffusers are usually mounted in a reverberation chamber to increase the diffuse sound field as recommended in Annex A of ISO 354. The ISO is not specific about the location or the material of the panels; the standard only states that the absorption coefficient of a highly absorbing material will increase and approach a maximum value. This value is usually much higher than 1 when diffusers are added. It is also known that the reproducibility of absorption coefficient measurements in reverberation chambers is unsatisfying. This study investigates the effect of panel diffusers, in particular considering that their dispositioning in a room can create coupled spaces, decreasing the effective volume of the chamber, and leading to an overestimation of the absorption coefficient. The decay curves are measured in a small chamber with panels placed in a corner creating a coupled space. Both in the empty room as well as with A = 3 m² absorbing porous sample on the floor, the decay curves are evaluated. Additionally, the effect of boundary diffusers is considered. The decay curves for different room configurations in the occupied (with high absorption on the floor) and unoccupied state (without any absorption) are compared. The decay curve in the occupied state without any panels or boundary diffusers has a breakpoint where the slope changes its value. This can also be observed in the unoccupied state with panels placed in the corner of the room.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Graz University of Technology, Rensselaer Polytechnic Institute
Authors: Balin, J. (Ekstern), Nolan, M. (Intern), Fernandez Grande, E. (Intern), Brunskog, J. (Intern), Jeong, C. (Intern), Xiang, N. (Ekstern), Graber, G. (Ekstern)
Number of pages: 10
Publication date: 2016
Decoupling Scheme for a Cryogenic Rx-Only RF Coil for 13C Imaging at 3T

In this study we evaluate the different active decoupling schemes that can be used to drive an Rx-only coil, in order to determine the optimal design for 13C MRI at 3T. Three different circuit schemes are studied: two known ones (with regular series and parallel tuning respectively), and a novel one which we found to be optimal for this case. The circuits have been cooled to 77K to reduce coil noise. Preliminary tests with the preamplifier cooled to 77K for reduction of noise figure, are also reported.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, Center for Magnetic Resonance, Electromagnetic Systems, Aarhus University
Authors: Sanchez, J. D. (Intern), Søvsø Szocska Hansen, E. (Ekstern), Laustsen, C. (Ekstern), Zhurbenko, V. (Intern), Ardenkjær-Larsen, J. H. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions: ISMRM2016_3639_Decoupling.pdf
Source: PublicationPreSubmission
Source-ID: 127237436
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Demand Forecasting at Low Aggregation Levels using Factored Conditional Restricted Boltzmann Machine.

The electrical demand forecasting problem can be regarded as a nonlinear time series prediction problem depending on many complex factors since it is required at various aggregation levels and at high temporal resolution. To solve this challenging problem, various time series and machine learning approaches have been proposed in the literature. As an evolution of neural network-based prediction methods, deep learning techniques are expected to increase the prediction accuracy by allowing stochastic formulations and bi-directional connections between neurons. In this paper, we investigate a newly developed deep learning model for time series prediction, namely Factored Conditional Restricted Boltzmann Machine (FCRBM), and extend it for electrical demand forecasting. The assessment is made on the EcoGrid dataset, originating from the Bornholm island experiment in Denmark, consisting of aggregated electric power consumption, local price and meteorological data collected from 1900 customers. The households are equipped with local generation and smart appliances capable of responding to realtime pricing signals. The results show that for the short-term (5 minute to 1 day ahead) prediction problems solved here, FCRBM outperforms the benchmark machine learning approach, i.e. Support Vector Machine.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets, Eindhoven University of Technology
Authors: Mocanu, E. (Ekstern), Nguyen, P. H. (Ekstern), Gibescu, M. (Ekstern), Larsen, E. M. (Intern), Pinson, P. (Intern)
Number of pages: 7
Publication date: 2016

Host publication information
Title of host publication: Proceedings of 19th Power Systems Computation Conference.
Demand response in a market environment

This thesis addresses the design, deployment and benefits of demand response in a market environment. Demand response is consumption that can be controlled by an external stimulus in the power system. Flexible consumption is a useful tool for absorbing volatile power from renewable sources like wind power and photovoltaics, and dealing with decentralised activity like electric vehicle charging. Without flexible consumption or other new technologies like storage, there will be several occasions of surplus or deficit of generation to meet the demand of the future, sometimes expected and sometimes not, that will lead to power system failure. The type of demand response investigated is consumption controlled by indirect means, like an electricity price. Initially, algorithms responding to real-time electricity prices are researched and benchmarked according to comfort and cost. After this simulation, real power system data from the Danish island of Bornholm is introduced and methods to quantify an aggregated load is developed. These methods can be used for real-time operation and to support investment decisions. More specifically, they can be used to forecast the response to electricity pricing and to classify different types of customers. The proposed models are then embedded into new five-minute electricity markets for system balancing and local congestion management. New market tools for exploiting and maintaining a degree of control over demand are developed, and the value of DR using indirect control is determined in terms of social welfare. This thesis is written in the context of Danish and European power systems because the data used - and the data-driven models subsequently created - come from and were developed for the EcoGrid EU project. The demand forecasting models and electricity markets proposed in this thesis have been implemented on the Danish island of Bornholm in the EcoGrid EU project. The real-time balancing market ran from October 2014 until May 2015, the congestion market operated from January 2015 onwards, and the demand forecast module operated from February 2015 onwards.

EcoGrid EU is a large-scale smart grid demonstration with 1900 residential households and 100 industrial customers with a peak load above 5MW. Customers are equipped with smart meters and a range of distributed energy resources with automated controllers that receive a new electricity price every five minutes and optimize consumption levels accordingly. DR from these customers is bid into the electricity market as balancing power and customer measurements are used in real-time to update the demand forecast.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Larsen, E. M. (Intern), Pinson, P. (Intern), Ding, Y. (Intern), Østergaard, J. (Intern)
Number of pages: 131
Publication date: 2016

Publication information
Publisher: Technical University of Denmark, Department of Electrical Engineering
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Demand_response_in_a_market_environment.pdf
Publication: Research › Ph.D. thesis – Annual report year: 2016

Demand Response on domestic thermostatically controlled loads

Electricity has become an inevitable part of human life in present day world. In the past two centuries, the electric power system has undergone a lot of changes. Due to the awareness about the adverse impact of the fossil fuels, the power industry is adopting green and sustainable energy sources. For a safe and reliable operation of electric power systems, the balance between electricity generation and consumption has to be maintained. The conventional fossil fuel based power generation achieves this balance by adjusting the generation to follow the consumption. In the electric power system with renewable energy sources, the production cannot be adjusted to match the demand due to the fluctuating nature of the renewable energy sources. Therefore, the demand has to be adjusted to match the power production. The concept of adjusting the demand to meet the production is called demand response. In general, the electricity consumers are classified as industrial, commercial and domestic. In this dissertation, only the thermostatically controlled loads (TCLs) in the domestic segment are considered for the demand response study. The study is funded by Danish Council for Strategic Research (DCSR) and supported by the project “Inducing consumer adoption of automated reaction technology for dynamic power pricing tariffs” (INCAP). As project INCAP provides access to domestic refrigerators, the TCLs considered for the demand response study are domestic refrigerators. In this study an experimental facility is developed to...
measure parameters from the refrigerators, in order to control them. The experimental facility is also used to communicate pseudo electricity prices to the consumers and has options to unsubscribe the control from the user end, as a part of the INCAP project requirement. A temperature prediction strategy is developed to predict the refrigerator temperature and to estimate the flexibility available for demand response activation. A field experiment with refrigerators is conducted to study secondary frequency control using demand response activation on TCLs. The response time and the ramp rate characteristics of a real population of domestic refrigerators, as well as their ability to provide frequency control, are analysed. The response characteristics are compared with conventional power plant specifications, indicated in the Danish grid code. The changes in the TCLs flexibility, with respect to different power reduction levels, are analysed. Finally, the impact of demand response activation on the TCLs aggregated power is studied in terms of error in power limit, ramping rates and peak overshoot in different control scenarios. Lastly, the advantage and disadvantage of the different control scenarios are analysed.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Risø National Laboratory for Sustainable Energy, Energy System Management
Authors: Lakshmanan, V. (Intern), Bindner, H. W. (Intern), Gehrke, O. (Intern), Kosek, A. M. (Intern)
Number of pages: 210
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Original language: English
Main Research Area: Technical/natural sciences
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Relations
Projects:
Demand Response on domestic thermostatically controlled loads
Source: PublicationPreSubmission
Source-ID: 133866266
Publication: Research › Ph.D. thesis – Annual report year: 2017

Design and Fabrication of Air-core Inductors for Power Conversion
Microelectromechanical systems (MEMS) inductors are used for e.g. RF MEMS and microelectronics. A new application is for power electronics in switched mode power supplies (SMPS). High-performance power inductors, which can be combined with integrated circuits (IC), are required for future power supply on chip (PwrSoC) [1]. Examples of PwrSoC applications are power adaptors for LED illumination and the “Internet of Things”. We report an air-core MEMS inductor. Our process is scalable and universal for making inductors with versatile geometries e.g. spiral, solenoid, toroid, and advanced inductors that are impossible to make by wire-winding technology. As all process temperatures are kept below 200 °C, the inductors can be integrated into CMOS wafers by MEMS post-processing.

General information
State: Published
Organisations: DTU Danchip, Department of Electrical Engineering, Electronics, Institute for Product Development
Authors: Lê Thanh, H. (Intern), Mizushima, I. (Ekstern), Tang, P. T. (Ekstern), Ouyang, Z. (Intern), Knott, A. (Intern), Jensen, F. (Intern), Han, A. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
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Poster contribution, PwrSoC 2016
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Publication: Research - peer-review › Poster – Annual report year: 2016

Design and Implementation of High Frequency Buck Converter Using Multi-Layer PCB Inductor
Increasing the switching frequency for switch mode power supplies is one of methods to achieve smaller, lighter weight and cheaper power converters. This work investigates the opportunity of using two layer circular spiral inductors implemented in a 150 μm finished thickness printed circuit board for a high frequency DC-DC converter. The inductor was tested in a 5 W buck converter switching at 10 MHz. The converter achieved 84.7% peak efficiency converting 12 V to 5 V
and 78% efficiency converting 24 V to 5 V.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Nour, Y. (Intern), Ouyang, Z. (Intern), Knott, A. (Intern), Jørgensen, I. H. H. (Intern)
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Publication date: 2016

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Publisher: IEEE
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Main Research Area: Technical/natural sciences
PCB Inductors, Gallium Nitride, High Frequency Converters
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**Design, characterization and modelling of high efficient solar powered lighting systems**

**General information**
State: Published
Organisations: Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Electrical Engineering, Electronics, Technical University of Denmark, Out-sider
Number of pages: 1
Publication date: 2016
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Main Research Area: Technical/natural sciences
Electronic versions:
PV_LED_Engine_Modelling.pdf
Source: PublicationPreSubmission
Source-ID: 124999826
Publication: Research - peer-review › Poster – Annual report year: 2016

This paper discusses some of the major challenges in the development of L2L (Light-2-Light) products. It's the lack of efficient converter electronics, modelling tools for dimensioning and furthermore, characterization facilities to support the successful development of the products. We report the development of 2 Three-Port-Converters respectively for 1-10Wp with a peak efficiency of 99.1% at 1.5 W output power at PV to battery and almost similar characteristics for a 10-50 Wp. Furthermore, a modelling tool for L2L products has been developed and a laboratory for feeding in component data not available in the datasheets to the model is described. A living lab facility is realized to field test prototypes of L2L lighting products in their development state to validate the modelling tool and tweak the parameters in the system for optimized performance the product. Finally, the model was validated against a field test from the living lab over a four-day period with an offset of 5.3 %
Designing high efficient solar powered lighting systems

Some major challenges in the development of L2L products is the lack of efficient converter electronics, modelling tools for dimensioning and furthermore, characterization facilities to support the successful development of the products. We report the development of 2 Three-Port-Converters respectively for 1-10Wp and 10-50 Wp with a peak efficiency of 97% at 1.8 W
of PV power for the 10 Wp version. Furthermore, a modelling tool for L2L products has been developed and a laboratory for feeding in component data not available in the datasheets to the model is described.

**General information**
State: Published
Organisations: Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Electrical Engineering, Electronics, Outsider
Authors: Poulsen, P. B. (Intern), Thorsteinsson, S. (Intern), Lindén, J. (Intern), Ploug, R. O. (Intern), Knott, A. (Intern), Mira Albert, M. D. C. (Intern), Mogensen, I. (Ekstern), Retof, K. (Ekstern)
Pages: 2712-2714
Publication date: 2016

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Main Research Area: Technical/natural sciences
Conference: 43rd IEEE Photovoltaic Specialists Conference, Portland, Oregon, United States, 05/06/2016 - 05/06/2016
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Source: PublicationPreSubmission
Source-ID: 124998295
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**Designing high efficient solar powered lighting systems**
Some major challenges in the development of L2L products is the lack of efficient converter electronics, modelling tools for dimensioning and furthermore, characterization facilities to support the successful development of the products. We report the development of 2 Three-Port-Converters respectively for 1-10 Wp and 10-50 Wp with a peak efficiency of 97% at 1.8 W of PV power for the 10 Wp version. Furthermore, a modelling tool for L2L products has been developed and a laboratory for feeding in component data not available in the datasheets to the model is described.

**General information**
State: Published
Organisations: Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Electrical Engineering, Electronics, Outsider
Authors: Poulsen, P. B. (Intern), Thorsteinsson, S. (Intern), Lindén, J. (Intern), Ploug, R. O. (Intern), Knott, A. (Intern), Mira Albert, M. D. C. (Intern), Mogensen, I. (Ekstern), Retof, K. (Ekstern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
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Source-ID: 124999849
Publication: Research - peer-review › Poster – Annual report year: 2016

**Designing High Efficient Solar Powered OLED Lighting Systems.**
OLEDs used in solar powered lighting applications is a market of the future. This paper reports the development of electronic Three-Port-Converters for PV OLED product integration in the low-power area respectively for 1-10 Wp and 10-50 Wp with a peak efficiency of 97% at 1.8 W of PV power for the 10 Wp version. Furthermore, we present measurements of state-of-the-art commercial available OLED with regards to the luminous flux, luminous efficacy, luminance homogeneity, temperature dependency and IV characteristic of the OLED panels. In addition, solar powered OLED product concepts are proposed.

**General information**
State: Published
Organisations: Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Electrical Engineering, Electronics
Design of Efficient Sound Systems for Low Voltage Battery Driven Applications

The efficiency of portable battery driven sound systems is crucial as it relates to both the playback time and cost of the system. This paper presents design considerations when designing such systems. This include loudspeaker and amplifier design. Using a low resistance voice coil realized with rectangular wire one can boost the efficiency of the loudspeaker driver and eliminate the need of an additional power supply. A newly developed switching topology is described which is beneficial to near-idle efficiency (< 2 W), which is crucial for real audio applications in the consumer electronics space. A small sized sound system was implemented using the discussed design considerations. The amplifier efficiency performance was found to be very high with near-idle efficiency reaching a remarkably 88% at 2 W. The average output SPL was estimated to be up to 90 dB in half spheric anechoic conditions. Measured results are compared with current state-of-art and shows a 14% points efficiency improvement.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, Merus Audio
Authors: Iversen, N. E. (Intern), Oortgiesen, R. (Ekstern), Knott, A. (Intern), Andersen, M. A. E. (Intern), Høyerby, M. (Ekstern)
Number of pages: 7
Publication date: 2016

Design of passive directional acoustic devices using Topology Optimization - from method to experimental validation

The paper presents a topology optimization based method for designing acoustic focusing devices, capable of tailoring the sound emission pattern of one or several sources, across a chosen frequency band. The method is demonstrated numerically considering devices optimized for directional sound emission in two dimensions and is experimentally validated using three dimensional prints of the optimized designs. The emitted fields exhibit a level difference of at least 15 dB on axis relative to the off-axis directions, over frequency bands of approximately an octave. It is demonstrated to be possible to design focusing devices of dimensions comparable to the acoustic wavelength, a frequency range which is typically problematic, as well as devices operating at higher frequencies. The classical parabolic reflector is used as a benchmark. The devices designed using the proposed method are shown to outperform the latter in terms of directivity and maximum side-lobe level over nearly an octave band. A set of frequencies are considered simultaneously in the design formulation and performance robustness toward uniform spatial production errors in the designed devices is assured by including perturbations of the geometry in the design formulation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Acoustic Technology
Authors: Christiansen, R. E. (Intern), Fernandez Grande, E. (Intern)
Pages: 3862-3873
Publication date: 2016
Main Research Area: Technical/natural sciences
Detection of icing on wind turbine blades by means of vibration and power curve analysis: Icing detection in wind turbines

Ice accretion on wind turbines' blades is one of the main challenges of systems installed in cold climate locations, resulting in power performance deterioration and excessive nacelle oscillation. In this work, consistent detection of icing events is achieved utilizing indications from the nacelle accelerometers and power performance analysis. Features extracted from these two techniques serve as inputs in a decision-making scheme, allowing early activation of de-icing systems or shut down of the wind turbine. An additional parameter is the month of operation, assuring consistent outcomes in both winter and summer seasons. The amplitude of lateral nacelle vibration at rotor speed is the used condition indicator from vibration standpoint, which is verified by the presence of sinusoidal shape in high-resolution time waveforms. Employment of k-nearest neighbour on wind speed - power production data sets leads to successful recognition of power performance deterioration. Results from one wind park consisting of 13 turbines operating under icing are presented, where similar patterns on both vibration and power curve data validate the effectiveness of the proposed approach on the reliable detection of icing formation.

General information

State: Published
Organisations: Department of Management Engineering, Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Technical University of Denmark, Bruel and Kjaer Vibro A/S, University of the Faroe Islands
Authors: Skrimpas, G. A. (Intern), Kleani, K. (Ekstern), Mijatovic, N. (Intern), Sweeney, C. W. (Ekstern), Jensen, B. B. (Ekstern), Holbøll, J. (Intern)
Pages: 1819–1832
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.079 SNIP 2.316
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.201 SNIP 2.165 CiteScore 3.06
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 1.209 SNIP 3.688 CiteScore 3.42
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Scopus rating (2013): SJR 1.235 SNIP 2.486 CiteScore 2.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Determining intrafractional prostate motion using four dimensional ultrasound system

Background: In prostate radiotherapy, it is essential that the prostate position is within the planned volume during the treatment delivery. The aim of this study is to investigate whether intrafractional motion of the prostate is of clinical consequence, using a novel 4D autoscan ultrasound probe.

Methods: Ten prostate patients were ultrasound (US) scanned at the time of CT imaging and once a week during their course of radiotherapy treatment in an ethics-approved study, using the transperineal Clarity autoscan system (Clarity®, Elekta Inc., Stockholm, Sweden). At each US scanning session (fraction) the prostate was monitored for 2 to 2.5 min, a typical beam-on time to deliver a RapidArc® radiotherapy fraction. The patients were instructed to remain motionless in supine position throughout the US scans. They were also requested to comply with a bladder-filling protocol. In total, 51 monitoring curves were acquired. Data of the prostate motion in three orthogonal directions were analyzed. Finally, the BMI value was calculated to investigate correlation between BMI and the extent of prostate displacement.

Results: The patients were cooperative, despite extra time for applying the TPUS scan. The mean (+/- 1SD) of the maximal intrafractional displacements were \([ \text{mm}]\); \([\text{I+]} \text{S}: (0.2 +/- 0.9); \text{L+} \text{R}: (-0.2 +/- 0.8); \text{A+} \text{P}: (-0.2 +/- 1.1)\), respectively. The largest displacement was 2.8 mm in the posterior direction. The percentage of fractions with displacements larger than 2.0 mm was 4 %, 2 %, and 10 % in the IS, LR, and AP directions, respectively. The mean of the maximal intrafractional Euclidean distance (3D vector) was 0.9 +/- 0.6 mm. For 12 % of the fractions the maximal 3D vector displacements were larger than 2.0 mm. At only two fractions (4 %) displacements larger than 3.0 mm were observed. There was no correlation between BMI and the extent of the prostate displacement.

Conclusions: The prostate intrafractional displacement is of no clinically consequence for treatment times in the order of 2 -2.5 min, which is typical for a RapidArc radiotherapy fraction. However, prostate motion should be considered for longer treatment times eg if applying conventional or IMRT radiotherapy.
Diagnosis for Control and Decision Support for Autonomous Vehicles

Diagnosis and, when possible, prognosis of faults are essential for safe and reliable operation. The area of fault diagnosis has emerged over three decades. The majority of studies are related to linear systems but real-life systems are complex and nonlinear. The development of methodologies coping with complex and nonlinear systems have matured and even though there are many unsolved problems, methodology and associated tools have become available in the form of theory and software for design. Genuine industrial cases have also become available. Analysis of system topology, referred to as structural analysis, has proven to be unique and simple in use and a recent extension to active structural techniques have made fault isolation possible in a wide range of systems.

Following residual generation using these topology-based methods, deterministic and statistical change detection has proven very useful for online prognosis and diagnosis. For complex systems, results from non-Gaussian detection theory have been employed with convincing results. The chapter presents the theoretical foundation for design methodologies that now appear as enabling technology for a new area of design of systems that are reliable in practise. Yet they are also affordable due to the use of fault-tolerant philosophies and tools that make engineering efforts minimal for their implementation. The chapter includes examples for an autonomous aircraft and a baling system for agriculture to illustrate the generic design procedures and real life results.

Diagnosis of bearing creep in wind turbine gearboxes

One of the most widespread gearbox topologies in the wind energy sector consists of a slow rotating planetary stage, an intermediate speed parallel stage and finally a high speed parallel stage driving the generator rotor. The shafts of the two latter stages are supported by ball or roller bearings where their outer races are fixed to the gearbox and their inner races rotate at the corresponding shaft speed. Bearing inner race defects are frequently encountered in gearboxes leading to either replacement of the whole unit or exchange of the shaft or bearing where feasible. The present work deals with the evaluation of the development of an inner race defect from surface pitting to race axial crack resulting in excessive rotational looseness, also referred to as bearing creep. It is shown that an inner race defect can be identified efficiently at an early stage by employing well known vibration condition indicators, e.g. crest factor, whereas development to rotational looseness is expressed as increased sideband activity between the gear mesh frequencies spaced at the shaft speed supported by the defective bearing due to abnormal meshing. The condition of the gears and the shaft during the final stage of the above described failure mode is essential in regards to the possibility of uptower repairs or their use in refurbished gearboxes. Case studies from operating multi-megawatt wind turbines are presented, illustrating the progression of the fault via continuous trending of condition indicators and detailed spectral analysis of high resolution
vibration signals.

**Diagnosis of wind turbine rotor system**

This paper describes a model free method for monitoring and fault diagnosis of the elements in a rotor system for a wind turbine. The diagnosis as well as the monitoring is done without using any model of the wind turbine and the applied controller or a description of the wind profile. The method is based on available standard sensors on wind turbines. The method can be used both on-line as well as off-line. Faults or changes in the rotor system will result in asymmetries, which can be monitored and diagnosed. This can be done by using the multi-blade coordinate transformation. Changes in the rotor system that can be diagnosed and monitored are: actuator faults, sensor faults and internal blade changes as e.g. change in mass of a blade.

**Difference between Extra- and Intracellular T1 Values of Carboxylic Acids Affects the Quantitative Analysis of Cellular Kinetics by Hyperpolarized NMR**

Incomplete knowledge of the longitudinal relaxation time constant (T1) leads to incorrect assumptions in quantitative kinetic models of cellular systems, studied by hyper-polarized real-time NMR. Using an assay that measures the intracellular signal of small carboxylic acids in living cells, the intracellular T1 of the carboxylic acid moiety of acetate, keto-isocaproate, pyruvate, and butyrate was determined. The intracellular T1s shown to be up to four-fold shorter than the extracellular T1. Such a large difference in T1 values between the inside and the outside of the cell has significant influence on the quantification of intracellular metabolic activity. It is expected that the significantly shorter T1 value of the carboxylic moieties inside cells is a result of macro-molecular crowding. An artificial cytosol has been prepared and applied to predict the T1 of other carboxylic acids. We demonstrate the value of this prediction tool.
Diffuse sound field: challenges and misconceptions

Diffuse sound field is a popular, yet widely misused concept. Although its definition is relatively well established, acousticians use this term for different meanings. The diffuse sound field is defined by a uniform sound pressure distribution (spatial diffusion or homogeneity) and uniform incident intensity distribution (directional diffusion or isotropy). In practice, reverberation chambers are assumed to be acoustically diffuse, and important acoustic quantities measured in there, i.e., sound absorption, scattering, transmission, and power, etc. However, the measured quantities vary tremendously in different chambers because the chambers are non-diffuse in variously different ways. Therefore, good objective measures that can quantify the degree of diffusion and potentially indicate how to fix such problems in reverberation chambers are needed. Acousticians often blend the concept of mixing and diffuse sound field. Acousticians often refer diffuse reflections from surfaces to diffuseness in rooms, and vice versa. Subjective aspects of diffuseness have not been much investigated. Finally, ways to realize a diffuse sound field in a finite space are discussed.

General information

State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology
Authors: Jeong, C. (Intern)
Diffusion Retardation by Binding of Tobramycin in an Alginate Biofilm Model.

Microbial cells embedded in a self-produced extracellular biofilm matrix cause chronic infections, e.g. by Pseudomonas aeruginosa in the lungs of cystic fibrosis patients. The antibiotic killing of bacteria in biofilms is generally known to be reduced by 100–1000 times relative to planktonic bacteria. This makes such infections difficult to treat. We have therefore proposed that biofilms can be regarded as an independent compartment with distinct pharmacokinetics. To elucidate this pharmacokinetics we have measured the penetration of the tobramycin into seaweed alginate beads which serve as a model of the extracellular polysaccharide matrix in P. aeruginosa biofilm. We find that, rather than a normal first order saturation curve, the concentration of tobramycin in the alginate beads follows a power-law as a function of the external concentration. Further, the tobramycin is observed to be uniformly distributed throughout the volume of the alginate bead. The power-law appears to be a consequence of binding to a multitude of different binding sites. In a diffusion model these results are shown to produce pronounced retardation of the penetration of tobramycin into the biofilm. This filtering of the free tobramycin concentration inside biofilm beads is expected to aid in augmenting the survival probability of bacteria residing in the biofilm.

General information
State: Published
Organisations: Copenhagen Center for Health Technology, Department of Electrical Engineering, Biomedical Engineering, University of Copenhagen
Authors: Cao, B. (Ekstern), Christophersen, L. (Ekstern), Kolpen, M. (Ekstern), Jensen, P. Ø. (Ekstern), Sneppen, K. (Ekstern), Helby, N. (Ekstern), Moser, C. (Ekstern), Sams, T. (Intern)
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.11 SJR 1.236 SNIP 1.101
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.427 SNIP 1.136 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.559 SNIP 1.148 CiteScore 3.54
Web of Science (2014): Indexed yes
Digital Control of a High Voltage (2.5 kV) Bidirectional Flyback DC-DC Converter for Driving a Capacitive Incremental Actuator

This paper presents a digital control technique to achieve valley switching in a bidirectional flyback converter used to drive a dielectric electro-active polymer based capacitive incremental actuator. The paper also provides the design of a low input voltage (24 V) and variable high output voltage (0-2.5 kV) bidirectional dc-dc flyback converter for driving a capacitive incremental actuator. The incremental actuator consists of three electrically isolated, mechanically connected capacitive actuators. It requires three high voltage (2-2.5 kV) bidirectional dc-dc converters, to accomplish the incremental motion by charging and discharging the capacitive actuators. The bidirectional flyback converter employs a digital controller to improve efficiency and charge/discharge speed using the valley switching technique during both charge and discharge processes, without the need to sense signals on the output high-voltage (HV) side. Experimental results verifying the bidirectional operation of a high voltage flyback converter are presented, using a 3 kV polypropylene film capacitor as the load. The energy loss distributions of the converter when 4 kV and 4.5 kV HV MOSFETs are used on HV side are presented. The flyback prototype with a 4 kV MOSFET demonstrated 89% charge energy efficiency to charge the capacitive load from 0 V to 2.5 kV, and 84% discharge energy efficiency to discharge it from 2.5 kV to 0 V, respectively.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics, National University of Singapore, University of Colorado at Boulder
Authors: Thummala, P. (Ekstern), Maksimovic, D. (Ekstern), Zhang, Z. (Intern), Andersen, M. A. E. (Intern)
Pages: 8500-8516
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
Digitized self-oscillating loop for piezoelectric transformer-based power converters

A new method is implemented in designing of self-oscillating loop for driving piezoelectric transformers. The implemented method is based on combining both analog and digital control systems. Digitized delay, or digitized phase shift through the self-oscillating loop results in a very precise frequency control and ensures an optimum operation of the piezoelectric transformer in terms of voltage gain and efficiency. In this work, additional time delay is implemented digitally for the first time through 16 bit digital-to-analog converter to the self-oscillating loop. Delay control setpoints updates at a rate of 417 kHz. This allows the control loop to dynamically follow frequency changes of the transformer in each resonant cycle. The operation principle behind self-oscillating is discussed in this paper. Moreover, experimental results are reported.

Directed graph based carbon flow tracing for demand side carbon obligation allocation

In order to achieve carbon emission abatement, some researchers and policy makers have cast their focus on demand side carbon abatement potentials. This paper addresses the problem of carbon flow calculation in power systems and carbon obligation allocation at demand side. A directed graph based method for tracing carbon flow is proposed. In a lossy network, matrices such as carbon losses, net carbon intensity (NCI) and footprint carbon intensity (FCI) are obtained with the proposed method and used to allocate carbon obligation at demand side. Case studies based on realistic distribution and transmission systems are provided to demonstrate the effectiveness of the proposed method.
Direct Extraction of InP/GaAsSb/InP DHBT Equivalent-Circuit Elements From S-Parameters Measured at Cut-Off and Normal Bias Conditions

A unique direct parameter extraction method for the small-signal equivalent-circuit model of InP/GaAsSb/InP double heterojunction bipolar transistors (DHBTs) is presented. S-parameters measured at cut-off bias are used, at first, to extract the distribution factor $X_{0}$ for the base-collector capacitance at zero collector current and the collector-to-emitter overlap capacitance $C_{ceo}$ present in InP DHBT devices. Low-frequency S-parameters measured at normal bias conditions then allows the extraction of the external access resistances $R_{b}$, $R_{e}$, and $R_{c}$ as well as the intrinsic HBT elements of the device. The terminal inductances of the device are extracted from high frequency S-parameters by employing the intrinsic HBT elements extracted at low-frequency. Compared to other published direct parameter extraction techniques the proposed method is developed specifically for III-V based HBTs and avoids S-parameters measured at the critical open-collector bias condition. The method is applied to an 1.5-μm emitter width InP/GaAsSb/InP DHBT device and leads to excellent prediction of the measured S-parameters in the 250 MHz – 65 GHz frequency range.
Direct Reuse of Rare Earth Permanent Magnets - Wind Turbine Generator Case Study

A novel recycling strategy, direct reuse, for rare earth permanent magnets were investigated in this article. Direct reuse uses small, unit-cell (segmented) magnets to replace the normal solid pole configuration, which is not directly reusable due its unique shape and size. The unit-cell magnets are directly reusable due to their standard shape and size, and direct reuse effectively bypasses a number of the expensive and energy intensive processes of normal recycling. Based on a model of a 3 MW direct drive wind turbine generator, the finite element studies concluded that normal values of average output torque, torque ripple, and cogging torque are achievable with this segmentation technique. The influence of the thickness of the adhesive layer was analyzed, and a pole-shaping technique was applied to improve the torque characteristics. The simulation models were verified experimentally.

General Information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Technical University of Denmark, Sintex A/S, University of the Faroe Islands
Authors: Högberg, S. (Intern), Pedersen, T. S. (Ekstern), Bendixen, F. B. (Ekstern), Mijatovic, N. (Intern), Jensen, B. B. (Ekstern), Holbøll, J. (Intern)
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Publisher: IEEE
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Main Research Area: Technical/natural sciences
Direct drive wind turbine generator, Direct reuse, Experimental verification, Finite element analysis, Recycling REPM
DOIs: 10.1109/ICELMACH.2016.7732741
Discussion on 'Of quantiles and expectiles: consistent scoring functions, Choquet representations and forecast rankings' by Werner Ehm, Tilmann Gneiting, Alexander Jordan and Fabian Krüger

General information
State: Published
Organisations: Department of Informatics and Mathematical Modeling, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Pinson, P. (Intern)
Number of pages: 1
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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Scopus rating (2017): SNIP 3.79 SJR 7.005 CiteScore 4.35
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 7.154 SNIP 4.006 CiteScore 4.84
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 7.086 SNIP 3.825 CiteScore 4.28
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 6.613 SNIP 5.096 CiteScore 5.72
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 7.737 SNIP 4.957 CiteScore 6.66
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 5.646 SNIP 4.086 CiteScore 5.5
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 6.176 SNIP 3.673 CiteScore 4.53
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 5.671 SNIP 3.061
BFI (2009): BFI-level 2
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 5.559 SNIP 3.024
Scopus rating (2007): SJR 5.133 SNIP 3.262
Scopus rating (2006): SJR 3.708 SNIP 2.947
Scopus rating (2005): SJR 5.551 SNIP 3.401
Scopus rating (2004): SJR 6.145 SNIP 3.33
Scopus rating (2003): SJR 4.525 SNIP 2.918
Scopus rating (2002): SJR 3.803 SNIP 2.71
Scopus rating (2001): SJR 4.856 SNIP 2.635
Scopus rating (2000): SJR 3.805 SNIP 3.004
Scopus rating (1999): SJR 5.006 SNIP 2.388
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Bibliographical note
Journal of the Royal Statistical Society, Series B, in press
Disrupting the Industry with Play
Decades of research into intelligent, playful technology and user-friendly man-machine interfaces has provided important insight into the creation of robotic systems and intelligent interactive systems which are much more user-friendly, safer and cheaper than what appeared possible merely a decade or two ago. This is significantly disrupting the industry in several market sectors. This paper describes the components of the playware and embodied artificial intelligence research that has led to disruption in the industrial robotics sector, and which points to the next disruption of the health care sector. This includes playful robotics, LEGO robots for kids, minimal robot systems, user-friendly, behavior-based, biomimetic, modular robotics and intelligent systems. The insight into these components and the use in synthesis for designing robots and intelligent systems allows anybody, anywhere, anytime to use these systems, providing an unforeseen flexibility into the sectors, which become disrupted with these systems.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Centre for Playware
Authors: Lund, H. H. (Intern)
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Dissolution Dynamic Nuclear Polarization capability study with fluid path
Signal enhancement by hyperpolarization is a way of overcoming the low sensitivity in magnetic resonance; MRI in particular. One of the most well-known methods, dissolution Dynamic Nuclear Polarization, has been used clinically in cancer patients. One way of ensuring a low bioburden of the hyperpolarized product is by use of a closed fluid path that constitutes a barrier to contamination. The fluid path can be filled with the pharmaceuticals, i.e. imaging agent and solvents, in a clean room, and then stored or immediately used at the polarizer. In this study, we present a method of filling the fluid path that allows it to be reused. The filling method has been investigated in terms of reproducibility at two extrema, high dose for patient use and low dose for rodent studies, using [1-13C]pyruvate as example. We demonstrate that the filling method allows high reproducibility of six quality control parameters with standard deviations 3–10 times smaller than the acceptance criteria intervals in clinical studies.

General information
State: Published
Organisations: Department of Chemistry, Department of Electrical Engineering, Center for Hyperpolarization in Magnetic Resonance, Center for Magnetic Resonance, Department of Automation
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Volume: 272
Distributed Energy Resources Flexibility in a Multi-Carrier Energy System Environment

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management
Authors: Richert, T. P. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
Poster_PowerLab_Thibaut_Richert.pdf

Distribution Line Parameter Estimation Under Consideration of Measurement Tolerances
State estimation and control approaches in electric distribution grids rely on precise electric models that may be inaccurate. This work presents a novel method of estimating distribution line parameters using only root mean square voltage and power measurements under consideration of measurement tolerances, noise, and asynchronous timestamps. A measurement tolerance compensation model and an alternative representation of the power flow equations without voltage phase angles are introduced. The line parameters are obtained using numeric methods. The simulation demonstrates in case of the series conductance that the absolute compensated error is −1.05% and −1.07% for both representations, as opposed to the expected uncompensated error of −79.68%. Identification of a laboratory distribution line using real measurement data grid yields a deviation of 6.75% and 4.00%, respectively, from a calculation based on the manufacturer’s cable specifications and estimated line length. The transformed power flow equations deliver similar results despite the reduced problem complexity.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Department of Informatics and Mathematical Modeling, Risø National Laboratory for Sustainable Energy, Austrian Institute of Technology
Authors: Prostejovsky, A. (Intern), Gehrke, O. (Intern), Kosek, A. M. (Intern), Strasser, T. (Ekstern), Bindner, H. W. (Intern)
Pages: 726-735
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BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 3.183 SJR 1.599 CiteScore 8.37
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 8.29 SJR 2.114 SNIP 3.418
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.381 SNIP 3.242 CiteScore 7.57
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.151 SNIP 3.883 CiteScore 8.17
Web of Science (2014): Indexed yes
Do wavelet filters provide more accurate estimates of reverberation times at low frequencies

It has been amply demonstrated in the literature that it is not possible to measure acoustic decays without significant errors for low BT values (narrow filters and or low reverberation times). Recently, it has been shown how the main source of distortion in the time envelope of the acoustic decay is the frequency dependent group delay of the common implementations of the 1/3 and 1/1 octave filters. Some authors report good results using wavelet filter banks as an alternative to the usual filters. In this paper, a critical review of the performance of wavelet filter banks is undertaken. A filter bank using the continuous wavelet transform (CTW) has been implemented using a Morlet mother function. Although in general, the wavelet filter bank performs better than the usual filters, the influence of decaying modes outside the filter bandwidth on the measurements has been detected, leading to a biased estimation of the reverberation time in the frequency band of interest.
Dynamic Droop-Based Inertial Control of a Doubly-Fed Induction Generator

If a large disturbance occurs in a power grid, two auxiliary loops for the inertial control of a wind turbine generator have been used: droop loop and rate of change of frequency (ROCOF) loop. Because their gains are fixed, difficulties arise in determining them suitable for all grid and wind conditions. This paper proposes a dynamic droop-based inertial control scheme of a doubly-fed induction generator (DFIG). The scheme aims to improve the frequency nadir (FN) and ensure stable operation of a DFIG. To achieve the first goal, the scheme uses a droop loop, but it dynamically changes its gain based on the ROCOF to release a large amount of kinetic energy during the initial stage of a disturbance. To do this, a shaping function that relates the droop to the ROCOF is used. To achieve the second goal, different shaping functions, which depend on rotor speeds, are used to give a large contribution in high wind conditions and prevent over-deceleration in low wind conditions during inertial control. The performance of the proposed scheme was investigated under various wind conditions using an EMTP-RV simulator. The results indicate that the scheme improves the FN and ensures stable operation of a DFIG.
Dynamic optimum dead time in piezoelectric transformer-based switch-mode power supplies

Soft switching is required to attain high efficiency in high-frequency power converters. Piezoelectric transformer-based converters can benefit from soft switching in terms of significantly diminished switching losses and stresses. Adequate dead time is needed in order to deliver sufficient energy to charge and discharge the input capacitance of piezoelectric transformers in order to achieve zero-voltage switching. This paper proposes a method for detecting the optimum dead time in piezoelectric transformer-based switch-mode power supplies. The provision of sufficient dead time in every cycle of the switching period results in the quick start up of resonant current inside the transformer. The new method is implemented by dynamically detecting the optimum dead time for each resonant cycle and results in reduced energy loss, and consequently, increased efficiency in the converter during initialization time and steady-state operation.

The theory of optimum dead time operation is also discussed in this paper. Experimental results and simulation are provided to show the implementation of the concept.
Dynamic Subsidy Method for Congestion Management in Distribution Networks

Dynamic subsidy (DS) is a locational price paid by the distribution system operator (DSO) to its customers in order to shift energy consumption to designated hours and nodes. It is promising for demand side management and congestion management. This paper proposes a new DS method for congestion management in distribution networks, including the market mechanism, the mathematical formulation through a two-level optimization, and the method solving the optimization by tightening the constraints and linearization. Case studies were conducted with a one node system and the Bus 4 distribution network of the Roy Billinton Test System (RBTS) with high penetration of electric vehicles (EVs) and heat pumps (HPs). The case studies demonstrate the efficacy of the DS method for congestion management in distribution networks. Studies in this paper show that the DS method offers the customers a fair opportunity to cheap energy prices and has no rebound effect.

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State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems
Authors: Huang, S. (Intern), Wu, Q. (Intern)
Pages: 2140 - 2151
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Volume: 9
Issue number: 3
ISSN (Print): 1949-3053
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
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Economic Comparison of Electric Vehicles Performing Unidirectional and Bidirectional Frequency Control in Denmark with Practical Validation

The paper aims at investigating different methods, based on unidirectional charge and Vehicle-to-Grid (V2G), in order to evaluate and compare the potential economic revenue for an EV owner in providing frequency control in Denmark. User constraints are considered while evaluating the daily duration the EV is plugged into the network ready to support the system frequency. Performing unidirectional frequency control with Electric Vehicles (EVs) requires little hardware implementation in the household but has the limit that the service only can be performed until the battery is fully charged. Bidirectional V2G frequency control requires an external charger but also enables the EV to perform services at higher powers, during the entire period the EV is parked. The yearly revenue is in both cases calculated using some assumptions that are then verified in 2 experiments. Both EVs are discharged with the same amount of energy, such that their initial State of Charge (SOC) is set to the same level.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, NUVWE Corporation, Technical University of Denmark
Authors: Thingvad, A. (Intern), Martinenas, S. (Intern), Andersen, P. B. (Intern), Marinelli, M. (Intern), Christensen, B. E. (Ekstern), Olesen, O. J. (Ekstern)
Number of pages: 6
Publication date: 2016

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Title of host publication: 2016 Proceedings of the 51st International Universities Power Engineering Conference
Educational simulator app and web page for exploring Nuclear and Compass Magnetic Resonance

A graphical app and browser-based simulator, CompassMR, was developed for initial Magnetic Resonance (MR) education. It is available at http://drcmr.dk/CompassMR/ and executes directly in most browsers with no further need for software. Easy access and a simple user interface invite student experimentation that improves understanding of basic MR phenomena. The simulator is used to introduce and explore electromagnetism, magnetic dipoles, static and radiofrequency fields, Compass MR, the free induction decay (FID), relaxation, the Fourier transform (FFT), the resonance condition, spin, precession, the Larmor equation, Nuclear MR, resonant excitation (linear and quadrature), and off-resonance effects.

Methods and implementation:
The simulator is a complete HTML5/JavaScript\cite{1,2} rewrite of the JavaCompass\cite{3} so it now executes in modern browsers with no additional software needed. Spin dynamics and enhanced responsiveness was added. Android App conversion was accomplished using Adobe phoneGap\cite{4}. The basis for the graphical spin simulation is the semi-classical Bloch vector equation\cite{5} for a proton in combined stationary and oscillating magnetic fields, B0 and B1. For providing intuitive insight, the corresponding classical equation of motion for a compass needle in similar fields is used to simulate Compass Magnetic Resonance (CMR) that is similar to NMR except for needle vibration substituting nuclear precession. The nuclear Bloch vector moves like the magnetic moment of a classical rotating charge distribution\cite{6} as shown in the simulator. Spin is a consequence of Quantum Mechanics (QM) and not all aspects of spin and nuclei are represented in this naive picture. Beyond spin, the consequences of QM for proton MR are largely not observable, however, and the QM Bloch vector moves as shown in the simulator. Hence, it demonstrates nuclear dynamics more accurately than typical QM-inspired “cone” pictorial representations aimed at giving better representations of MR than classical mechanics, while often doing the opposite. This justification of the classical perspective is discussed in detail in\cite{7}.

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Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance
Authors: Hanson, L. G. (Intern)
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Main Research Area: Technical/natural sciences
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Effect of modulation depth, frequency, and intermittence on wind turbine noise annoyance
Amplitude modulation (AM) may be an important factor for the perceived annoyance of wind turbine noise (WTN). Two AM types, typically referred to as “normal AM” (NAM) and “other AM” (OAM), characterize WTN AM, OAM corresponding to having intermittent periods with larger AM depth in lower frequency regions than NAM. The extent to which AM depth, frequency, and type affect WTN annoyance remains uncertain. Moreover, the temporal variations of WTN AM have often
not been considered. Here, realistic stimuli accounting for such temporal variations were synthesized such that AM depth, frequency, and type, while determined from real on-site recordings, could be varied systematically. Listening tests with both original and synthesized stimuli showed that a reduction in mean AM depth across the spectrum led to a significant decrease in annoyance. When the spectrotemporal characteristics of the original far-field stimuli and the temporal AM variations were taken into account, the effect of AM frequency remained limited and the presence of intermittent OAM periods did not affect annoyance. These findings suggest that, at a given overall level, the AM depth of NAM periods is the most crucial AM parameter for WTN annoyance.
Effects of dynamic-range compression on temporal acuity

Some of the challenges that hearing-aid listeners experience with speech perception in complex acoustic environments may originate from limitations in the temporal processing of sounds. To systematically investigate the influence of hearing impairment and hearing-aid signal processing on temporal processing, temporal modulation transfer functions (TMTFs) and "supra-threshold" modulation-depth discrimination (MDD) thresholds were obtained in normal-hearing (NH) and hearing-impaired (HI) listeners with and without wide-dynamic range compression (WDRC). The TMTFs were obtained using tonal carriers of 1 and 5 kHz and modulation frequencies from 8 to 256 Hz. MDD thresholds were obtained using a reference modulation depth of -15 dB. A compression ratio of 2:1 was chosen. The attack and release time constants were 10 and 60 ms, respectively. For both carrier frequencies the TMTF thresholds decreased with the physical compression of the modulation depth due to the WDRC. Indications of reduced temporal resolution in the HI listeners were observed in the TMTF patterns for the 5 kHz carrier. Significantly higher MDD thresholds were found for the HI group relative to the NH group. No relationship was found between the MDD thresholds and the TMTF threshold. These findings indicate that the two measures may represent different aspects of temporal processing.

General information

State: Published
Organisations: Department of Electrical Engineering, Hearing Systems, Widex A/S
Authors: Wiinberg, A. (Intern), Jepsen, M. L. (Ekstern), Epp, B. (Intern), Dau, T. (Intern)
Number of pages: 8
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Editors: Santurette, S., Dau, T., Dalsgaard, J. C., Tranøj, T., Andersen, T.
Main Research Area: Technical/natural sciences
Conference: 5th International Symposium on Auditory and Audiological Research, Nyborg, Denmark, 26/08/2015 - 28/08/2015
Source: PublicationPreSubmission
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Effects of Risk Aversion on Market Outcomes: A Stochastic Two-Stage Equilibrium Model

This paper evaluates how different risk preferences of electricity producers alter the market-clearing outcomes. Toward this goal, we propose a stochastic equilibrium model for electricity markets with two settlements, i.e., day-ahead and balancing, in which a number of conventional and stochastic renewable (e.g., wind power) producers compete. We
assume that all producers are price-taking and can be risk-averse, while loads are inelastic to price. Renewable power production is the only source of uncertainty considered. The risk of profit variability of each producer is incorporated into the model using the conditional value-at-risk (CVaR) metric. The proposed equilibrium model consists of several risk-constrained profit maximization problems (one per producer), several curtailment cost minimization problems (one per load), and power balance constraints. Each optimization problem is then replaced by its optimality conditions, resulting in a mixed complementarity problem. Numerical results from a case study based on the IEEE one-area reliability test system are derived and discussed.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets
Authors: Kazempour, J. (Intern), Pinson, P. (Intern)
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Effets d'une compression cochléaire et d'une sélectivité en fréquence réduites sur la discrimination de la hauteur de tons complexes

Des études physiologiques ont montré qu'une perte auditive neurosensorielle (PANS) augmente l'amplitude de l'enveloppe temporelle du signal (ci-après, enveloppe) dans les fibres nerveuses auditives. La perception de la hauteur des tons complexes aux harmoniques non résolus reposant sur des mécanismes de codage de l'enveloppe, cette étude examine si des changements dans le traitement de l'enveloppe chez des sujets avec PANS ont des conséquences sur la discrimination de la hauteur. Des seuils de discrimination de fréquence fondamentale (SDF0) sont tout d'abord obtenus chez 14 sujets à audition normale et 10 sujets avec PANS pour des tons complexes dont les harmoniques sont ajoutées soit en phase sinusoïdale (PS) soit en phase aléatoire (PA). Pour des harmoniques non résolus, une PANS entraîne des SDF0 plus élevés que chez les personnes à audition normale dans la condition PA, mais similaires dans la condition PS. La compression cochléaire et la bande passante des filtres auditifs sont ensuite estimés chez les mêmes sujets. Les résultats démontrent une corrélation significative entre la réduction de la compression cochléaire et le rapport entre les SDF0 pour les conditions PA et PS. Les effets d'une dégradation de sélectivité en fréquence et d'une perte de compression sont enfin pris en compte comme facteurs potentiels de l'augmentation de l'enveloppe dans un modèle simplifié de la périphérie auditive. Ces simulations suggèrent que la réduction de la compression cochléaire et l'augmentation de la largeur des filtres auditifs améliorent sensiblement la représentation de l'enveloppe pour des harmoniques en PS, tout en l'affectant à peine pour des harmoniques en PA. Dans l'ensemble, les résultats comportementaux et de modélisation indiquent que la réduction de compression cochléaire est le facteur dominant dans l'augmentation de l'amplitude de l'enveloppe des tons complexes non résolus en PS, conduisant à une discrimination accrue de leur hauteur chez les personnes avec PANS

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Santurette, S. (Intern), Bianchi, F. (Intern), Fereczkowski, M. (Intern), Zaar, J. (Intern), Dau, T. (Intern)
Pages: 805-810
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Title of host publication: Proceedings of the French Acoustics Congress
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Source: PublicationPreSubmission
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
Efficiency Analysis of Magnetic Field Measurement for MR Electrical Impedance Tomography (MREIT)

MREIT is an emerging method to measure the ohmic tissue conductivities, with several potential biomedical applications. Its sensitivity depends on the magnitude of the applied current, which is limited to 1-2 mA in the human brain [1, 2]. This renders in-vivo applications challenging. Here, we aim to analyze and optimize the efficiency of two MREIT pulse sequences for in-vivo brain imaging.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance, University of Tubingen
Authors: Göksu, C. (Intern), Hanson, L. G. (Intern), Ehses, P. (Ekstern), Thielischer, A. (Intern), Scheffler, K. (Ekstern)
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Main Research Area: Technical/natural sciences
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esmrm2016.076024d.NORMAL.pdf
EfficiencyAnalysisOfMagneticFieldMeasurementsForMREIT_ESMRMB2016.pdf

Efficiency of Switch-Mode Power Audio Amplifiers - Test Signals and Measurement Techniques

Switch-mode technology is greatly used for audio amplification. This is mainly due to the great efficiency this technology offers. Normally the efficiency of a switch-mode audio amplifier is measured using a sine wave input. However this paper shows that sine waves represent real audio very poorly. An alternative signal is proposed for test purposes. The efficiency of a switch-mode power audio amplifier is modelled and measured with both sine wave and the proposed test signal as inputs. The results show that the choice of switching devices with low on resistances are unfairly favored when measuring the efficiency with sine waves. A 10% efficiency improvement was found for low power outputs. It is therefore of great importance to use proper test signals when measuring the efficiency.

General information
State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Iversen, N. E. (Intern), Knott, A. (Intern), Andersen, M. A. E. (Intern)
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Efficiency_of_Switch_Mode_Power_Audio_Amplifiers_post_print.pdf
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Efficiency Study of Vertical Distance Variations in Wireless Power Transfer for E-Mobility

A Wireless Power Transfer (WPT) system is a safe, convenient and smart charging solution for Electric Vehicle (EV) users. However, a drawback of WPT systems is reduced efficiency in comparison to conventional wired charging due to lower coupling. By increasing the volume of EVs in the market, improving the system efficiency even a few percent, beside of being environmentally suitable, will benefit both consumers and distributors. According to the previous studies, efficiency improvement by decreasing the vertical distance (VD) between transmitter (TX) and receiver (RX) coils, has been one of the aims of the companies and universities. However, in low VD, system performance becomes highly sensitive, due to the magnetic coupling strength. The focus of this paper is to analyze the effects of decreasing the vertical distances to WPT resonance tank efficiency’s. Finally, some of the most significant parameters that affect the system efficiency at low VD such as quality factor and third harmonic interference are analyzed and a mitigating approach is proposed.

General information
Efficiency Test Method for Electric Vehicle Chargers

This paper investigates different methods for measuring the charger efficiency of mass produced electric vehicles (EVs), in order to compare the different models. The consumers have low attention to the loss in the charger though the impact on the driving cost is high. It is not a high priority area for the Original Equipment Manufacturer (OEM), which means the cost of the power converter equipment is minimised. The internal wiring and the composition of components within an EV is different for each OEM and model, hence a unified test method is needed in order to compare results across different vehicles. A unified method for testing the efficiency of the charger in EVs, without direct access to the component, is presented. The method is validated through extensive tests of the models Renault Zoe, Nissan LEAF and Peugeot iOn. The results show a loss between 15 % and 40 %, which is far above the state of the art power converters. This is an unnecessary high consumption of electrical energy during charging, which not only affects the consumer financially, but also creates unnecessary load on the grid.

Efficient Control of Active Transformers for Increasing the PV Hosting Capacity of LV Grids

The increased penetration of grid-connected photovoltaic (PV) systems in low voltage (LV) grids creates concerns about overvoltage in these grids. The proposed methods to prevent overvoltage, such as reactive power absorption by PV inverters and active power management of customers, focus on decreasing the voltage rise along LV feeders, and the potential of active medium voltage to low voltage (MV/LV) transformers for overvoltage prevention has not been thoroughly investigated. This paper presents the application of active MV/LV transformers for increasing the PV hosting capacity of LV grids. The potential interferences between the operation of active transformers and the reactive power absorption by PV inverters are investigated, and a voltage droop control approach is proposed for the efficient control of these transformers during high PV generation periods. The proposed method can potentially increase the PV hosting capacity of the grid, while eliminating the need for a complex and centralized controller. The voltages of specific locations or the grid state estimations provide adequate data for adjustments of the droop parameters. The simulations and field test results associated with the implementation of the proposed method to a newly developed active LV grid with high PV penetration in Felsberg, Germany, confirm the efficiency of the proposed method.
Photovoltaic (PV) systems are among the renewable sources that electrical energy systems are adopting with increasing frequency. The majority of already-installed PV systems are decentralized units that are usually connected to low-voltage (LV) distribution grids. The PV hosting capacity of an LV grid is usually limited by overvoltage, and the efficient control of distributed electrical energy storage systems (EESs) can considerably increase this capacity. In this paper, a new control approach based on the voltage sensitivity analysis is proposed to prevent overvoltage and increase the PV hosting capacity of LV grids by determining dynamic set points for EESS management. The method has the effectiveness of central control methods and can effectively decrease the energy storage required for overvoltage prevention, yet it eliminates the need for a broadband and fast communication. The net power injected into the grid and the amount of reactive power absorbed by PV inverters are estimated using the PV generation forecast and load consumption forecast, and the dynamic operating points for energy storage management are determined for a specific period of time by solving a linear optimization problem. Simulations performed on a realistic LV feeder of the Danish island Bornholm verify the performance of the proposed method.

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Organisations: Department of Electrical Engineering, Center for Electric Power and Energy
Authors: Hashemi Toghroljerdi, S. (Intern), Østergaard, J. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 7.92 SJR 2.73 SNIP 2.837
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 3.424 SNIP 3.284 CiteScore 8.48
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.582 SNIP 3.687 CiteScore 7.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.581 SNIP 4.642 CiteScore 9.88
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 1.797 SNIP 6.273 CiteScore 13.33
ISI indexed (2012): ISI indexed no
Efficient Modelling Methodology for Reconfigurable Underwater Robots

This paper considers the challenge of applying reconfigurable robots in an underwater environment. The main result presented is the development of a model for a system comprised of N, possibly heterogeneous, robots dynamically connected to each other and moving with 6 Degrees of Freedom (DOF). This paper presents an application of the Udwadia-Kalaba Equation for modelling the Reconfigurable Underwater Robots. The constraints developed to enforce the rigid connection between robots in the system is derived through restrictions on relative distances and orientations. To avoid singularities in the orientation and, thereby, allow the robots to undertake any relative configuration the attitude is represented in Euler parameters.
Efficient topology optimisation of multiscale and multiphysics problems

The aim of this Thesis is to present efficient methods for optimising high-resolution problems of a multiscale and multiphysics nature. The Thesis consists of two parts: one treating topology optimisation of microstructural details and the other treating topology optimisation of conjugate heat transfer problems.

Part I begins with an introduction to the concept of microstructural details in the context of topology optimisation. Relevant literature is briefly reviewed and problems with existing methodologies are identified. The proposed methodology and its strengths are summarised.

Details on the proposed methodology, for the design of structures with periodic and layered microstructural details, are given and the computational performance is investigated. It is shown that the used spectral coarse basis preconditioner, and its associated basis reutilisation scheme, significantly reduce the computational cost of treating structures with fully-resolved microstructural details.

The methodology is further applied to examples, where it is shown that it ensures connectivity of the microstructural details and that forced periodicity of the microstructural details can yield an implicit robustness to load position. An example of expansion control of a structure under compression is treated in detail, where it is shown that taking boundary effects into account is paramount.

Part II starts with an introduction to conjugate heat transfer and briefly reviews relevant literature. The governing equations used to describe heat transfer and fluid flow are outlined, describing both a commonly-used simplified convection model and the full natural convection model.

Topology optimisation using the simplified model is investigated as a means to reduce the computational time of optimising heat sinks. The model is shown to be useful in an industrial context to provide a first approximation in the design of heat sinks. However, serious flaws and drawbacks of combining the model with topology optimisation are identified.

In order to take full advantage of topology optimisation for providing insight into optimal design of heat sinks, a full conjugate heat transfer model is introduced. Optimised heat sinks are presented for both two- and three-dimensional natural convection problems, where similarities and differences are discussed. Generally, the observations are in line with classical heat sink design, but topology optimisation spawns designs exhibiting optimal characteristics without any prerequisite knowledge. Furthermore, it is shown that when using the full model, the local convection coefficients and surface fluxes are in direct disagreement with the assumptions of the simplified model.

The computational performance and scalability of the developed framework is presented and it is shown that it allows for efficient optimisation of problems with more than 300 million degrees of freedom and almost 30 million design variables. Finally, the framework is used to generate novel passive coolers for light-emitting diode (LED) lamps, where a 20 − 25% lower temperature of the LED package is achieved as compared to reference designs, using around 16% less material.
Electric-Coupled Antenna for Hearing-Instrument Applications

An electrically small, electric coupled antenna that operates at the 2.4 GHz ISM band has been designed for hearing instrument applications. The antenna consists of a driven monopole and a coupled structure that is separated by an air gap. The input reflection coefficient S11 is measured and compared to the simulated results. Investigation of the antenna center frequency, reflection coefficient, and efficiency sensitivity to the position of the coupled element is performed. Simulated and measured results suggest that the antenna is a suitable candidate for hearing instrument applications.

Electricity Markets Ontology to Support MASCEM's Simulations

Power systems worldwide are complex and challenging environments. The increasing necessity for an adequate integration of renewable energy sources is resulting in a rising complexity in power systems operation. Multi-agent based simulation platforms have proven to be a good option to study the several issues related to these systems, including the involved players that act in this domain. To take better advantage of these systems, their integration is mandatory. The main contribution of this paper is the development of the Electricity Markets Ontology, which integrates the essential concepts necessary to interpret all the available information related to electricity markets, while enabling an easier cooperation and adequate communication between related systems. Additionally, the concepts and rules defined by this ontology can be extended and complemented according to the needs of other simulation and real systems in this area. Each system's particular ontology must import the proposed ontology, thus enabling the effective interoperability between independent systems.
Electric vehicle fleet management in smart grids: A review of services, optimization and control aspects

Electric vehicles can become integral parts of a smart grid, since they are capable of providing valuable services to power systems other than just consuming power. On the transmission system level, electric vehicles are regarded as an important means of balancing the intermittent renewable energy resources such as wind power. This is because electric vehicles can be used to absorb the energy during the period of high electricity penetration and feed the electricity back into the grid when the demand is high or in situations of insufficient electricity generation. However, on the distribution system level, the extra loads created by the increasing number of electric vehicles may have adverse impacts on grid. These factors bring new challenges to the power system operators. To coordinate the interests and solve the conflicts, electric vehicle fleet operators are proposed both by academics and industries. This paper presents a review and classification of methods for smart charging (including power to vehicle and vehicle-to-grid) of electric vehicles for fleet operators. The study firstly presents service relationships between fleet operators and other four actors in smart grids; then, modeling of battery dynamics and driving patterns of electric vehicles, charging and communications standards are introduced; after that, three control strategies and their commonly used algorithms are described; finally, conclusion and recommendations are made.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Energy System Management, Automation and Control, EDF Lab Clamart, Instituto Politécnico do Porto
Authors: Hu, J. (Intern), Morais, H. (Ekstern), Sousa, T. (Ekstern), Lind, M. (Intern)
Pages: 1207–1226
Publication date: 2016
Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
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Scopus rating (2017): CiteScore 10.54 SJR 3.036 SNIP 3.594
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.52 SJR 2.998 SNIP 3.501
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.921 SNIP 3.368 CiteScore 8.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.03 SNIP 3.72 CiteScore 7.79
Web of Science (2014): Indexed yes
Electromagnetic Fields at the Surface of Human-Body Cylinders

The electromagnetic fields around an infinitely long cylinder with different material parameters are analyzed. The cylinder is modeled as muscle, skin, fat, and perfect electric conductor respectively. The cylinder is illuminated by a plane wave incident from different angles and with both transverse electric and transverse magnetic polarization. The results show that the material assumption when modeling the human body as a homogeneous material is very important. Furthermore, it is shown that one assumption might lead to higher fields for a specific polarization, angle of incidence and frequency, but that does not translate to similar relative performance at another polarization, angle of incidence, and frequency.

**General information**

**State:** Published
**Organisations:** Department of Electrical Engineering, Electromagnetic Systems, GN ReSound A/S
**Authors:** Kammersgaard, N. P. I. (Intern), Kvist, S. H. (Ekstern), Thaysen, J. (Ekstern), Jakobsen, K. B. (Intern)
**Pages:** 170-173
**Publication date:** 2016

**Host publication information**

**Title of host publication:** Proceedings of the 2016 International Workshop on Antenna Technology
**Publisher:** IEEE Press
**ISBN (Print):** 978-1-5090-0267-2
Elimination of Second-Harmonics in CMUTs using Square Pulse Excitation

The harmonic imaging mode is today a fundamental part of ultrasound imaging; it is not only used for suppressing the grating lobe artifact, but also to reduce many other acoustical artifacts in the ultrasound image. A vital performance parameter for accepting CMUT probes as a clinical usable transducer technology is, that it can support harmonic imaging. The large bandwidth of the CMUT is a clear advantage for harmonic imaging, but the inherent nonlinear behavior of the CMUT poses an issue as it is difficult to dissociate the harmonics generated in the tissue from the harmonic content of the transmitted signal. This work presents how proper pulse coding of a bipolar pulser, which is present in most commercial ultrasound scanners, can reduce the intrinsic generated harmonic to fundamental pressure amplitude ratio to below $-35$ dB, making CMUT probes usable for clinical applications.

Ellipsoidal reflector for measuring otoacoustic emissions

Otoacoustic emissions (OAEs) are low-intensity sounds present in the ear canal, generated by mechanical processing in the cochlear in the inner ear. OAEs provide a noninvasive technique to sense the mechanical processing of sound in the inner ear. These signals are commonly measured by placing a miniature microphone into the ear canal of the listener. Such small microphones have however a self-noise at frequencies below 1 kHz that is comparable in intensity with typical intensities of OAEs at frequencies above 1 kHz. Due to this fact, not much is known about the presence or absence of OAEs, and especially SOAE at these low frequencies. In addition, blocking of the ear canal changes the impedance of the middle ear, potentially changing the transmission of acoustical energy from the inner ear to the ear canal, hampering the interpretation of the data in terms of normal listening conditions with open ear canal. This study presents the design and evaluation of a truncated prolate ellipsoidal reflector in combination with a large-diaphragm low-noise microphone to measure OAEs in the open ear canal of human listeners. The reflector was designed to gain information about BM processing at low frequencies where miniature microphones are not easily applicable. Acoustical evaluation of the reflector shows a focusing effect of sound from one focal point into the other focal point. Partial removal of elements of the reflector allow to control multiple reflections between the microphone membrane and the ear canal. Spontaneous-and distortion-product OAEs show similar amplitudes and an improved noise floor at frequencies below 2 kHz compared to a commercially available OAE probe. The advantages and physical limitations of this system to measure OAEs in listeners with open ear canal and at low frequencies will be discussed.
**EMC Investigation of a Very High Frequency Self-oscillating Resonant Power Converter**

This paper focuses on the electromagnetic compatibility (EMC) performance of a Very High Frequency (VHF) converter and how to lower the emissions. To test the EMC performance a VHF converter is implemented with a Class-E inverter and a Class-DE rectifier. The converter is designed to deliver 3 W to a 60 V LED, it has a switching frequency of 37 MHz and achieves an efficiency of 80%. For an LED driver to be used on the consumer market it has to fulfil the standard regarding EMC emissions. The conducted emission is often used as a reason to increase the switching frequency to the VHF range to avoid the regulations. This converter shows to be well below the levels for conducted emission even without filtering. For the radiated emissions the converter is above the limits without input and output filters. Several designs with different ways to lower the emissions are implemented and the different layouts and filtering are compared and discussed.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electronics
Authors: Pedersen, J. A. (Intern), Knott, A. (Intern), Andersen, M. A. E. (Intern)
Pages: 1541-1546
Publication date: 2016

**EMC, RF, and Antenna Systems in Miniature Electronic Devices**

Advanced techniques for the control of electromagnetic interference (EMI) and for the optimization of the electromagnetic compatibility (EMC) performance has been developed under the constraints typical of miniature electronic devices (MED). The electromagnetic coexistence of multiple systems and their mutual interaction have been the underlying theme of the work. The research results concern different aspects related to the integration of radio-frequency (RF) electronics in MEDs and hearing instruments (HI). To control internal EMI, a novel near-field parasitic resonator (NFPR) has been researched. The structure allows for effective suppression of radiation from the MED, while taking into consideration the integration and miniaturization aspects. To increase the sensitivity of the system, a compact LNA suitable for on-body applications has been developed. The LNA allows for an increase in the overall sensitivity of a system comprised of two HIs communicating among them. To optimize the on-body and off-body communication links of HIs, a novel wearable antenna was designed. The design originates from considerations about the EM environment where the antenna operates. An EMC-robust alternative to the on-body link was investigated through the use of body-coupled communications (BCC) and integrated with the antenna in a unique system. Overall, the novel researched solutions effectively addressed a set of intraand inter-system EMI and EMC issues, as dictated by the complexity of emerging modern miniature electronics.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems, GN ReSound A/S
Authors: Ruaro, A. (Intern), Jakobsen, K. B. (Intern), Thaysen, J. (Ekstern)
Number of pages: 137
Publication date: 2016
Endothelial derived hyperpolarization in vivo in hypertensive rats

General information
State: Published
Organisations: Department of Electrical Engineering, Biomedical Engineering, University of Copenhagen
Authors: Brasen, J. C. (Intern), Stannov, S. U. (Ekstern), Salomonsson, M. (Ekstern), Sorensen, C. M. (Ekstern)
Publication date: 2016
Conference: Experimental Biology 2016 Meeting, San Diego, United States, 02/04/2016 - 02/04/2016
Main Research Area: Technical/natural sciences

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Scopus rating (2017): CiteScore 4.53 SJR 2.438 SNIP 1.2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.68 SJR 2.694 SNIP 1.239
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.831 SNIP 1.273 CiteScore 4.68
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.049 SNIP 1.355 CiteScore 4.92
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.188 SNIP 1.431 CiteScore 5.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.147 SNIP 1.469 CiteScore 5.6
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 3.141 SNIP 1.581 CiteScore 5.4
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.519 SNIP 1.605
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.933 SNIP 1.344
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 3.132 SNIP 1.23
EnergyLab Nordhavn – Progress and Physical Implementation

EnergyLab Nordhavn is a large-scale integrated research and demonstration project that contributes to the grand challenge of transforming the energy system to efficiently integrate a large share of renewable energy. The project focuses on a cost-effective future smart energy system that integrates multiple energy infrastructures (electricity, thermal, transportation) and provides an intelligent control of subsystems and components – providing necessary flexibility for efficient utilisation of renewable energy. The project results will be based on combining a number of elements established or under establishment in Copenhagen’s Nordhavn, one of the largest development districts in Europe. With a diverse set of such elements in the electrical and heating grids, in the built environment, and involving citizens in the area, the EnergyLab Nordhavn project is well on the way to establish itself as a living laboratory and an environment for strong research-based innovation in smart energy technologies, innovative business models and energy management tools for the future sustainable low-energy city districts. Particularly exciting is the synergy between the physical density of the environment in Nordhavn, the “settler attitude” of the new local population, new trends of co-creation and participation, new tools creating awareness on carbon footprint and other environmental impact. EnergyLab Nordhavn partners are DTU BYG, DTU MEK, DTU CEE, Københavns Kommune, DONG Energy Electricity Distributions, HOFOR, By&Havn, ABB, Danfoss, Balslev, MetroTherm, Glen Dimplex, CleanCharge and the PowerLab facilities. The project has a total budget of € 19 mio, of which € 11 mio are funded in two rounds by the Danish Energy Technology Development and Demonstration Programme (EUDP).

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Department of Civil Engineering, Section for Indoor Climate and Building Physics, HOFOR A/S
Authors: Greisen, C. (Intern), Honoré, K. (Ekstern), Foteinaki, K. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
Sustain Abstract L-4
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Energy Optimization for Distributed Energy Resources Scheduling with Enhancements in Voltage Stability Margin

The need for developing new methodologies in order to improve power system stability has increased due to the recent growth of distributed energy resources. In this paper, the inclusion of a voltage stability index in distributed energy resources scheduling is proposed. Two techniques were used to evaluate the resulting multiobjective optimization problem: the sum-weighted Pareto front and an adapted goal programming methodology. With this new methodology, the system operators can consider both the costs and voltage stability. Priority can be assigned to one objective function according to the operating scenario. Additionally, it is possible to evaluate the impact of the distributed generation and the electric vehicles in the management of voltage stability in the future electric networks. One detailed case study considering a distribution network with high penetration of distributed energy resources is presented to analyse the proposed methodology. Additionally, the methodology is tested in a real distribution network.
General information
State: Published
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.279 SNIP 0.5 CiteScore 0.77
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.285 SNIP 0.564 CiteScore 0.74
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.287 SNIP 0.606 CiteScore 0.79
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.289 SNIP 0.886 CiteScore 1.14
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.363 SNIP 0.947 CiteScore 1.22
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.417 SNIP 0.749 CiteScore 0.92
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.233 SNIP 0.565
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.258 SNIP 0.44
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.313 SNIP 0.553
Scopus rating (2007): SJR 0.275 SNIP 0.492
Scopus rating (2006): SJR 0.237 SNIP 0.732
Scopus rating (2005): SJR 0.297 SNIP 0.702
Scopus rating (2004): SJR 0.263 SNIP 0.463
Scopus rating (2003): SJR 0.261 SNIP 0.493
Scopus rating (2002): SJR 0.351 SNIP 0.313
Scopus rating (2001): SJR 0.222 SNIP 0.561
Scopus rating (2000): SJR 0.221 SNIP 0.545
Scopus rating (1999): SJR 0.19 SNIP 0.34

Original language: English
Distributed power generation, Power system control, Optimisation techniques, distributed power generation, electric vehicles, mathematical programming, Pareto optimisation, power generation scheduling, power system stability, distribution network, voltage stability management, electric vehicle, distributed generation, objective function, adapted goal programming methodology, sum-weighted Pareto front, multiobjective optimization problem, voltage stability index, voltage stability margin, energy optimization, distributed energy resource scheduling
Enhanced Situational Awareness and Decision Support for Operators of Future Distributed Power Network Architectures

This paper describes scenarios proposed for a control room decision support system aimed at future power network operators. The purpose is to consider the requirements of the future control room from the perspective of the operator under the conditions of a significant frequency excursion incident. The control room visualisation and decision support functionality for aiding the operator in restoring the frequency to its target value will be considered. The analysis takes place within the Web-of-Cells framework, adopted to deal with power system control through a web of subsystems, called cells, which are highly automated, and operated by Cell Operators.

General information
State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources, Energy System Management, University of Strathclyde
Authors: Zaher, A. S. A. E. (Ekstern), Catterson, V. M. (Ekstern), Syed, M. H. (Ekstern), McArthur, S. (Ekstern), Burt, G. M. (Ekstern), Marinelli, M. (Intern), Prostejovsky, A. (Intern)
Number of pages: 6
Publication date: 2016

Enhancing predicted efficacy of tumor treating fields therapy of glioblastoma using targeted surgical craniectomy: A computer modeling study

Objective: The present work proposes a new clinical approach to TTFields therapy of glioblastoma. The approach combines targeted surgical skull removal (craniectomy) with TTFields therapy to enhance the induced electrical field in the underlying tumor tissue. Using computer simulations, we explore the potential of the intervention to improve the clinical efficacy of TTFields therapy of brain cancer. Methods: We used finite element analysis to calculate the electrical field distribution in realistic head models based on MRI data from two patients: One with left cortical/subcortical glioblastoma and one with deeply seated right thalamic anaplastic astrocytoma. Field strength was assessed in the tumor regions before and after virtual removal of bone areas of varying shape and size (10 to 100 mm) immediately above the tumor. Field strength was evaluated before and after tumor resection to assess realistic clinical scenarios. Results: For the superficial tumor, removal of a standard craniotomy bone flap increased the electrical field strength by 60-70% in the tumor. The percentage of tissue in expected growth arrest or regression was increased from negligible values to 30-50%. The observed effects were highly focal and targeted at the regions of pathology underlying the craniectomy. No significant changes were observed in surrounding healthy tissues. Median field strengths in tumor tissue increased with increasing craniectomy diameter up to 50-70 mm. Multiple smaller burr holes were more efficient than single craniectomies of equivalent area. Craniectomy caused no significant field enhancement in the deeply seated tumor, but rather a focal enhancement in the brain tissue underlying the skull defect. Conclusions: Our results provide theoretical evidence that small and clinically feasible craniectomies may provide significant enhancement of TTFields intensity in cerebral
hemispheric tumors without severely compromising brain protection or causing unacceptable heating in healthy tissues. A clinical trial is being planned to validate safety and efficacy.

**General information**

State: Published

Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, Aarhus University, University of Copenhagen


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- BFI (2017): BFI-level 1
- Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.11 SJR 1.236 SNIP 1.101
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.427 SNIP 1.136 CiteScore 3.32
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.559 SNIP 1.148 CiteScore 3.54
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.772 SNIP 1.153 CiteScore 3.94
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.982 SNIP 1.156 CiteScore 4.15
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 2.425 SNIP 1.233 CiteScore 4.58
- ISI indexed (2011): ISI indexed no
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 2.705 SNIP 1.178
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 2.614 SNIP 1.046
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 2.506 SNIP 1.006
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.379 SNIP 0.537
- Web of Science (2006): Indexed yes
Enhancing the Role of Electric Vehicles in the Power Grid: Field Validation of Multiple Ancillary Services

With increased penetration of distributed energy resources and electric vehicles (EVs), different EV integration strategies can be used for mitigating various adverse effects, and supporting the grid. However, the research regarding EV smart charging has mostly remained on simulations, whereas the experimental validation has rarely been touched upon. This paper focuses mainly on evaluating the technical feasibility of a series-produced EV to provide flexibility in real distribution grids. The implemented controller uses contemporary and widely supported standards for limiting the EV charging rate, which essentially means it is applicable to any EV complying with IEC 61851 and SAE J1772 standards. The field test validation is conducted in a real Danish distribution grid with a Nissan Leaf providing three ancillary services through unidirectional AC charging, namely congestion management, local voltage support, and primary frequency regulation. Several performance parameters, such as EV response time and accuracy, are assessed and benchmarked with current requirements. Ultimately, the paper aims to strengthen the applied research within the EV integration domain through validating smart grid concepts on original standard-compliant equipment.

General information

State: Published
Organisations: Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources
Authors: Knezovic, K. (Intern), Martinenas, S. (Intern), Andersen, P. B. (Intern), Zecchino, A. (Intern), Marinelli, M. (Intern)
Pages: 201 - 209
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: IEEE Transactions on Transportation Electrification
Volume: 3
Issue number: 1
ISSN (Print): 2332-7782
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Web of Science (2016): Indexed yes
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Electronic versions:
MANUSCRIPT_TTE_Reg_2016_05_0112.pdf
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Relations

Projects:
Enhancing the Role of Electric Vehicles in the Power Grid: Field Validation of Multiple Ancillary Services

Ensemble regression model-based anomaly detection for cyber-physical intrusion detection in smart grids

The shift from centralised large production to distributed energy production has several consequences for current power system operation. The replacement of large power plants by growing numbers of distributed energy resources (DERs) increases the dependency of the power system on small scale, distributed production. Many of these DERs can be
accessed and controlled remotely, posing a cybersecurity risk. This paper investigates an intrusion detection system which evaluates the DER operation in order to discover unauthorized control actions. The proposed anomaly detection method is based on an ensemble of non-linear artificial neural network DER models which detect and evaluate anomalies in DER operation. The proposed method is validated against measurement data which yields a precision of 0.947 and an accuracy of 0.976. This improves the precision and accuracy of a classic model-based anomaly detection by 75.7% and 9.2%, respectively.

**General information**

State: Published
Organisations: Center for Electric Power and Energy, Energy System Management, Risø National Laboratory for Sustainable Energy, Department of Electrical Engineering, Department of Informatics and Mathematical Modeling
Authors: Kosek, A. M. (Intern), Gehrke, O. (Intern)
Number of pages: 7
Pages: 1-7
Publication date: 2016

**Estimating the Permittivity of Rogers 4003C Substrate at Low Frequencies for Application in a Superdirective First-Order Probe for SNF Measurements**

The bulk permittivity of Rogers 4003C substrate is estimated in the lower UHF frequency band by comparing the simulated and measured return loss for a bandpass filter based on a coplanar waveguide and a capacitively loaded loop. The obtained value, which deviates from that specified by Rogers at 10 GHz, is subsequently utilized for accurate design of a new light-weight superdirective first-order probe for spherical near-field (SNF) antenna measurements at low frequencies.

**General information**

State: Published
Organisations: Department of Electrical Engineering, Electromagnetic Systems
Authors: Kim, O. S. (Intern)
Pages: 349-351
Publication date: 2016

**European cold season lightning map for wind turbines based on radio soundings**

In this paper, the meteorological data of cold season thunderstorms in Japan and Spain are reviewed to determine the threshold conditions at which cold season lightning was recorded in the past. The variables investigated are the height of the -10°C and 0°C isotherms above ground, the wind velocity, the precipitable water in the cloud, and the wind direction.
Meteorological data of 72 radio sounding stations in Europe is analyzed for a 5 year period (2009-2014) in the months from October until March. Based on this information, a European map has been created indicating areas where the meteorological conditions for self-triggered upward lightning, as being observed in Japan and Spain, are identified. This map may give an indication if a potential wind power plant or structure has the risk to be affected by frequent lightning attachments in the cold season which are predominantly upward initiated. The advantage of using meteorological parameters to define cold season thunderstorm areas is the independence of Lightning Location Systems (LLS), which are limited to detect upward lightning. Additionally, meteorological data is publicly available.

**General information**

**State:** Published  
**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Electric Equipment Technologies, Global Lightning Protection Services A/S  
**Authors:** Vogel, S. (Intern), Holbøll, J. (Intern), López, J. (Ekstern), Garolera, A. C. (Ekstern), Madsen, S. F. (Ekstern)  
**Number of pages:** 7  
**Publication date:** 2016  

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**Title of host publication:** Proceedings of International Colloquium on Lightning and Power Systems  
**Publisher:** CIGRE Conseil international des grands réseaux électriques  
**Main Research Area:** Technical/natural sciences  
**Conference:** International Colloquium on Lightning and Power Systems, Bologna, Italy, 27/06/2016 - 27/06/2016  
**Upward Lightning, Tall structures, Wind turbines, Winter lightning, Cold season lightning, Radio sounding**

**Evaluating price-based demand response in practice – with application to the EcoGrid EU Experiment**

Increased emphasis is placed today on various types of demand response, motivated by the integration of renewable energy generation and efficiency improvements in electricity markets. Some advocated for the development of price-based approaches, where the conditional dynamic elasticity of final users is exploited in the power system, e.g. for system balancing. However, very few real-world experiments have been carried out and price-based demand response has consistently been found difficult to assess and quantify. It is our aim here to describe an approach to do so, as motivated by the large-scale EcoGrid EU experiment. In this project, 1900 houses were equipped with smart meters and other automation devices in order to adapt consumption to real-time electricity prices every five minutes, while monitoring it with the same resolution. Our approach first relies on the clustering of residential load observations that behave similarly within a given experiment. Then, a clinical testing approach, based on a test and a control group, is adapted to assess whether price-responsive loads were actually responsive or not. Interestingly, in the deployment phase of the project, the results show that houses could be deemed price-responsive on some test days, while results were inconclusive on some others.

**General information**

**State:** Published  
**Organisations:** Department of Applied Mathematics and Computer Science, Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets  
**Authors:** Le Ray, G. (Intern), Larsen, E. M. (Intern), Pinson, P. (Intern)  
**Pages:** 2304 - 2313  
**Publication date:** 2016  
**Main Research Area:** Technical/natural sciences  

**Publication information**

**Journal:** IEEE Transactions on Smart Grid  
**Volume:** 9  
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**BFI (2018):** BFI-level 2  
**Web of Science (2018):** Indexed yes  
**BFI (2017):** BFI-level 1  
**Scopus rating (2017):** CiteScore 9.02 SJR 2.854 SNIP 2.995  
**Web of Science (2017):** Indexed yes  
**BFI (2016):** BFI-level 1  
**Scopus rating (2016):** CiteScore 7.92 SJR 2.73 SNIP 2.837  
**Web of Science (2016):** Indexed yes  
**BFI (2015):** BFI-level 1
Evaluating the auralization of a small room in a virtual sound environment using objective room acoustic measures

To study human auditory perception in realistic environments, loudspeaker-based reproduction techniques have recently become state-of-the-art. To evaluate the accuracy of a simulation-based room auralization of a small room, objective measures, such as early-decay-time (EDT), reverberation time, clarity, interaural cross-correlation (IACC), and the speech transmission index were measured in an IEC listening room for 28 source-receiver combinations. The room was then modeled in the room acoustics software ODEON, and the same objective measures were also evaluated for the auralized version of the room. The auralizations were generated using the loudspeaker-based room auralization toolbox (LoRA; Favrot and Buchholz, 2010) and reproduced in a 64-channel loudspeaker array, set up in an anechoic chamber. Differences between the objective measures evaluated in the real and the virtual room were within about twice the just-noticeable differences for most measures, and were comparable to the median results of the study by Favrot and Buchholz, who did not consider the contribution of a real reproduction system. However, the EDT showed considerably higher errors than the other measures, even though medians were similar in the real and auralized room. This suggests that fine details in the early part of the room impulse response may be difficult to reproduce accurately.

General information
State: Published
Organisations: Department of Electrical Engineering, Hearing Systems
Authors: Ahrens, A. (Intern), Marschall, M. (Intern), Dau, T. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: The Journal of the Acoustical Society of America
Volume: 140
Issue number: 4
ISSN (Print): 0001-4966
Ratings:
BFI (2018): BFI-level 2
when we are in what we call the "state of play". Further, the thesis gives an account of an important finding in playware to present we in play we have a special attitude towards the world, and this frames our understanding of actions done for enjoyment it brings, or, as it is formulated: The purpose of play is play itself. From this understanding, the thesis goes on to investigate how the MOTO tiles as an example of playware and exergames created play among the users. This was realized using higher-order ambisonics (HOA), mixed-order ambisonics (MOA), and a nearest-loudspeaker method (NL) and reproduced in a virtual sound environment.

The trials and shows that the participants saw statistically significant improvements on the balance score ("Line Walk") with an impressive increase of 149% in score after adjusting for the outlier. Besides the physical tests, the pilots and shows that the participants saw statistically significant improvements on the balance score ("Line Walk") and one was unaffected (no difference in the test “Timed Up & Go”), while one was unaffected (no difference in the test “Chair Stand”) and another that had indications that there could be an important clinical finding (a decrease of 12% in score in the test “Timed Up & Go”), while one was unaffected (no difference in the test “6 Minutes Walking Test”). The author concludes that more studies are still needed and that higher power of the studies should be considered or meta-analysis on several trials combined. The trial additionally confirms the findings from the pilot tests and shows that the participants saw statistically significant improvements on the balance score (“Line Walk” or "Tandem Walk") with an impressive increase of 149% in score after adjusting for the outlier. Besides the physical tests, the participants answered a questionnaire, and here the findings showed that the vast majority of the participants enjoyed the training and wanted to continue using the MOTO tiles. Over half also indicated that they felt better and 75% indicated that they had improved physically. This shows that playware such as the MOTO tiles can promote health and, not least, that this can be done in a playful and thus, motivational manner. Taking these findings as the point of departure, the thesis further investigates how the MOTO tiles as an example of playware and exergames created play among the users. This investigation begins with a presentation of the concept of play, based on the philosophy of play that is the foundation of modern game research. Play is here understood as something we humans engage in for nothing else than the sake of the enjoyment it brings, or, as it is formulated: The purpose of play is play itself. From this understanding, the thesis goes on to present we in play we have a special attitude towards the world, and this frames our understanding of actions done when we are in what we call the "state of play". Further, the thesis gives an account of an important finding in playware...
research, that in order to get into the state of play we use “play tools”, such as games, toys etc. This finding is further developed in the thesis by applying the Actor Network Theory (ANT) as a framework for analysis, by which the author reaches a new understanding of games as “actors” which encourage their players to act in certain prescribed ways, with the goal of bringing them into the state of play. This brings a new perspective on games and gives a framework to understand how play tools work. Developing on these findings, the thesis then presents the notion of “play dynamics” that is, dynamics, which play tools make use of to bring players into the state of play. Examples of such dynamics are presented, and the thesis points to the need to further develop our understanding of play dynamics, the different types of dynamics and how they work together to create new dynamics and effects.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Centre for Playware, Copenhagen Center for Health Technology
Authors: Jessen, J. D. (Intern), Lund, H. H. (Intern)
Number of pages: 276
Publication date: 2016

**Publication information**
Publisher: Technical University of Denmark, Department of Electrical Engineering
ISBN (Print): 978-87-92465-61-0
Original language: English
Main Research Area: Technical/natural sciences

**Relations**
Projects:
Evaluation and understanding of Playware Technology – trials with playful balance training.
Publication: Research › Ph.D. thesis – Annual report year: 2016

**Evaluation of a Modified High-Definition Electrode Montage for Transcranial Alternating Current Stimulation (tACS) of Pre-Central Areas**
Objective: To evaluate a modified electrode montage with respect to its effect on tACS-dependent modulation of corticospinal excitability and discomfort caused by neurosensory side effects accompanying stimulation. Methods: In a double-blind cross-over design, the classical electrode montage for primary motor cortex (M1) stimulation (two patch electrodes over M1 and contralateral supraorbital area) was compared with an M1 centre-ring montage. Corticospinal excitability was evaluated before, during, immediately after and 15 minutes after tACS (10 min., 20 Hz vs. 30 s low-frequency transcranial random noise stimulation). Results: Corticospinal excitability increased significantly during and immediately after tACS with the centre-ring montage. This was not the case with the classical montage or tRNS stimulation. Level of discomfort was rated on average lower with the centre-ring montage. Conclusions: In comparison to the classic montage, the M1 centre-ring montage enables a more focal stimulation of the target area and, at the same time, significantly reduces neurosensory side effects, essential for placebo-controlled study designs.

**General information**
State: Published
Organisations: Department of Electrical Engineering, Center for Magnetic Resonance, KU Leuven, Copenhagen University Hospital
Authors: Heise, K. F. (Ekstern), Kortzorg, N. (Ekstern), Saturnino, G. B. (Ekstern), Fujiyama, H. (Ekstern), Cuypers, K. (Ekstern), Thielscher, A. (Intern), Swinnen, S. P. (Ekstern)
Number of pages: 5
Pages: 700–704
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Brain Stimulation
Volume: 9
Issue number: 5
ISSN (Print): 1935-861X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Scopus rating (2017): SNIP 1.533 SJR 2.753 CiteScore 4.46
Evaluation of different initial solution algorithms to be used in the heuristics optimization to solve the energy resource scheduling in smart grids

Over the last years, an increasing number of distributed resources have been connected to the power system due to the ambitious environmental targets, which resulted into a more complex operation of the power system. In the future, an even larger number of resources is expected to be coupled which will turn the day-ahead optimal resource scheduling problem into an even more difficult optimization problem. Under these circumstances, metaheuristics can be used to address this optimization problem. An adequate algorithm for generating a good initial solution can improve the metaheuristic’s performance of finding a final solution near to the optimal than using a random initial solution. This paper proposes two initial solution algorithms to be used by a metaheuristic technique (simulated annealing). These algorithms are tested and evaluated with other published algorithms that obtain initial solution. The proposed algorithms have been developed as modules to be more flexible their use by other metaheuristics than just simulated annealing. The simulated annealing with different initial solution algorithms has been tested in a 37-bus distribution network with distributed resources, especially electric vehicles. The proposed algorithms proved to present results very close to the optimal with a small difference between 0.1%. A deterministic technique is used as comparison and it took around 26 h to obtain the optimal one. On the other hand, the simulated annealing was able of obtaining results around 1 min.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Polytechnic Institute of Porto, University of Lisbon
Authors: Sousa, T. (Ekstern), Morais, H. (Intern), Castro, R. (Ekstern), Vale, Z. (Ekstern)
Pages: 491-506
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Software, Electric vehicles, Hybrid metaheuristic, Optimal power scheduling, Simulated annealing, Virtual power player, Algorithms, Complex networks, Electric power transmission networks, Energy resources, Heuristic algorithms, Scheduling, Smart power grids, Deterministic technique, Distributed resources, Environmental targets, Hybrid Meta-heuristic, Meta-heuristic techniques, Optimal power, Optimization problems, Virtual power players, Optimization

DOIs:
10.1016/j.asoc.2016.07.028

Source: FindIt
Source-ID: 2306876704
Publication: Research - peer-review › Journal article – Annual report year: 2016

Evaluation of Electric Vehicle Charging Controllability for Provision of Time Critical Grid Services
Replacement of conventional generation by more stochastic renewable generation sources leads to reduction of inertia and controllability in the power system. This introduces the need for more dynamic regulation services. These faster services could potentially be provided by the growing number of electric vehicles. EVs are a fast responding energy resource with high availability. This work evaluates and experimentally shows the limits of EV charging controllability with...
the focus on its suitability for providing ancillary grid services. Three different series produced EVs are tested. The experimental testing is done by using charging current controllability of built-in AC charger to provide a primary frequency regulation service with very dynamic input frequency. The results show that most the controllability of most EVs is more than suitable for providing time critical grid services. Meanwhile, charging current ramping rates of recently produced EVs are potentially suitable to provide synthetic inertia.

**General information**

**State:** Published

**Organisations:** Department of Electrical Engineering, Center for Electric Power and Energy, Distributed Energy Resources

**Authors:** Martinenas, S. (Intern), Marinelli, M. (Intern), Andersen, P. B. (Intern), Træholt, C. (Intern)

**Number of pages:** 5

**Publication date:** 2016

**Host publication information**

**Title of host publication:** Proceedings of the 51st International Universities Power Engineering Conference

**Publisher:** IEEE

**ISBN (Print):** 9781509046508

**Main Research Area:** Technical/natural sciences

**Conference:** 51st International Universities Power Engineering Conference, Coimbra, Portugal, 06/09/2016 - 06/09/2016

**Electric Vehicles, Charging Stations, Power Control, Smart Grid**

**Electronic versions:** upec2016_full_v2.pdf

**DOIs:** 10.1109/UPEC.2016.8113989

**Source:** PublicationPreSubmission

**Source-ID:** 125324685

**Publication:** Research - peer-review › Article in proceedings – Annual report year: 2017

**Evaluation of healthy muscle tissue by strain and shear wave elastography – Dependency on depth and ROI position in relation to underlying bone**

**Purpose:** The aim of this study was to evaluate the influence of depth and underlying bone on strain ratios and shear wave speeds for three different muscles in healthy volunteers. For strain ratios the influence from different reference region-of-interest positions was also evaluated. Material and methods: Ten healthy volunteers (five males and five females) had their biceps brachii, gastrocnemius, and quadriceps muscle examined with strain- and shear wave elastography at three different depths and in regions located above bone and beside bone. Strain ratios were averaged from cine-loops of 10 s length, and shear wave speeds were measured 10 times at each target point. The distance from the skin surface to the centre of each region-of-interest was measured. Measurements were evaluated with descriptive statistics and linear regression. Results: Linear regression showed a significant influence on strain ratio measurements from the reference region-of-interest position, i.e. being above the same structures as the target region-of-interest or not (means: 1.65 and 0.78; \( P < 0.001 \)). For shear wave speeds, there was a significant influence from depth and location above or beside bone \( P = 0.011 \) and \( P = 0.031 \). Conclusion: Strain ratio values depend significantly on reference and target region-of-interest being above the same tissue, for instance bone. Strain ratios were not influenced by depth in this study. Shear wave speeds decreased with increasing scanning depth and if there was bone below the region-of-interest.

**General information**

**State:** Published

**Organisations:** Department of Information Technology, Department of Electrical Engineering, Biomedical Engineering, Center for Fast Ultrasound Imaging, Copenhagen University Hospital

**Authors:** Ewertsen, C. (Ekstern), Carlsen, J. F. (Ekstern), Christiansen, I. R. (Ekstern), Jensen, J. A. (Intern), Nielsen, M. B. (Ekstern)

**Pages:** 127-133

**Publication date:** 2016

**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Ultrasonics

**Volume:** 71

**ISSN (Print):** 0041-624X

**Ratings:**

**BFI (2018):** BFI-level 1

**Web of Science (2018):** Indexed yes

**BFI (2017):** BFI-level 1

**Scopus rating (2017):** SNIP 1.714 SJR 0.973 CiteScore 2.72

**Web of Science (2017):** Indexed Yes
Evaluation of Shipboard Wave Estimation Techniques through Model-scale Experiments

The paper continues a study on the wave buoy analogy that uses shipboard measurements to estimate sea states. In the present study, the wave buoy analogy is formulated directly in the time domain and relies only partly on wave-vessel response amplitude operators (RAOs), which is in contrast to all previous works that either are formulated in the frequency domain and/or depend entirely on RAOs. Specifically, the paper evaluates a novel concept for wave estimation based on combined techniques using a wave frequency estimator, not dependent on RAOs, to detect wave frequency and, respectively, nonlinear least squares fitting to estimate wave amplitude and phase. The concept has been previously tested with only numerical simulations but in this study the techniques are applied to model-scale experiments. It is shown
that the techniques successfully can be used to estimate the wave parameters of a regular wave train.
Acoustic Array Processing and Sound Field Analysis in Rooms

Department of Electrical Engineering
Period: 01/07/2018 → 30/06/2021
Number of participants: 3
Phd Student:
Verburg Riezu, Samuel Arturo (Intern)
Supervisor:
Agerkvist, Finn T. (Intern)
Main Supervisor:
Fernandez Grande, Efren (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Counteraction planning based on Multilevel Flow Modelling
Department of Electrical Engineering
Period: 01/07/2018 → 30/06/2021
Number of participants: 3
Phd Student:
Reinartz, Christopher Clarc (Intern)
Supervisor:
Lind, Morten (Intern)
Main Supervisor:
Ravn, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Improving cochlear implant performance with new pulse shapes: a multidisciplinary approach
Department of Electrical Engineering
Period: 01/07/2018 → 30/06/2020
Number of participants: 3
Phd Student:
Navntoft, Charlotte Amalie Emdal (Intern)
Supervisor:
Barkat, Tania Rinaldi (Ekstern)
Main Supervisor:
Marozeau, Jeremy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Audio-visual deep learning for hearing instrument control
Department of Electrical Engineering
Period: 01/06/2018 → 31/05/2021
Number of participants: 7
Phd Student:
Pedersen, Nicolai (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Hjortkjær, Jens (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Sparsø, Jens (Intern)
Fitzgerald, John S. (Ekstern)
Nielsen, Peter Østergaard (Ekstern)
Characterizing consequences of hearing impairment and hearing-aid on speech perception in competing-talker scenarios

Department of Electrical Engineering
Period: 01/06/2018 → 31/05/2021
Number of participants: 4
Phd Student: Mesiano, Paolo Attilio (Intern)
Supervisor: Pontoppidan, Niels Henrik Bohl (Intern)
Zaar, Johannes (Intern)
Main Supervisor: Dau, Torsten (Intern)

Deep learning in Medical Ultrasound Imaging

Department of Electrical Engineering
Period: 15/05/2018 → 14/05/2021
Number of participants: 4
Phd Student: Youn, Jihwan (Intern)
Supervisor: Stuart, Matthias Bo (Intern)
Winther, Ole (Intern)
Main Supervisor: Jensen, Jørgen Arendt (Intern)

Coordinated control for incorporating synchronous condensers in low inertia grids

Department of Electrical Engineering
Period: 01/05/2018 → 30/04/2021
Number of participants: 4
Phd Student: Kkuni, Kanakesh Vatta (Intern)
Supervisor: Booth, Campbell (Ekstern)
Ramachandran, Jayaraman (Ekstern)
Main Supervisor: Yang, Guangya (Intern)

Distributed and Modular Bio-Inspired Architecture for Motor Learning and Control
Department of Electrical Engineering  
Period: 01/05/2018 → 30/04/2021  
Number of participants: 4  
Phd Student:  
Capolei, Marie Claire (Intern)  
Supervisor:  
Falotico, Egidio (Ekstern)  
Tolu, Silvia (Intern)  
Main Supervisor:  
Lund, Henrik Hautop (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Anden EU-finansiering  
Project: PhD

Speech processing in hearing-impaired Chinese  
Department of Electrical Engineering  
Period: 01/05/2018 → 30/04/2021  
Number of participants: 3  
Phd Student:  
Bachmann, Florine Lena (Intern)  
Supervisor:  
Santurette, Sébastien (Intern)  
Main Supervisor:  
MacDonald, Ewen (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Samfinansierede - Virksomhed  
Project: PhD

Human Brain Project. Subproject 10 Neurorobotics Platform (HBP) - SGA2  
Department of Electrical Engineering  
Automation and Control  
Centre for Playware  
Centre for Playware  
Copenhagen Center for Health Technology  
Period: 02/04/2018 → 01/04/2020  
Number of participants: 4  
Acronym: HBP SGA2  
Number of related Ph.D. students: 1  
Project participant:  
Capolei, Marie Claire (Intern)  
Corchado Miralles, Carlos (Intern)  
Project Manager, academic:  
Lund, Henrik Hautop (Intern)  
Project Coordinator:  
Tolu, Silvia (Intern)  
Project

Hybrid synchronous condenser system design and control for enhanced grid services  
Department of Electrical Engineering  
Period: 01/04/2018 → 31/03/2021  
Number of participants: 4  
Phd Student:
Nuhic, Mirza (Intern)
Supervisor:
Brozio, Cornel (Ekstern)
Rivas, Richard A. (Ekstern)
Main Supervisor:
Yang, Guangya (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Modelling of Cardiac Biomechanics
Department of Electrical Engineering
Period: 01/04/2018 → 31/03/2021
Number of participants: 4
Phd Student:
Hvid, Rasmus (Intern)
Supervisor:
Jensen, Jørgen Arendt (Intern)
Stuart, Matthias Bo (Intern)
Main Supervisor:
Traberg, Marie Sand (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Nano-Photonic Circuits for Optical Communication (provisional)
Department of Electrical Engineering
Period: 01/03/2018 → 28/02/2021
Number of participants: 4
Phd Student:
Gür, Ugr Meriç (Intern)
Supervisor:
Arslanagic, Samel (Intern)
Gregersen, Niels (Intern)
Main Supervisor:
Mattes, Michael (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Optimization of loudspeakers using material and shape optimization
Department of Electrical Engineering
Period: 01/03/2018 → 28/02/2021
Number of participants: 3
Phd Student:
Nielsen, Daniel Gert (Intern)
Supervisor:
Jensen, Jakob Søndergaard (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)

Financing sources
Optimization and Market Integration of Multi-Area AC/HVDC Grids under Uncertainty

Department of Electrical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
PhD Student:
Tosatto, Andrea (Intern)
Supervisor:
Pinson, Pierre (Intern)
Weckesser, Johannes Tilman Gabriel (Intern)
Main Supervisor:
Chatzivasileiadis, Spyros (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

The influence of vision on spatial hearing of hearing-impaired listeners

Department of Electrical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
PhD Student:
Huisman, Thirsa (Intern)
Supervisor:
Dau, Torsten (Intern)
Piechowiak, Tobias (Intern)
Main Supervisor:
MacDonald, Ewen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Dynamic Nuclear Polarization with Labile Radicals

Department of Electrical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
PhD Student:
Gunnarsson, Christine Pepke (Intern)
Supervisor:
Capozzi, Andrea (Intern)
Karlsson, Magnus (Ekstern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Enhanced Stability and Control of AC/HVDC Grids in Varying Inertis Systems

Department of Electrical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
Phd Student:
Misyris, Georgios (Intern)
Supervisor:
Chatzivasileiadis, Spyros (Intern)
Weckesser, Johannes Tilman Gabriel (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Enhancing the role of electric vehicles for a proactive integration in global power systems
Department of Electrical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
Phd Student:
Thingvad, Andreas (Intern)
Supervisor:
Hu, Junjie (Intern)
Træholt, Chresten (Intern)
Main Supervisor:
Marinelli, Mattia (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Metabolomics using Dissolution DNP-NMR
Department of Electrical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 3
Phd Student:
Frahm, Anne Birk (Intern)
Supervisor:
Jensen, Pernille Rose (Intern)
Main Supervisor:
Lerche, Mathilde Hauge (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

QAMeleon
QAMeleon aims to deliver a new generation of faster, cheaper, and greener photonic devices with reduced footprint towards scaling core and metro networks to the next decade.

Department of Electrical Engineering
Electromagnetic Systems
Period: 01/01/2018 → 31/12/2021
Number of participants: 2
Project participant:
Johansen, Tom Keinicke (Intern)
Dong, Yunfeng (Intern)
Real time dynamic rating condition monitoring of offshore wind farm export systems

Department of Electrical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
Phd Student:
Kazmi, Syed Hamza Hasan (Intern)
Supervisor:
Herskind Olesen, Thomas (Ekstern)
Sørensen (fratrådt), Troels (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Assessing Hearing Device Benefit using Virtual Sound Environments

Department of Electrical Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Mansour, Naim (Intern)
Supervisor:
Marschall, Marton (Intern)
Westermann, Adam (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Auditory Training Strategies to Improve Speech Intelligibility in Hearing-Impaired Listeners

Department of Electrical Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 4
Phd Student:
Koprowska, Aleksandra (Intern)
Supervisor:
Santurette, Sébastien (Intern)
Serman, Maja (Ekstern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Metabolic Responses to Bacterial Pathogens

Department of Electrical Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
PV+STorage - Operation and Economics

Transforming the electricity retail market and activate the demand side participation in system operation is a critical step in enabling a greener energy system to the benefit of consumers and society. A significant step was taken when distribution grid operators were separated from electricity retail, which lays the groundwork for the future retail market operation.

In parallel to this, the ever decreasing costs of PV and battery systems provide increasing competitiveness to both technologies and have brought great investment in solar PV energy, as shown in both EU and the world. Recent market perspective reports predict that there will be a rapid pace of adoption in the coming years for the two technologies. The industry has led the trend and various storage solutions have been developed for residential customers, especially combining PV plus storage solutions for increasing self-consumption.

While PV and storage technology is constantly improving, both these industries have effectively scaled-up and continue to expand their manufacturing output worldwide. New PV production techniques are improving performance and causing 20% price reduction per year. The recorded bid of solar PV in 2017 is USD 0.03 $ kWh. The average cost seems will go further down in the coming years.

The business case for investment in the local stationary storage systems rests on the cooperation with local PV for increasing self-consumption rate. The combination of PV and storage can provide benefits to the system owners in the form of lower electricity bills and a greener electricity supply. However, development has been so fast that several key issues remain unresolved. The technical requirements for storage units are not yet defined. The impact on the current business of distribution grid operators and electricity retailers is also unknown.

In order to prepare the industry for the upcoming change, it is necessary to have the impact evaluated by research institutes, manufacturers, grid operators, and retailers. The Danish project PVST (PV+STorage Operation and Economics in distribution systems) will, therefore, set out to study the performance of the current technology, as well as the impact on the electricity grid and retailing. During the project, the impact of PV+storage will be studied from a technical and economic viewpoint for both grid operators and market retailers. Also, the interoperability and efficiency of the PV+storage system will be enhanced for better operational and market value.
Uhlen, Kjetil (Ekstern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Electronic Outlook
Research-based evaluation of human versus electronic outlook for ships’ navigation
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Automation and Control
Period: 15/10/2017 → 30/09/2018
Number of participants: 2
Project ID: 56322
Project participant:
Blanke, Mogens (Intern)
Hansen, Søren (Intern)

Investigation of the relationships between the subjective assessment and objective parameters of music listening spaces
Department of Electrical Engineering
Period: 15/10/2017 → 14/10/2021
Number of participants: 4
Phd Student:
Wincentz, Jakob Nygård (Intern)
Supervisor:
Brunskog, Jonas (Intern)
Gade, Anders Christian (Intern)
Main Supervisor:
Jeong, Cheol-Ho (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Design Approaches for Terahertz Electronics using Active Device Configurations
Department of Electrical Engineering
Period: 01/10/2017 → 30/09/2020
Number of participants: 3
Phd Student:
Turhaner, Arsen (Intern)
Supervisor:
Boppel, Sebastian (Ekstern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

3D Ultrasound Cardiac Vector Flow imaging
Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 4
Phd Student:
Parkhomenko, Kseniya (Intern)
Supervisor:
Jensen, Jørgen Arendt (Intern)
Traberg, Marie Sand (Intern)
Main Supervisor:
Stuart, Matthias Bo (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Advanced Game-Theoretical Aspects in Electricity Markets

Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 3
Phd Student:
Dvorkin, Vladimir (Intern)
Supervisor:
Kazempour, Jalal (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Efficient and Scalable Market Design for Renewable-based Integrated Energy Systems

Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 3
Phd Student:
Schwele, Anna (Intern)
Supervisor:
Kazempour, Jalal (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Optimal Dispatch and Online Control of Integrated Energy Systems

Department of Electrical Engineering
Period: 01/09/2017 → 30/11/2017
Number of participants: 3
Phd Student:
Nie, Yinghui (Intern)
Supervisor:
Huang, Shaojun (Intern)
Main Supervisor:
Wu, Qiuwei (Intern)
Optimized Seamless Transfer System for DG Inverter

Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 3

PhD Student:
Sun, Bainan (Intern)

Supervisor:
Andersen, Michael A. E. (Intern)

Main Supervisor:
Zhang, Zhe (Intern)

Perfusion Ultrasound Imaging

Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 3

PhD Student:
Schou, Mikkel (Intern)

Supervisor:
Stuart, Matthias Bo (Intern)

Main Supervisor:
Jensen, Jørgen Arendt (Intern)

Robust Congestion Management and Self-healing for Active Distribution Networks

Department of Electrical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 4

PhD Student:
Shen, Feifan (Intern)

Supervisor:
Huang, Shaojun (Intern)

Xu, Yan (Ekstern)

Main Supervisor:
Wu, Qiuwei (Intern)

Detection and evaluation of abnormal events in complex industrial processes

Department of Electrical Engineering
Period: 15/08/2017 → 14/08/2020
Number of participants: 3
Prospective Motion Correction in Magnetic Resonance Imaging

Department of Electrical Engineering
Period: 01/08/2017 → 31/07/2020
Number of participants: 4
PhD Student:
Laustsen, Malte (Intern)
Supervisor:
Madsen, Kristoffer Hougaard (Intern)
Xue, Rong (Ekstern)
Main Supervisor:
Hanson, Lars G. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Brain-Computer Interface Controlled Functional Electrical Stimulation as a Complete Neurorehabilitation Tool for Post-Stroke Patients

Department of Electrical Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 4
PhD Student:
Møller, Jakob Skadkær (Intern)
Supervisor:
Iversen, Helle Klinkenberg (Ekstern)
Larsson, Henrik B.W. (Ekstern)
Main Supervisor:
Puthusserypady, Sadasivan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Miniaturized AC-DC offline converters for Solid State Lighting Applications

Department of Electrical Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 3
PhD Student:
Ammar, Ahmed Morsi (Intern)
Supervisor:
Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor:
Knott, Arnold (Intern)

Financing sources
Optimization, Control, and Stability of AC-DC Grids under Uncertainty

Department of Electrical Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 3
Phd Student:
Venzke, Andreas (Intern)
Supervisor:
Pinson, Pierre (Intern)
Main Supervisor:
Chatzivasileiadis, Spyros (Intern)

Costs
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

High Performance Algorithms Enabling Real-Time Security Assessment of Sustainable Electric Power Systems

Department of Electrical Engineering
Period: 15/05/2017 → 14/05/2020
Number of participants: 4
Phd Student:
Jørgensen, Christina Hildebrandt Lüthje (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Sommer, Stefan Horst (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)

Costs
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Innovative Methods for Optimal Operation of Multiple HVDC Connections and Grids

Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Energinet.dk
ABB Power Technologies
Svenska Kraftnat
KTH - Royal Institute of Technology
University of Liège
Period: 01/05/2017 → 30/04/2021
Number of participants: 2
Acronym: MULTI-DC
Number of related Ph.D. students: 3
Project Coordinator:
Chatzivasileiadis, Spyros (Intern)
Østergaard, Jacob (Intern)

Costs
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Development of continuous non-invasive monitoring system for early detection and prevention of serious morbidity and mortality after abdominal cancer surgery

Department of Electrical Engineering
Period: 01/05/2017 → 30/04/2020
Number of participants: 4
Phd Student:
Olsen, Rasmus Munch (Intern)
Supervisor:
Aasvang, Eske Kvanner (Ekstern)
Meyhoff, Christian Sahlholt (Ekstern)
Main Supervisor:
Serensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Market design and operations for Energy Collectives

Department of Electrical Engineering
Period: 01/05/2017 → 30/04/2020
Number of participants: 3
Phd Student:
Moret, Fabio (Intern)
Supervisor:
Papakonstantinou, Athanasios (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Real time sound field control for outdoor concerts - silent zones, adaptation and objective-subjective performance

Department of Electrical Engineering
Period: 01/05/2017 → 30/04/2020
Number of participants: 4
Phd Student:
Plewe, Daniel (Intern)
Supervisor:
Brunskog, Jonas (Intern)
Fernandez Grande, Efren (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Cryogenic Receiver Array Coils for Hyperpolarized Magnetic Resonance

Department of Electrical Engineering
Period: 15/04/2017 → 14/04/2020
Number of participants: 4
Phd Student: Baron, Rafael Antonio (Intern)
Supervisor: Grivel, Jean-Claude (Intern)
Zhurbenko, Vitaliy (Intern)
Main Supervisor: Ardenkjær-Larsen, Jan Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

The effect of hearing loss and noise on conversational dynamics

Department of Electrical Engineering
Period: 15/04/2017 → 14/04/2020
Number of participants: 3
Phd Student: Sørensen, A. Josefine (Intern)
Supervisor: Lunner, Thomas Fritiof (Ekstern)
Main Supervisor: MacDonald, Ewen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Fonde
Project: PhD

Across Continents Electric Vehicle Services
ACES intends to holistically investigate technical and economic system benefits and impacts by large scale electric vehicles integration in Bornholm, augmented by real usage patterns, grid data and field testing for across continents replicability.

A full scale penetration scenario of EVs in Bornholm will be simulated in order to assess how new aggregating functionality can support both technically and economically the successful integration of electric vehicles into the energy system. It will also initiate a small scale pilot project involving up to 50 publicly and privately owned Nissan vehicles and V2G chargers for proving that EVs can be used for effectively balance the system.

The analysis, although focused on a Danish context, is enhanced also by comparing existing electricity market services in UK and in Japan, taking advantage by the strong collaboration established with the Japanese and UK based research centers of Nissan.

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Energy System Management
Nissan Motor Co.
Bornholms Energi og Forsyning
NUVVE Corporation
Period: 01/04/2017 → 30/09/2020
Number of participants: 8
Electric power system, Demand, Frequency control, Electric vehicles, Distributed energy resources, distribution system operation
Acronym: ACES
Number of related Ph.D. students: 1
Project participant:
Træholt, Chresten (Intern)
Sørensen, Thomas Meier (Intern)
Andersen, Peter Bach (Intern)
Hu, Junjie (Intern)
Zecchino, Antonio (Intern)
Thingvad, Andreas (Intern)
Pedersen, Anders Bro (Intern)

Project Coordinator:
Marinelli, Mattia (Intern)

Design of pervasive systems for chronic sleep/brain disorders
Department of Electrical Engineering
Period: 01/04/2017 → 31/03/2020
Number of participants: 4
Phd Student:
Olsen, Mads (Intern)
Supervisor:
Jennum, Poul (Ekstern)
Mignot, Emmanuel (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Modelling and Control of Multi-Energy System for Wind Power Integration
Department of Electrical Engineering
Period: 01/04/2017 → 31/03/2020
Number of participants: 4
Phd Student:
Chyhryn, Serafym (Intern)
Supervisor:
You, Shi (Intern)
Zong, Yi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Next generation Power Supplies and their applications in mobility and electrolysis
Department of Electrical Engineering
Period: 15/02/2017 → 14/02/2020
Number of participants: 3
Phd Student:
Jørgensen, Kasper Lüthje (Intern)
Supervisor:
Andersen, Michael A. E. (Intern)
Main Supervisor:
Zhang, Zhe (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Control of Flywheel energy storage in the role of peak power reduction**
Department of Electrical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 3
Phd Student: D’Ambrosio, Alessandro (Intern)
Supervisor: Vikelgaard, Hans Henrik (Ekstern)
Main Supervisor: Mijatovic, Nenad (Intern)

**Miniaturized Power Factor Correction in Solid State Lighting Applications**
Department of Electrical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 3
Phd Student: Spliid, Frederik Monrad (Intern)
Supervisor: Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor: Knott, Arnold (Intern)

**Topology optimization of acoustic-mechanical interaction**
Department of Electrical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 3
Phd Student: Dilgen, Sümer Bartug (Intern)
Supervisor: Aage, Niels (Intern)
Main Supervisor: Jensen, Jakob Søndergaard (Intern)

**A Biomimetic Learning Control Scheme for control of Modular Robots**
Department of Electrical Engineering
Automation and Control

Centre for Playware
Period: 16/01/2017 → 14/01/2019
Number of participants: 1
Acronym: Biomodular
Project applicant:
Tolu, Silvia (Intern)

Learning-based Model Predictive Control of Spray Dryers

Department of Electrical Engineering
Period: 01/01/2017 → 31/12/2019
Number of participants: 6
Phd Student:
Miklos, Robert (Intern)
Supervisor:
Jørgensen, John Bagterp (Intern)
Petersen, Lars Norbert (Intern)
Poulsen, Niels Kjølstad (Intern)
Utzen, Christer (Ekstern)
Main Supervisor:
Niemann, Hans Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Biomedical Signal Processing for Improved Diagnosis of Sleep Disorders and Brain Diseases

Department of Electrical Engineering
Period: 15/12/2016 → 14/12/2019
Number of participants: 4
Phd Student:
Olesen, Alexander Neergaard (Intern)
Supervisor:
Jennum, Poul (Ekstern)
Mignot, Emmanuel (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Efficient low frequency room acoustic modelling

Department of Electrical Engineering
Period: 15/12/2016 → 14/12/2019
Number of participants: 4
Phd Student:
Mondet, Boris Jean-Francois (Intern)
Supervisor:
Christensen, Claus Lynge (Ekstern)
Jeong, Cheol-Ho (Intern)
Main Supervisor:
Brunskog, Jonas (Intern)
**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Industrial PhD  
Project: PhD  

**Integration of Gas, District Heating and the Electric Power Systems - Integrated Simulation Framework**  
Department of Electrical Engineering  
Period: 15/12/2016 → 14/12/2019  
Number of participants: 4  
PhD Student:  
Wang, Jiawei (Intern)  
Supervisor:  
You, Shi (Intern)  
Zong, Yi (Intern)  
Main Supervisor:  
Træholt, Chresten (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Privatist  
Project: PhD  

**Outdoor Sound Propagation and Monitoring for Sound Field Control Applications**  
Department of Electrical Engineering  
Period: 15/12/2016 → 14/12/2019  
Number of participants: 4  
PhD Student:  
Caviedes Nozal, Diego (Intern)  
Supervisor:  
Agerkvist, Finn T. (Intern)  
Fernandez Grande, Efren (Intern)  
Main Supervisor:  
Brunskog, Jonas (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD  

**Sound field control for outdoor concerts**  
Department of Electrical Engineering  
Period: 15/12/2016 → 14/12/2019  
Number of participants: 4  
PhD Student:  
Heuchel, Franz Maria (Intern)  
Supervisor:  
Brunskog, Jonas (Intern)  
Fernandez Grande, Efren (Intern)  
Main Supervisor:  
Agerkvist, Finn T. (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD  

**Impedance calibration and measurement techniques in hearing diagnostics**
Optimized utilization of transmission grid capacity - Dynamic rating versus grid performance

Department of Electrical Engineering
Period: 15/11/2016 → 14/11/2019
Number of participants: 3
Phd Student:
Viafora, Nicola (Intern)
Supervisor:
Kristensen, Anders Steen (Ekstern)
Main Supervisor:
Holbøll, Joachim (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Architecture acoustics: an improved design process using integrated hybrid room acoustic simulations

Department of Electrical Engineering
Period: 01/11/2016 → 31/10/2019
Number of participants: 4
Phd Student:
Pind Jörgensson, Finnur Kári (Intern)
Supervisor:
Engsig-Karup, Allan Peter (Intern)
Strømann-Andersen, Jakob Bjørn (Intern)
Main Supervisor:
Jeong, Cheol-Ho (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Predicting and mobilizing energy flexibility in intelligent buildings

Department of Electrical Engineering
Period: 01/11/2016 → 31/10/2019
Number of participants: 3
Phd Student:
Christensen, Morten Herget (Intern)
Supervisor:
Rensberg, Søren (Ekstern)
Main Supervisor:
Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Design of Knowledge-Driven and Data-Driven Algorithms for Neurodegenerative Diseases
Department of Electrical Engineering
Period: 15/10/2016 → 14/10/2019
Number of participants: 4
PhD Student:
Cesari, Matteo (Intern)
Supervisor:
Christensen, Julie Anja Engelhard (Intern)
Jennum, Poul (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Enhancing wind Power Integration through optimal use of cross-sectoral flexibility in an integrated Multi-Energy System
The scientific objective of "EPIMES" is to enhance wind power integration through optimal use of cross-sectoral flexibility in an integrated wind-electricity-heat-gas system where the flexibility options (also known as indirect electric energy storage options) are ingrained in both the energy infrastructures and the customer side.
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Electronics
Tsinghua University
National Institute of Clean-And-Low-Carbon Energy (NICE), Shenhua Group Corporation Limited
Danfoss A/S
Period: 01/10/2016 → 30/09/2019
Number of participants: 5
Power2Heat, Power2Gas, wind energy integration, multi energy system
Acronym: EPIMES
Project ID: 56196
Number of related Ph.D. students: 1
Project participant:
Zong, Yi (Intern)
You, Shi (Intern)
Zhang, Zhe (Intern)
Chyhryn, Serafym (Intern)

Project Manager, organisational:
Bindner, Henrik W. (Intern)

Relations
Publications:
Enhancing Wind Power Integration through Optimal Use of Flexibility in Multi-Carrier Energy Systems from the Danish Perspective
Challenges of implementing economic model predictive control strategy for buildings interacting with smart energy systems
Economic Model Predictive Control for Hot Water Based Heating Systems in Smart Buildings
A review of Danish integrated multi-energy system flexibility options for high wind power penetration
丹麦区域能源互联网发展综述.
An evolving experience learned for modelling thermal dynamics of buildings from live experiments: the Flexhouse story
Potential Energy Flexibility for a Hot-Water Based Heating System in Smart Buildings Via Economic Model Predictive Control
High Voltage Gain Dual Active Bridge Converter with an Extended Operation Range for Renewable Energy Systems

**PV LED ENGINE 10**
Ultra efficient converter electronics for solar powered lighting applications

Department of Photonics Engineering
Diode Lasers and LED Systems
Department of Electrical Engineering
Electronics

Office for Innovation & Sector Services
Period: 01/10/2016 → 30/09/2017
Number of participants: 4
Photovoltaics, LED, Power electronics
Acronym: PVLE10
Project participant:
Ploug, Rasmus Overgaard (Intern)
Thorsteinsson, Sune (Intern)
Kejlberg, Jørgen (Intern)
Project Manager, organisational:
Poulsen, Peter Behrensdorff (Intern)

**Design Approaches for Terahertz electronics using Active Device Configurations**

Department of Electrical Engineering
Period: 01/10/2016 → 23/04/2017
Number of participants: 4
Phd Student:
Zhang, Yaxin (Intern)
Supervisor:
Tafur Monroy, Idelfonso (Intern)
Weimann, Nils (Ekstern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

**Functional Modeling of water treatment system**

Department of Electrical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 4
Phd Student:
Nielsen, Emil Krabbe (Intern)
Supervisor:
Lind, Morten (Intern)
Sin, Gürkan (Intern)
Main Supervisor:
Ravn, Ole (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Situation-aware control solutions for enabling smart network services
Department of Electrical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 3
Phd Student:
Cai, Hanmin (Intern)
Supervisor:
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Tool Sets for System Operators in Future Market Setting
Department of Electrical Engineering
Period: 15/09/2016 → 25/04/2020
Number of participants: 3
Phd Student:
Heinrich, Carsten (Intern)
Supervisor:
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Combining functional modeling and reasoning with on-line event analytics
Department of Electrical Engineering
Period: 01/09/2016 → 31/08/2019
Number of participants: 3
Phd Student:
Kirchhübel, Denis (Intern)
Supervisor:
Lind, Morten (Intern)
Main Supervisor:
Ravn, Ole (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Parker project
The Parker project seeks to validate that series produced electric vehicles, as part of an operational vehicle fleet, can be made to participate in advanced, vertically integrated, smart grid services.
Aided performance of hearing-aid users in realistic listening situations

Department of Electrical Engineering
Period: 01/08/2016 → 31/03/2017
Number of participants: 4
Phd Student:
Pedersen, Anja Kofod (Intern)
Supervisor:
Bianchi, Federica (Intern)
Santurette, Sébastien (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Clinical auditory profiling and hearing-aid fitting strategies
In audiological clinics, the choice of a hearing aid and the adjustment of its amplification and processing parameters are today mostly based on the audiogram, a measure of pure-tone hearing sensitivity at different frequencies. While adjusting the gain of a hearing aid based on the loss of sensitivity reflected by the audiogram can be successful in restoring audibility of soft sounds and improving speech intelligibility in quiet situations, it is well established that hearing-impaired listeners still experience difficulty with understanding speech in more complex listening situations that are typical of everyday life, such as noisy and reverberant environments (Moore, 2007). Despite amplification from the hearing aid,
sounds are thus still perceived as distorted, and this “distortion loss” (Plomp, 1978) is still a challenge to compensate for in practice.

The idea of the present project is to improve the hearing-aid fitting process and suggest parameter adjustment rationales based on a more complete evaluation of each patient’s hearing profile that reflects distortion loss as well. It is hypothesized that hearing-aid benefit can be improved by directly relating outcomes from such an extended clinical hearing profile to the choice of hearing-aid fitting.

Department of Electrical Engineering

Clinical auditory profiling and hearing-aid fitting strategies

Department of Electrical Engineering
Period: 01/07/2016 → 30/06/2019
Number of participants: 4
PhD Student: Sanchez Lopez, Raul (Intern)
Supervisor: Bianchi, Federica (Intern)
Santurette, Sébastien (Intern)
Main Supervisor: Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Effect of room acoustics and head movements on aided and unaided sound-field auditory steady state response (ASSR) measurements

Department of Electrical Engineering
Period: 01/07/2016 → 30/06/2019
Number of participants: 5
PhD Student: Zapata Rodriguez, Valentina (Intern)
Supervisor: Brunskog, Jonas (Intern)
Harte, James (Intern)
Laugesen, Søren (Intern)
Main Supervisor: Jeong, Cheol-Ho (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

A Live PV Testing Platform for Larger Adoption

Reliable solar photovoltaic (PV) generation technology has high potential to contribute significant electric energy to society. Thanks to modern power electronic technology, solar PV plants provide many opportunities to support the grid operation. However, grid operators are still reluctant to welcome more PV capacities to their grids.

The reason lies in the fact that most solar PV plants are relatively small in size compared with other RE sources, and their individual controllability is hard to be utilised by the system operators. This makes difficulties for the operators to
accommodate PV plants in operation and planning.

This project aims to bridge the gap between the opportunities that solar PV can provide and the operators’ needs. An extended PV testing platform will be developed on the Campus of DTU incorporating with the facilities of PowerLab for the purpose of implementing the latest technologies and grid codes. Different control functions of PV plants will then tested. Finally the results will be verified in the real power system of Bornholm.

The project consortium is formed by DTU ELEK, DTU CAS, Bornholm Energi og Forsyning, Kenergy, EnergiMidt, and Solarconnectivity, which includes research institute, distribution system operators, PV project developers and practitioners.

Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems
Kenergy
Bornholms Energi og Forsyning
Eniig
Solarconnectivity.eu
Period: 01/06/2016 → 30/09/2018
Number of participants: 1
Solar PV integration, Reactive power control, remote monitoring, distribution system operation, SCADA
Acronym: PVTP
Project Coordinator:
Yang, Guangya (Intern)
Project

Data-driven Condition Monitoring of Switches and Crossings
Department of Electrical Engineering
Period: 01/06/2016 → 31/05/2019
Number of participants: 3
Phd Student:
Barkhordari, Pegah (Intern)
Supervisor:
Blanke, Mogens (Intern)
Main Supervisor:
Galeazzi, Roberto (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Voltage Stability in RES based power systems
Department of Electrical Engineering
Period: 15/05/2016 → 14/05/2019
Number of participants: 3
Phd Student:
Karatas, Bahtiyar Can (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
**PV LED ENGINE**
PoC project | Business development of high efficient 3-port converter for solar lighting applications

Department of Photonics Engineering
Diode Lasers and LED Systems
Department of Electrical Engineering
Electronics
Period: 01/05/2016 → 30/04/2017
Number of participants: 2
Project participant:
Poulsen, Peter Behrensdorff (Intern)
Knott, Arnold (Intern)

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**Advanced Design Methods for Active Distribution Networks**

Department of Electrical Engineering
Period: 01/05/2016 → 30/04/2019
Number of participants: 3
Phd Student:
Klyapovskiy, Sergey (Intern)
Supervisor:
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

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**Hyperpolarized Parallel MRI**

Department of Electrical Engineering
Period: 01/05/2016 → 30/04/2019
Number of participants: 3
Phd Student:
Hansen, Rie Beck (Intern)
Supervisor:
Hanson, Lars G. (Intern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

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**Nonlinear fractional order derivative models of components and materials in hearing aids and transducers**

Department of Electrical Engineering
Period: 01/05/2016 → 30/04/2019
Number of participants: 4
Phd Student:
King, Alexander Weider (Intern)
Supervisor:
Brunskog, Jonas (Intern)
Jensen, Jakob Søndergaard (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Human Brain Project, Subproject 10 Neurorobotics Platform - SGA1**
The Neurorobotics Platform (NRP) developed in the Human Brain Project (HBP) is an Internet-accessible simulation system that allows the simulation of robots controlled by spiking neural networks. It targets researchers of multiple fields. Prospected users include but are not limited to neuroscientists wanting to validate brain models in the context of closed action-perception loops as well as robotics researchers wanting to develop new neuro-inspired controllers.

Department of Electrical Engineering
Automation and Control
Centre for Playware
Centre for Playware
Copenhagen Center for Health Technology
Period: 01/04/2016 → 01/04/2018
Number of participants: 4
Acronym: HBP SGA1
Project participant:
Capolei, Marie Claire (Intern)
Corchado Miralles, Carlos (Intern)
Project Manager, academic:
Lund, Henrik Hautop (Intern)
Project Coordinator:
Tolu, Silvia (Intern)
Project

**Security Assessment of Renewable Power Systems**
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems
Department of Wind Energy
Integration & Planning
Period: 01/04/2016 → 31/03/2020
Number of participants: 5
Acronym: SARP
Project participant:
Sørensen, Poul Ejnar (Intern)
Phd Student:
Karatas, Bahtiyar Can (Intern)
Sarkar, Moumita (Intern)
Jørgensen, Christina Hildebrandt Lüthje (Intern)
Project Coordinator:
Jóhannsson, Hjörtur (Intern)

**Relations**
Related projects:
Voltage Stability in RES based power systems
Modelling of renewable energy under stressed power system stability conditions
Secure Operation of Sustainable Power Systems
High Performance Algorithms Enabling Real-Time Security Assessment of Sustainable Electric Power Systems
Project
Classification and aggregation of energy components

Department of Electrical Engineering
Period: 01/04/2016 → 31/03/2019
Number of participants: 4
Phd Student:
Richert, Thibaut Pierre (Intern)
Supervisor:
Gehrke, Oliver (Intern)
Madsen, Henrik (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Relations
Activities:
CITIES consortium 2016
Project: PhD

Electric Vehicle Integration in an Energy - Optimized Neighbourhood

Department of Electrical Engineering
Period: 01/04/2016 → 31/03/2019
Number of participants: 4
Phd Student:
Gjelaj, Marjan (Intern)
Supervisor:
Andersen, Peter Bach (Intern)
Hashemi Toghroljerdi, Seyedmostafa (Intern)
Main Supervisor:
Træholt, Chresten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Security assessment and protection of cyber-physical energy systems

Department of Electrical Engineering
Period: 01/04/2016 → 31/03/2019
Number of participants: 4
Phd Student:
Rasmussen, Theis Bo (Intern)
Supervisor:
Dong, Z. Y. (Ekstern)
Nielsen, Arne Hejde (Intern)
Main Supervisor:
Yang, Guangya (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Activities:
12th IEEE Power and Energy Society PowerTech Conference
Federated Conference on Computer Science and Information Systems
EuroTech Summer School 2016 @ EPFL: Energy Systems
Functional modelling in the operation of a cyber physical energy system
University of New South Wales
Project: PhD

Toolsets development for DER aggregators providing concurrent services
Department of Electrical Engineering
Period: 01/04/2016 → 31/03/2019
Number of participants: 3
PhD Student:
Ziras, Charalampos (Intern)
Supervisor:
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Module Integrated Converter for Photovoltaic Systems
Department of Electrical Engineering
Period: 15/03/2016 → 14/03/2019
Number of participants: 3
PhD Student:
bin Abdul Rahman, Norjasmi (Intern)
Supervisor:
Ouyang, Ziwei (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications
CELTA aims to produce the next generation of researchers who will enable Europe to take a leading role in the multidisciplinary area of utilising Terahertz technology for applications involving components and complete systems for sensing, instrumentation, imaging, spectroscopy, and communications. All these technologies are keys to tackling challenges and creating solutions in a large number of focus areas relevant for the societal challenges identified in the Horizon 2020 programme. To achieve this objective, CELTA is comprised of 11 leading research institutions and has assembled a comprehensive research training programme for all the 15 early-stage researchers (ESRs). CELTA integrates multidisciplinary scientific expertise, complementary skills, and experience working in academia and industry to empower ESRs to work in interdisciplinary teams, integrate their activities, share expertise, and promote a vision of a converged co-design and common engineering language between electronics and photonics for Terahertz technologies.

CELTA will introduce the strategy of converged electronics and photonics co-design in its research programme and makes a special effort on establishing a common engineering language in its training programme across the electronics, photonics and applications disciplines. We believe this common engineering language and converged co-design is mandatory to make the next logical step towards efficient and innovative solutions that can reach the market. The detailed compendium of lectures on state-of-the-art technology, soft skills and entrepreneurship is accompanied by a research programme that focuses on THz key technologies. CELTA ESRs will develop three demonstrators: beam steering technology for communication applications, a photonic vector analyser for spectroscopy and materials characterisation, and a THz imager for sensing applications.

Department of Photonics Engineering
Administration
Metro-Access and Short Range Systems
Department of Electrical Engineering

Electromagnetic Systems
Period: 01/03/2016 → 29/02/2020
Number of participants: 3
Convergence of Electronics and Photonics Technologies for Enabling Terahertz Applications, sensing, instrumentation, imaging, spectroscopy
Acronym: CELTA
Number of related Ph.D. students: 15
Contact person:
Reippure, Mie (Intern)
Project participant:
Tafur Monroy, Idelfonso (Intern)
Johansen, Tom Keinicke (Intern)

Financing sources
Source: EU research programme (public)
Name of research programme: H2020-MSCA-ITN-2015
Amount: 3,808,558.08 Euro

Perceptual consequences of noise-induced neural degeneration in humans
Department of Electrical Engineering
Period: 01/03/2016 → 28/02/2019
Number of participants: 4
Phd Student:
Holtegaard, Pernille (Intern)
Supervisor:
Dau, Torsten (Intern)
Mehraei, Golbarg (Intern)
Main Supervisor:
Epp, Bastian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Triple resonant electromagnetic structures for polarization transfer in DNP
Department of Electrical Engineering
Period: 01/03/2016 → 28/02/2019
Number of participants: 4
Phd Student:
Albannay, Mohammed (Intern)
Supervisor:
Bowen, Sean (Intern)
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Operations and Maintenance Technology, CTR1
The objective of this programme is to develop a Water Management Plan that addresses both operational performance and process development/design aspects related to facilities.

A close collaboration between researchers and a small Norwegian start-up leads to a new product, the ‘AlarmTracker’, ready for the control rooms of oil and gas platforms in 2019. The device supports the operator in making the right
decisions in abnormal situations. Its objective is to secure a steady production, leading to an expected five percent increase of oil production.

Centre for oil and gas – DTU
Department of Electrical Engineering
Statistics and Data Analysis
Aalborg University
Eldor Technology
Period: 15/02/2016 → 01/01/2020
Number of participants: 1
Acronym: CTR1
Number of related Ph.D. students: 5
Project participant:
Jørgensen, Thomas Martini (Intern)

Reconfigurable Modular Robotic System for Aquatic Environment
Department of Electrical Engineering
Automation and Control
Centre for Playware
National Institute of Aquatic Resources
Section for Oceans and Arctic
Department of Mechanical Engineering
Engineering Design and Product Development
Fluid Mechanics, Coastal and Maritime Engineering
Period: 01/02/2016 → 31/01/2018
Number of participants: 6
Acronym: REMORA
Project participant:
Christensen, David Johan (Intern)
Mariani, Patrizio (Intern)
Visser, Andre (Intern)
Özkil, Ali Gürcan (Intern)
Nielsen, Ulrik Dam (Intern)
Project Manager, academic:
Galeazzi, Roberto (Intern)

Danish Sound Innovation: Improved sound insulation for headsets
Department of Electrical Engineering
Acoustic Technology
Terma A/S
Period: 01/02/2016 → 31/03/2016
Number of participants: 1
Project participant:
King, Alexander Weider (Intern)

Cryogenic Single and Array Coils for Magnetic Resonance Systems
Department of Electrical Engineering
Period: 01/02/2016 → 31/01/2019
Number of participants: 4
Phd Student:
Johansen, Daniel Højrup (Intern)
Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)
Laustsen, Christoffer (Ekstern)
Main Supervisor:
Zhurbenko, Vitaliy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Highly Sensitive Magnetic Sensing of Neural Activity
Department of Electrical Engineering
Period: 01/02/2016 → 31/01/2019
Number of participants: 4
Phd Student:
Karadas, Mürsel (Intern)
Supervisor:
Andersen, Ulrik Lund (Intern)
Hanson, Lars G. (Intern)
Main Supervisor:
Thielscher, Axel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Spatial release from masking in complex acoustical scenes and the effect of hearing aid processing
Department of Electrical Engineering
Hearing Systems
Period: 04/01/2016 → 04/07/2016
Number of participants: 5
Speech intelligibility, Spatial Hearing, Spatial Release from Masking
Project participant:
Löw, Vera (Ekstern)
Supervisor:
Westermann, Adam (Ekstern)
Marschall, Marton (Intern)
Cubick, Jens (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Electric vehicles in the Nordic countries: Control strategies for coordinated grid services
Nowadays, both Norway and Denmark face challenges in supporting a stable and economic future power system based on renewable energy production and an increasing flexible demand based on electric vehicles (EV). Specifically, the main challenge is to address the adverse effects that the EVs may have on local distribution lines (distribution system operator (DSO) perspective) and enhance their usage to optimize utilization of national renewables, here under the high wind power penetration (transmission system operator (TSO) perspective).
The research emphasis is on power and energy services that EVs can provide both locally and system-wide. Three main topics will be strongly faced:
1. Identification of the technical benefits that ancillary service provision from EVs may provide. EVs may be considered as active grid components and not just mere large loads that cause technical issues on the grid. Under the above mentioned circumstances, also the barriers to EVs grid support services (imposed for instance by national/European grid codes or by the necessity of economic advantages to the EV owner for grid support – also just for the availability) will be identified and
classified.
2. Balance of prioritization regarding services between DSO and TSO. This problem comes from the TSOs’ need of grid stability services from small dispatched units, due to displacement of big power plants which traditionally assure reliable grid services. At the same time, it is in the interest of the DSO not to have power provision from distributed energy sources violating the local grid constraints.
3. Common solutions for EV integration across the Nordic countries. Considering the existence of two distinct Danish synchronous regions (DK1 and DK2) managed by the same national TSO and considering that DK2 and Norway, although belonging to the same synchronous region, are managed by two independent TSOs, the investigation will face EVs’ grid support services replicability in different contexts (different constrains). Studies will also consider guidelines and trends at European level (ENTSOE).

Through the usage of dedicated simulation platforms, such as Matlab SimPowerSystems and DlgSILENT PowerFactory, static study scenarios - unbalanced and balanced load flows - as well as optimal power flows and transient analysis will be conducted primarily in order to analyze network components’ overloading and voltage violations. Furthermore, micro-grid analysis with different generation sets and EV management will be tested at the DTU facilities including both the Electric Lab of Lyngby Campus and SYSLAB in Risø Campus as well as EVLab that spans both the campuses. The PhD student will be kept in the loop of current and relevant EV projects both at DTU (EnergyLab Nordhavn and Parker) and NTNU (The Smartgrids centre, Smartgrids lab, OADE and ChargeFlex project).

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Energy System Management
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Electric vehicles, Smart Grid, Distributed energy resources
Project participant:
Zecchino, Antonio (Intern)
Supervisor:
Marinelli, Mattia (Intern)
Korpås, Magnus (Ekstern)
Main Supervisor:
Træholt, Chresten (Intern)
Documents:
Short description of the PhD project

Project

EnergyLab Nordhavn PhD Le Ray
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Period: 15/12/2015 → 15/12/2018
Number of participants: 1
Project participant:
Le Ray, Guillaume (Intern)

Project

Active Filter Solutions for Reducing Harmonic Emissions in Wind Power Plants
Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Guest, Emerson (Intern)
Supervisor:
Holbøll, Joachim (Intern)
Jensen, Kim Høj (Intern)
Main Supervisor:
Rasmussen, Tonny Wederberg (Intern)
Characterization of acoustic properties of surfaces based on spatio-temporal information

Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Richard, Antoine Philippe André (Intern)
Supervisor:
Brunskog, Jonas (Intern)
Jeong, Cheol-Ho (Intern)
Main Supervisor:
Fernandez Grande, Efren (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Combining ultrasound brain stimulation with MR imaging

Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Pasquinelli, Cristina (Intern)
Supervisor:
Hanson, Lars G. (Intern)
Lee, Hyunjoo Jenny (Ekstern)
Main Supervisor:
Thielscher, Axel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Controlling a hearing aid by electrically assessed eye-gaze

Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Favre-Félix, Antoine (Intern)
Supervisor:
Graversen, Carina (Ekstern)
Lunner, Thomas Fritiof (Ekstern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt EU-finansieret
Project: PhD

Electric vehicles in the Nordic countries: Control strategies for coordinated grid services
Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Zecchino, Antonio (Intern)
Supervisor:
Korpås, Magnus (Ekstern)
Træholt, Chresten (Intern)
Main Supervisor:
Marinelli, Mattia (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Managing Complex Systems and Applications fusing methods from AI and Control and Signal Processing

Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Maurin, Adrian Llopart (Intern)
Supervisor:
Andersen, Nils Axel (Intern)
Kim, Jon-Hwan (Ekstern)
Main Supervisor:
Ravn, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Resilient overlay networks for the distributed provision of aggregated power systems services

Department of Electrical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 3
Phd Student:
Orda, Lasse Dreisig (Intern)
Supervisor:
Gehrke, Oliver (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Impact assessment of HVDC Systems at the European level

Department of Electrical Engineering
Period: 01/12/2015 → 30/11/2018
Number of participants: 3
Phd Student:
Halilbasic, Lejla (Ekstern)
Supervisor:
Pinson, Pierre (Intern)
Main Supervisor:
Renewable energy sources are key enablers to decrease greenhouse gas emissions and to cope with the anthropogenic global warming. The intermittent behaviour of them and their limited storage capabilities present new challenges to power system operators in maintaining power quality and reliability. However, the increased availability of advanced automation and communication technologies has also provided new intelligent solutions to these challenges. Previous work has presented various new methods to operate highly interconnected power grids with corresponding components in a more effective way. As a consequence of these developments the traditional power system is transformed into a cyber-physical system, a Smart Grid. Previous and ongoing research activities have mainly focused on validating certain aspects of
Smart Grids, but until now no integrated approach for analysing and evaluating complex configurations in a cyber-physical systems manner is available. The lack of system validation approaches for Smart Grids is especially addressed by ERIGrid. By providing a Pan-European research infrastructure ERIGrid supports the technology development as well as the roll out of Smart Grid solutions and concepts in Europe. It tackles a holistic, cyber-physical systems based approach by integrating 18 European research centres and institutions with outstanding research infrastructures and jointly develops common methods, concepts, and procedures. ERIGrid also integrates and enhances the necessary research services for analysing, validating and testing Smart Grid configurations. System level support and education for industrial and academic researchers is provided as well to foster future innovation.

ERIGrid addresses these challenging aims by providing a single entry point to the provided research infrastructure and offering a broad spectrum of services to researchers active in Smart Grids. This will strengthen the technical leadership of Europe in the energy domain.

Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management
Automation and Control
Period: 01/11/2015 → 30/04/2020
Number of participants: 5
Acronym: ERIGrid
Project participant:
Gehrke, Oliver (Intern)
Bondy, Daniel Esteban Morales (Intern)
Bindner, Henrik W. (Intern)
Heussen, Kai (Intern)
Project Coordinator:
Kosek, Anna Magdalena (Intern)

Relations
Publications:
Cyber-Physical Energy Systems Modeling, Test Specification, and Co-Simulation Based Testing
Project

Bimodal Fusion in Cochlear Implant Users
Department of Electrical Engineering
Period: 01/11/2015 → 01/12/2018
Number of participants: 4
Phd Student:
Janssen, Niclas Alexander (Intern)
Supervisor:
Bramsløw, Lars (Ekstern)
Riis, Søren Kamaric (Intern)
Main Supervisor:
Marozeau, Jeremy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Integrated grid connected rectifier with power management functionality
Department of Electrical Engineering
Period: 01/11/2015 → 28/02/2018
Number of participants: 4
Phd Student:
Pejtersen, Jens (Intern)
Supervisor:
Andersen, Toke Meyer (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor:
Knott, Arnold (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Market Mechanisms for Integrated Energy Systems
Department of Electrical Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 3
Phd Student:
Mitridati, Lesia Marie-Jeanne Mariane (Intern)
Supervisor:
Kazempour, Jalal (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Network Design Strategies for Medium Voltage Active Distribution Grids
Department of Electrical Engineering
Period: 01/10/2015 → 31/12/2015
Number of participants: 3
Phd Student:
Hübner, Julius Andreas (Intern)
Supervisor:
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Numerical and experimental study of the acoustical-mechanical interaction at the micro-scale including losses
Department of Electrical Engineering
Period: 01/10/2015 → 30/09/2018
Number of participants: 3
Phd Student:
Andersen, Peter Risby (Intern)
Supervisor:
Aage, Niels (Intern)
Main Supervisor:
Cutanda Henriquez, Vicente (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD
Integrated Very High Frequency Rectifier with On-chip Control and Load Failure Protection Features

Department of Electrical Engineering
Period: 15/09/2015 → 19/04/2019
Number of participants: 4
Phd Student: Hertel, Jens Christian (Intern)
Supervisor: Andersen, Toke Meyer (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor: Knott, Arnold (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

The microgrid with wind and storage systems to supply reliable power for oil/gas platforms

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Energy System Management
Period: 01/09/2015 → 31/12/2016
Number of participants: 2
wind energy integration, oil/gas platform
Acronym: STATOIL project
Project ID: 56119
Project participant: You, Shi (Intern)
Project Manager, organisational: Zong, Yi (Intern)

Photovoltaic-Battery Modular Power Converter for Local Energy Storage

Department of Electrical Engineering
Period: 01/09/2015 → 31/08/2018
Number of participants: 3
Phd Student: Tomas Manez, Kevin (Intern)
Supervisor: Ouyang, Ziwei (Intern)
Main Supervisor: Zhang, Zhe (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Frequency Characterization and Control for Future Low Inertia Systems

Fossil-fueled power plants in Danish power system will be phased out before 2050, where majority of the electric energy will be supplied by renewable generation. The conventional energy system comprises synchronous generators that provide inertia to support system frequency while the renewable plants mostly interface with grids by power electronic converters that have different frequency responses as synchronous generators.

To make sure a smooth transition from the traditional synchronous-machine-based system to a renewable-based system, this project will study the system inertia and frequency of a renewable-based system using future Danish power grid as a background. Firstly, a future Danish renewable-based system will be studied and modelled. Then, the system frequency characteristics will be considered according to different operational scenarios. Various operational conditions may include but not limited to, different situations of wind and solar output, demand response and power exchanges with neighboring
countries. Finally, the requirements from ENTSO-E on renewable system synthetic inertia provisions will be incorporated into the renewable system modelling and the effects will be evaluated.

To improve the impact of renewable systems on system inertia, an application of synchronous condensers (SCs), a synchronous generator without prime mover will be investigated. The inertia contribution from SCs to the system may not be as significant as synchronous generators. However, it is still valuable for system operators to understand and perhaps use SCs for system frequency control.

Methods will be developed to simplify the modelling for system inertia quantification, as scenarios may change quickly in the future system. The frequency control scheme will be revisited and a new control design will be proposed.

Department of Electrical Engineering

Center for Electric Power and Energy

Electric Power Systems
Period: 15/08/2015 → 14/08/2018
Number of participants: 4
Phd Student:
Nguyen, Ha Thi (Intern)
Supervisor:
Nielsen, Arne Hejde (Intern)
Jensen, Peter Hejgaard (Ekstern)
Main Supervisor:
Yang, Guangya (Intern)

Relations
Parent project:
Synchronous Condensers APPlication in Low Inertia Systems
Project

Avtive nanophotonic antanna arrays for effective light-matter interactions

Department of Electrical Engineering
Period: 15/08/2015 → 14/12/2018
Number of participants: 4
Phd Student:
Kaminski, Piotr Marek (Intern)
Supervisor:
Breinbjerg, Olav (Intern)
Mark, Jesper (Intern)
Main Supervisor:
Arslanagic, Samel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Frequency Characterization and Control for Future Low Inertia Systems

Department of Electrical Engineering
Period: 15/08/2015 → 14/08/2018
Number of participants: 4
Phd Student:
Nguyen, Ha Thi (Intern)
Supervisor:
Jensen, Peter Hejgaard (Ekstern)
Nielsen, Arne Hejde (Intern)
Main Supervisor:
Yang, Guangya (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Towards solid oxide electrolysis plants in 2020

Department of Electrical Engineering

Electronics
Period: 01/08/2015 → 31/07/2017
Number of participants: 2
Project participant:
Zhang, Zhe (Intern)
Anthon, Alexander (Intern)

Assessment of short circuit power and protection systems for future low inertia power systems

Fossil-fuelled power plants in Danish system will be phased out in the future, where majority of the electric energy will be supplied by renewable generation. The conventional power plants comprises large synchronous generators that are capable of supplying instantaneous short circuit power during faults to trigger system protections, while renewable generators mostly interface with the electric grids by converters, whose contribution during faults can be limited.

The project will model and evaluate the system’s short-circuit power level at critical lines and buses, incorporating the latest requirements for generation modules, for a future Danish scenario. The system requirements for short-circuit power will be quantified and the need for synchronous condensers can therefore be determined. The location and size of synchronous condensers in systems will be determined to fulfil the requirements for short-circuit power and the operation of protection systems.

The project will use real time digital simulator (RTDS) at PowerlabDK (http://www.powerlab.dk) to perform simulation and testing. The project is part of a Danish ForskEL project Application of Synchronous Condensers in Low Inertia Systems, grant no. 12196, funded by PSO (Public Service Obligation). This project will be in close collaboration with Siemens and Danish transmission system operator Energinet.dk.

Department of Electrical Engineering

Relations
Parent project:
Synchronous Condensers APPlication in Low Inertia Systems
Related projects:
Frequency Characterization and Control for Future Low Inertia Systems
Project
Quantification of diffuseness chambers for sound absorption measurements

Department of Electrical Engineering
Period: 01/08/2015 → 28/09/2018
Number of participants: 3
Phd Student:
Nolan, Melanie (Intern)
Supervisor:
Jeong, Cheol-Ho (Intern)
Main Supervisor:
Brunskog, Jonas (Intern)

Reconfigurable Microwave Filters

Department of Electrical Engineering
Period: 01/08/2015 → 31/08/2018
Number of participants: 4
Phd Student:
Cimoli, Bruno (Intern)
Supervisor:
Vegas Olmos, Juan José (Intern)
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)

Market Mechanisms for Integrated Energy Systems

Centre for IT-Intelligent Energy Systems in Cities
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Department of Applied Mathematics and Computer Science
Dynamical Systems
Period: 01/07/2015 → 30/06/2018
Number of participants: 3
Phd Student:
Ordoudis, Christos (Intern)
Supervisor:
Morales González, Juan Miguel (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
System adequacy and reserve margins with increasing levels of variable generation
The project aims at investigating system adequacy and reserve margins with increasing levels of variable generation (wind and photovoltaic mainly) in South Africa

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Department of Wind Energy
Meteorology
Wind Energy Systems

EA Energy Analysis A/S
Period: 01/07/2015 → 31/08/2016
Number of participants: 4
wind power, Photovoltaic, large scale
Acronym: SANEDI
Project participant:
Sørensen, Poul Ejnar (Intern)
Marinelli, Mattia (Intern)
Litong-Palima, Marisciel (Intern)
Hahmann, Andrea N. (Intern)

Characterizing the effects of distortion and audibility loss on speech recognition

Department of Electrical Engineering
Period: 01/07/2015 → 30/11/2018
Number of participants: 4
Phd Student:
Iborra, Helia Relano (Intern)
Supervisor:
May, Tobias (Intern)
Zaar, Johannes (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Impact assessment and control of HVDC systems at the European level

Department of Electrical Engineering
Period: 01/07/2015 → 30/09/2018
Number of participants: 4
Phd Student:
Thams, Florian (Intern)
Supervisor:
Eriksson, Robert (Intern)
Nielsen, Arne Hejde (Intern)
Main Supervisor:
Chatzivasileiadis, Spyros (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Market Mechanisms for Integrated Energy Systems
Department of Electrical Engineering
Period: 01/07/2015 → 30/09/2018
Number of participants: 4
Phd Student:
Ordoudis, Christos (Intern)
Supervisor:
Morales González, Juan Miguel (Intern)
Kazempour, Jalal (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Characterizing neural mechanisms of attention-driven speech processing
Department of Electrical Engineering
Period: 15/05/2015 → 14/05/2018
Number of participants: 4
Phd Student:
Fuglsang, Søren (Intern)
Supervisor:
Hjortkjær, Jens (Intern)
May, Tobias (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Characterizing neutral mechanisms of attention-driven speech processing
Department of Electrical Engineering
Period: 15/05/2015 → 13/11/2018
Number of participants: 4
Phd Student:
Fuglsang, Søren (Intern)
Supervisor:
Hjortkjær, Jens (Intern)
May, Tobias (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Use of Multilevel Flow Modelling for on-line supervision in the oil and gas industry
Department of Electrical Engineering
Automation and Control
dDNP as a method to assess altered cellular metabolism in vitro

Department of Electrical Engineering
Period: 01/05/2015 → 31/10/2018
Number of participants: 4
Phd Student:
Malinowski, Ronja Maja (Intern)
Supervisor:
Duus, Jens Øllgaard (Intern)
Jensen, Pernille Rose (Intern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Validation of Decentralized and Coordinated Operation of Frequency and Voltage Control Systems
As a part of ELECTRA IRP project, this PhD work will focus on development and validation of robust and coordinated control algorithm for frequency and voltage control. One of the actual research points is the virtual inertia which could be achieved by means of energy storage system or energy resources able to be deployed quickly in the system (e.g. electric vehicles). Different research studies concentrated on the implementation of virtual inertia control algorithms considering single or multiple units but in both cases has not been mentioned the limitation and/or consequence on the controller stability in function of the system inertia. Due to the fast variability of the energy resources mix (i.e. between renewable and traditional power plant) influencing the system inertia, the control algorithm need to be auto adapted to the network reconfiguration ensuring the controller optimization and the system stability. Moreover injecting active power in the distribution grid for frequency control (virtual inertia and/or primary control) could lead to local voltage deviation. Different studies focused on providing voltage and frequency control from the same unit acting on the active power but assuming a power grid with high inertia which limits frequency instability. Thus this study will take into account the impact of possible coupling between voltage and frequency controller due to the low system inertia which could lead to system instability. Further the control architecture will be investigated according to the different control objective and time scale limitation. For example, on one hand the virtual inertia controller need to be fast enough to limit the rate of change of frequency implying the need of local automatic controller limiting communication delays. On the other hand the controller should to be accessed and modifiable by the operator in case of need (e.g. network reconfiguration). This study will address the frequency and voltage control considering actual and new boundaries:
1) Ensure the state of the charge of the energy storage within high and low limits
2) Provide frequency and voltage control from the same unit considering low inertia in the system.
3) Coupling among different controllers
4) Investigate the different control architecture and the relative constraint (e.g. time scale, communication delay)

Department of Electrical Engineering
Center for Electric Power and Energy

Energy System Management
Period: 01/04/2015 → 31/03/2018
Number of participants: 4
Smart Grid, Power Systems, Control System, Synthetic Inertia, Frequency Control
Phd Student:
Rezkalla, Michel Maher Naguib (Intern)
Supervisor:
Marinelli, Mattia (Intern)
Heussen, Kai (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Relations
Related projects:
ELECTRA Top-Up
European Liaison on Electricity grid Committed Towards long-term Research Activities

Dynamic Propeller Shaft Speed Control
Department of Electrical Engineering
Automation and Control
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Maersk Maritime Technology
Lyngsø Marine A/S
Propelco
Period: 01/04/2015 → 01/05/2017
Number of participants: 2
Project participant:
Galeazzi, Roberto (Intern)
Andersen, Poul (Intern)

DC-DC converters for use of Li-Ion batteries in hearing aids
Department of Electrical Engineering
Period: 01/04/2015 → 28/10/2018
Number of participants: 4
Phd Student:
Larsen, Dennis Øland (Intern)
Supervisor:
Knott, Arnold (Intern)
Vinter, Martin (Ekstern)
Main Supervisor:
Jørgensen, Ivan Harald Holger (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

EnergyLab Nordhavn - New Urban Energy Infrastructures
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Energy Analytics and Markets
Energy System Management
Department of Applied Mathematics and Computer Science
Department of Civil Engineering
Section for Building Energy
Section for Indoor Climate and Building Physics
Department of Mechanical Engineering
Thermal Energy
HOFOR A/S
Balslev Consulting Engineers A/S
METRO THERM A/S
ABB Group
Københavns Kommune
By og Havn
Radius Elnet

CleanCharge Solutions
Period: 01/04/2015 → 31/03/2019
Number of participants: 20
Acronym: ELN
Number of related Ph.D. students: 9
Project participant:
Hashemi Toghroljerdi, Seyedmostafa (Intern)
Østergaard, Jacob (Intern)
Træholt, Chresten (Intern)
Pinson, Pierre (Intern)
Mitridati, Lesia Marie-Jeanne Mariane (Intern)
Klyapovskiy, Sergey (Intern)
Le Ray, Guillaume (Intern)
Gjelaj, Marjan (Intern)
You, Shi (Intern)
Harrestrup, Maria (Intern)
Rode, Carsten (Intern)
Ommen, Torben Schmidt (Intern)
Foteinaki, Kyriaki (Intern)
Luc, Katarzyna Marta (Intern)
Pieper, Henrik (Intern)
Meesenburg, Wiebke (Intern)
Mitridati, Lesia Marie-Jeanne Mariane (Intern)
Le Ray, Guillaume (Intern)

Project Manager, organisational:
Greisen, Christoffer (Intern)

Relations
Activities:
Performance analysis of heat pumps utilizing different low temperature heat sources to supply district heating
Publications:
Efficient Control of Active Transformers for Increasing the PV Hosting Capacity of LV Grids
Cost-Benefit Analysis of a Novel DC Fast-Charging Station with a Local Battery Storage for EVs
Optimal Design of DC Fast-Charging Stations for EVs in Low Voltage Grids
Active and reactive power support of MV distribution systems using battery energy storage
Efficient Control of Energy Storage for Increasing the PV Hosting Capacity of LV Grids
Optimal usage of low temperature heat sources to supply district heating by heat pumps
DC Fast-Charging Stations for EVs Controlled by a Local Battery Storage in Low Voltage Grids
Methods and Strategies for Overvoltage Prevention in Low Voltage Distribution Systems with PV

Impact assessment of HVDC Systems at the European level
Department of Electrical Engineering
Period: 01/04/2015 → 31/07/2015
Number of participants: 3
Phd Student:
Haro Larrodé, Marta (Intern)
Supervisor:
Eriksson, Robert (Intern)
Main Supervisor:
Pinson, Pierre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Improving music perception and voice pitch in cochlear implant users
Department of Electrical Engineering
Period: 01/04/2015 → 29/01/2019
Number of participants: 3
Phd Student:
Lamping, Wiebke (Intern)
Supervisor:
Santurette, Sébastien (Intern)
Main Supervisor:
Marozeau, Jeremy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Activities:
Nordiske Konference - Hørelse, kognition, kommunikation
Listening to music with a cochlear implant: Limitations and possible solutions
Project: PhD

Validation of decentralized and coordinated operation of frequency and voltage control systems in the control room
Department of Electrical Engineering
Period: 01/04/2015 → 31/03/2018
Number of participants: 7
Phd Student:
Rezkalla, Michel Maher Naguib (Intern)
Supervisor:
Bindner, Henrik W. (Intern)
Heussen, Kai (Intern)
Main Supervisor:
Marinelli, Mattia (Intern)
Examiner:
Sørensen, Poul Ejnar (Intern)
Pilo, Fabrizio (Ekstern)
Uhlen, Kjetil (Ekstern)

Financing sources
Source: Internal funding (public)
**Intelligent Quality Assessment of Railway Switches and Crossings**

This project aims at significantly improving the safety, reliability and operational lifetime of the 3500 switches and crossings (S&Cs) in the Danish railway network. The project is a close cooperation between the Technical University of Denmark (DTU), the Danish rail infrastructure provider Rail Net Denmark and four affiliated European partners with significant expertise within this field. An inter-disciplinary scientific effort is employed to obtain enhanced rail transport reliability and regularity simultaneously with significant savings in S&Cs maintenance costs. The project results will make maintenance based on intelligent fault prediction tools, instead of the presently used regular planned inspections, and it will provide sophisticated tools to prevent hidden faults from developing to failure in the future. In a novel approach, the project will install state-of-the-art sensor technology in selected S&Cs and correlate dynamic parameters during train passage with static geometry data from conventional measurement vehicles. Monitoring of the dynamic responses will provide diagnosis of patterns that indicate when components or ballast begin to deviate from fully functional conditions. Modelling of dynamics will identify root causes to signs of degradation. Damage assessment of components identified by anomalous readings will be done by metallurgical examinations. Data and results will be processed by a holistic model that can produce Maintenance Performance Indicators (MPI) for the S&C condition. The correlation of sensor data to measuring vehicle data will allow existing data to be used reliably as input for the MPI model. It is expected that this project will enable optimisation of maintenance procedures, by which appropriate maintenance can be predicted in advance, thus avoiding unscheduled repairs and delays in the railway traffic.

Department of Wind Energy
Materials science and characterization
Department of Electrical Engineering
Automation and Control
Department of Mechanical Engineering
Solid Mechanics
Department of Applied Mathematics and Computer Science
Statistics and Data Analysis
Banedanmark
Period: 01/03/2015 → 28/02/2019
Number of participants: 14
Acronym: INTELLISWITCH
Number of related Ph.D. students: 1
Project participant:
Galeazzi, Roberto (Intern)
Blanke, Mogens (Intern)
Hansen, Søren (Intern)
Barkhordari, Pegah (Intern)
Asadzadeh, Seyed Mohammad (Intern)
Santos, Ilmar (Intern)
Tejada, Alejandro de Miguel (Intern)
Danielsen, Hilmar Kjartansson (Intern)
Dhar, Somrita (Intern)
Ersbøll, Bjarne Kjærr (Intern)
Kulahci, Murat (Intern)
Thyregod, Camilla (Intern)
Hovad, Emil (Intern)
Project Manager, academic:
Juul Jensen, Dorte (Intern)

**Financing sources**
Source: Public research council
**Behavioral and objective measures of auditory streaming in cochlear implant users**

Department of Electrical Engineering  
Period: 01/03/2015 → 31/05/2018  
Number of participants: 6  
Phd Student:  
Paredes Gallardo, Andreu (Intern)  
Supervisor:  
Dau, Torsten (Intern)  
Main Supervisor:  
Marozeau, Jeremy (Intern)  
Examiner:  
Andersen, Tobias (Intern)  
Chatterjee, Monita (Ekstern)  
Micheyl, Christophe (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansierede - Virksomhed  
Project: PhD

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**Intelligent Quality Assessment of Railway Switches and Crossings (INTELLISWITCH)**  
Department of Electrical Engineering  
Department of Mechanical Engineering  
Department of Applied Mathematics and Computer Science  
Statistics and Data Analysis  
Department of Wind Energy  
Materials science and characterization  
Banedanmark  
Period: 01/03/2015 → 31/12/2019  
Number of participants: 3  
Project participant:  
Thyregod, Camilla (Intern)  
Ersbøll, Bjarne Kjær (Intern)  
Project Manager, organisational:  
Juul Jensen, Dorte (Intern)  

**Financing sources**  
Source: Public research council  
Name of research programme: Innovation Fund Denmark  
Amount: 12.70 Danish Kroner  
Project

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**Integrated off-line power converter using integrated inductors**  
Department of Electrical Engineering  
Period: 15/02/2015 → 06/06/2018  
Number of participants: 6  
Phd Student:  
Nour, Yasser (Intern)  
Supervisor:
Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor:
Knott, Arnold (Intern)
Examiner:
Andersen, Michael A. E. (Intern)
Carobolante, Francesco (Ekstern)
Pilawa-Podgurski, Robert C. N. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Computational methods for wind-energy forecasting**
Department of Applied Mathematics and Computer Science
Cognitive Systems
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Period: 01/02/2015 → 29/02/2016
Number of participants: 3
Project participant:
Bezzera, Erick (Ekstern)
Supervisor:
Pinson, Pierre (Intern)
Project Coordinator:
Guillot, Gilles (Intern)
Project

**Integrated off-line power converter using piezo elements**
Department of Electrical Engineering
Period: 01/02/2015 → 03/05/2018
Number of participants: 6
Phd Student:
Fan, Lin (Intern)
Supervisor:
Knott, Arnold (Intern)
Main Supervisor:
Jørgensen, Ivan Harald Holger (Intern)
Examiner:
Zhang, Zhe (Intern)
Allard, Bruno (Ekstern)
Nee, Hans-Peter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

**Relations**
Publications:
Integrated Off-Line Power Converter
Project: PhD

**The influence of visual cues on sound externalization**
Department of Electrical Engineering
**Comparison of binaural microphones for externalization of sound**

Department of Electrical Engineering

**Hearing Systems**

Period: 26/01/2015 → 26/07/2015  
Number of participants: 4  
Project participant: \[\text{Gil Carvajal, Juan Camilo (Ekstern)}\]  
Supervisor: \[\text{Cubick, Jens (Intern)}\]
\[\text{Santurette, Sébastien (Intern)}\]
\[\text{Dau, Torsten (Intern)}\]

**Project**

**Computational reduction techniques for numerical vibro-acoustic analysis of hearing aids**

Numerical vibro-acoustic analysis of hearing aids is essential for the study of current problems such as feedback paths. Significant computational challenges are encountered when solving numerical problems that require repeated calculations of large complex models. This is a problem of concern in the field of hearing aids, which are composed of a large number of small parts with complex dynamic and acoustical behavior.

This project focuses on developing computational reduction techniques to make these processes practically possible. These methods should be such that the precision of the model is kept at a desired level. The suggested approach is to divide the complex system into a set of physical subsystems, which are described by simplified substructure synthesis models.

Tasks that will benefit from this reduction are topology optimization of hearing aid parts and parametric uncertainty analysis of the vibro-acoustic response.

Department of Electrical Engineering

Acoustic Technology

Oticon A/S
Period: 01/01/2015 → 31/12/2017  
Number of participants: 3  
PhD Student: \[\text{Creixell Mediante, Ester (Intern)}\]  
Supervisor: \[\text{Jensen, Jakob Søndergaard (Intern)}\]  
Main Supervisor: \[\text{Brunskog, Jonas (Intern)}\]

**GenScen - Variable generation production scenario generation for planning and integration studies**

Department of Electrical Engineering

Center for Electric Power and Energy
Energy Analytics and Markets
Period: 01/01/2015 → 31/12/2015
Number of participants: 2
Project participant:
Pinson, Pierre (Intern)
Iversen, Jan Emil Banning (Intern)

Energy Management Systems for Active Distribution Grids
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Period: 01/01/2015 → 31/12/2015
Number of participants: 1
Energy Management Systems, active distribution grids
Acronym: EMS4ADGrids
Project ID: 56063
Project Manager, organisational:
Zong, Yi (Intern)

Computational reduction techniques for numerical vibro-acoustic analysis of hearing aids
Department of Electrical Engineering
Period: 01/01/2015 → 05/04/2018
Number of participants: 7
Phd Student:
Creixell Mediante, Ester (Intern)
Supervisor:
Jensen, Jakob Søndergaard (Intern)
Larsen, Martin (Ekstern)
Main Supervisor:
Brunskog, Jonas (Intern)
Examiner:
Cutanda Henriquez, Vicente (Intern)
Desmet, Wim (Ekstern)
Marburg, Steffen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD

Relations
Publications:
Computational reduction techniques for numerical vibro-acoustic analysis of hearing aids
Project: PhD

Interpretation of Brain Connectivity in CNS Diseases for Improvement of Drug Development
Department of Electrical Engineering
Period: 01/01/2015 → 22/09/2018
Number of participants: 4
Phd Student:
Hansen, Ingeborg Helbech (Intern)
Supervisor:
Bastlund, Jesper Frank (Ekstern)
Herrik, Kjartan Frisch (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Industrial PhD
- Project: PhD

**Engineering passive electronic components for the world's smallest AC-DC power supply by nanofabrication**
- Department of Electrical Engineering
- Period: 15/12/2014 → 07/03/2018
- Number of participants: 8
- PhD Student: Lê Thanh, Hoà (Intern)
- Supervisor: Han, Anpan (Intern)
- Knott, Arnold (Intern)
- Ouyang, Ziwei (Intern)
- Main Supervisor: Jensen, Flemming (Intern)
- Examiner: Andersen, Michael A. E. (Intern)
- Duffy, Maeve (Ekstern)
- Niklaus, Frank (Ekstern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Forskningsrådsfinansiering
- Project: PhD

**Fault Diagnosis and Optimal Control of Electro - Mechanical systems**
- Department of Electrical Engineering
- Period: 15/12/2014 → 03/05/2018
- Number of participants: 7
- PhD Student: Sekunda, André Krabdrup (Intern)
- Supervisor: Poulsen, Niels Kjølstad (Intern)
- Santos, Ilmar (Intern)
- Main Supervisor: Niemann, Hans Henrik (Intern)
- Examiner: Galeazzi, Roberto (Intern)
- Kallesøe, Carsten Skovmose (Ekstern)
- Kinnaert, Michel (Ekstern)

**Financing sources**
- Source: Internal funding (public)
- Name of research programme: Institut stipendie (DTU)

**Relations**
- Publications:
  - Fault Diagnosis and Identification of Electro Mechanical Systems - Methods for Closed Loop Systems.
  - Project: PhD

**High Frequency Switch-Mode Audio Power Amplifiers**
- Department of Electrical Engineering
Period: 15/12/2014 → 06/06/2018
Number of participants: 6
Phd Student:
Iversen, Niels Elkjær (Intern)
Supervisor:
Andersen, Michael A. E. (Intern)
Main Supervisor:
Knott, Arnold (Intern)
Examiner:
Zhang, Zhe (Intern)
Angus, Jamie (Ekstern)
Honda, Jun (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Observability and decision support for supervision of distributed power system control**
Department of Electrical Engineering
Period: 15/12/2014 → 05/04/2018
Number of participants: 7
Phd Student:
Pertl, Michael Gerold (Intern)
Supervisor:
Heussen, Kai (Intern)
Marinelli, Mattia (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Træholt, Chresten (Intern)
Keane, Andrew (Ekstern)
Turri, Roberto (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

**Relations**
Publications:
Observability and Decision Support for Supervision of Distributed Power System Control
Project: PhD

**Encoding of non-MR signals in Magnetic Resonance Imaging data**
Department of Electrical Engineering
Period: 01/12/2014 → 06/06/2018
Number of participants: 7
Phd Student:
Pedersen, Jan Ole (Intern)
Supervisor:
Xue, Rong (Ekstern)
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Hanson, Lars G. (Intern)
Examiner:
Petersen, Esben Thade (Intern)
Ringgaard, Steffen (Ekstern)
Webb, Andrew (Ekstern)
**Optimisation of Combine Harvesters Yield Using Model-Based Control**

Department of Electrical Engineering  
Period: 01/12/2014 → 02/05/2018  
Number of participants: 7  
Phd Student:  
Hermann, Dan (Intern)  
Supervisor:  
Andersen, Nils Axel (Intern)  
Bilde, Morten Leth (Ekstern)  
Main Supervisor:  
Ravn, Ole (Intern)  
Examiner:  
Niemann, Hans Henrik (Intern)  
Herlitzius, Thomas (Ekstern)  
Hägglund, Tore (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**Relations**

Publications:  
Optimisation of Combine Harvesters using Model-based Control

**Strategies for Hybrid Integration and Packaging at Millimeter-Wave and THz Frequencies**

Department of Electrical Engineering  
Period: 01/12/2014 → 31/05/2018  
Number of participants: 3  
Phd Student:  
Dong, Yunfeng (Intern)  
Supervisor:  
Zhurbenko, Vitaliy (Intern)  
Main Supervisor:  
Johansen, Tom Keinicke (Intern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Analysis and Design of Wideband Matched Feeds for Reflector Antennas**

Department of Electrical Engineering  
Period: 15/11/2014 → 03/05/2018  
Number of participants: 7  
Phd Student:  
Palvig, Michael Forum (Intern)  
Supervisor:  
Jørgensen, Erik (Intern)  
Meincke, Peter (Intern)  
Main Supervisor:  
Breinbjerg, Olav (Intern)  
Examiner:
Jepsen, Peter Uhd (Intern)
Bhattacharjee, Ratnajit (Ekstern)
Teniente-Vallinas, Jorge (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Characterizing auditory and audio-visual perception in virtual environments

Department of Electrical Engineering
Period: 15/11/2014 → 16/11/2018
Number of participants: 3
Phd Student:
Ahrens, Axel (Intern)
Supervisor:
Marschall, Marton (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Millimeter-wave Near-Field Antenna Measurements

Department of Electrical Engineering
Period: 15/11/2014 → 01/12/2018
Number of participants: 3
Phd Student:
Muntianu, Paula Irina (Intern)
Supervisor:
Breinbjerg, Olav (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

ELECTRA Top-Up

The project will focus on derive and develop a concept of metrics for characterization of the state of the power system to be used as part of the information presented to operators in the control room.

The concept will be experimentally tested in a control room decision support that will be required for the real time operation of the 2030 power systems, utilising visualisation and control features being investigated in ELECTRA Top-Up to ensure that the control room operator is provided with the optimal information of the state of the system and of the possible control actions to maintain the system in safe state.

Enhance the usage of the existing experimental facilities SYSLAB (in Risø Campus) and ControlLab (in Lyngby Campus) along with Risø MV network (property of DONG Energy) so that proper measurement needs can be identified and controlling strategies be tested with real MV and LV meshed networks (Risø) and using the realistic visualization facility (Lyngby). Studies and testing are done having in mind both the needs of a real DSO.

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Energy System Management  
Period: 01/11/2014 → 31/10/2017  
Number of participants: 4  
smart grid, Power systems, Control System  
Project ID: 3594756936313  
Project participant: Bindner, Henrik W. (Intern)  
Phd Student: Perl, Michael Gerold (Intern)  
Rezkalla, Michel Maher Naguib (Intern)  
Project Coordinator: Marinelli, Mattia (Intern)  

Financing sources  
Source: Public research council  
Name of research programme: EUDP  
Amount: 4,800,000.00 Danish Kroner  
Year of approval: 2014  

Relations  
Parent project: European Liaison on Electricity grid Committed Towards long-term Research Activities Project  

Enhanced Lightning effect TEsting capabilities for optimized wind turbine reliability  
Ph.D.-project  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Electric Equipment Technologies  
Global Lightning Protection Services A/S  
Period: 15/10/2014 → 14/10/2017  
Number of participants: 2  
Acronym: Elite  
Phd Student: Vogel, Stephan (Intern)  
Project Manager, academic: Holbøll, Joachim (Intern)  

Realistic Lightning Exposure System For Optimized Wid Turbine Reliability  
Department of Electrical Engineering  
Period: 15/10/2014 → 30/11/2017  
Number of participants: 6  
Phd Student: Vogel, Stephan (Intern)  
Supervisor: Madsen, Søren Find (Intern)  
Main Supervisor: Holbøll, Joachim (Intern)  
Examiner: Mijatovic, Nenad (Intern)  
Montaña Puig, Juan (Ekstern)  
Siew, Wah Hoon (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD
Distribution network observability and development of decision support features for real time operation of 2030 power system
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management
Period: 01/10/2014 → 30/09/2017
Number of participants: 3
Phd Student:
Prostejovsky, Alexander Maria (Intern)
Supervisor:
Kosek, Anna Magdalena (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)

Relations
Related projects:
European Liaison on Electricity grid Committed Towards long-term Research Activities
SALVAGE: Cyber-phySicAl security for Low-VoltAGE grids
DynTopo

TinyPower
DTU Danchip
Department of Electrical Engineering
Period: 01/10/2014 → 01/04/2018
Number of participants: 4
Project participant:
Birkelund, Karen (Intern)
Phd Student:
Lê Thanh, Hoà (Intern)
Supervisor:
Han, Anpan (Intern)
Project Coordinator:
Jørgensen, Anders Michael (Intern)

Wireless Communication for Custom Hearing Aids
Department of Electrical Engineering
Electromagnetic Systems
GN ReSound A/S
Period: 01/10/2014 → 30/09/2017
Number of participants: 3
Phd Student:
Kammersgaard, Nikolaj Peter Brunvoll (Intern)
Supervisor:
Thaysen, Jesper (Ekstern)
Main Supervisor:
Jakobsen, Kaj Bjarne (Intern)

Best Paths
To establish a low-carbon economy and to keep the global average temperature rise below 2°C, industrialised countries have to reduce greenhouse gas emission by up to 95% by 2050. Europe's energy sector is expected to make a major contribution towards achieving these reductions and to become the engine for a low-carbon economy.
The integration of decentralised renewable energy systems into the power grid is one of the principal drivers for investments in electricity infrastructure and offers many opportunities for the reduction of grid loads and energy losses in transportation. At the same time, grid operators and the electricity industry are facing major challenges in implementing this complete transformation of the way electricity is generated and transmitted.

By 2050, the majority of Europe’s electricity will come from renewables and the continent’s transmission grids will need to be geared to both transporting large quantities of offshore wind-generated electricity and integrating it into micro-grids. For electricity production, onshore and offshore wind power is a key provider, which is projected to increase to over 190 GW of installed capacity in the EU by 2020.

The challenge of integrating large volumes of renewable energies into the grid hinges on their intermittent nature and uneven geographical distribution. Major development of the European grid infrastructure is thus considered critical to maintaining reliable power supplies and bringing renewable-generated electricity from generation sites to far away consumption sites.

Department of Electrical Engineering

Center for Electric Power and Energy

Energy Analytics and Markets

Electric Power Systems
Period: 01/10/2014 → 30/09/2018
Number of participants: 4
Renewable Energy, HVDC, Electricity Markets, Energy System Modelling
Number of related Ph.D. students: 2
Project participant:
Pinson, Pierre (Intern)
Thams, Florian (Intern)
Chatzivasileiadis, Spyros (Intern)

Distribution network observability and development of decision support features for real-time operation of 2030 power system

Department of Electrical Engineering
Period: 01/10/2014 → 26/09/2017
Number of participants: 6
Phd Student:
Prostejovsky, Alexander Maria (Intern)
Supervisor:
Kok, Koen (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Træholt, Chresten (Intern)
Monti, Antonello (Ekstern)
Nordström, Lars Martin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Increased Observability in Electric Distribution Grids
Project: PhD

Synchronous Condensers APPlication in Low Inertia Systems
The electricity grid of the future will be supplied by 100% renewable energy generators. Most of these generators will be connected to the grid by electronic power converters, which gives rise to protection and control difficulties during disturbances.

A solution to this problem associated with renewable-energy-based grids is to install synchronous condensers (SC), which
are synchronous generators without a prime mover. SCs therefore possess all the advantages of a synchronous generator during fault conditions and eliminate the protection issues that otherwise exist.

Siemens A/S detected this challenge early and has committed to building a global competence centre in Denmark that focuses on synchronous condensers. The Center for Electric Power and Energy, Technical University of Denmark (DTU) has a strong competence centre focusing on power system operation and electrical machines.

In this project, Siemens A/S and DTU set out to investigate the characteristics of a renewable-energy-based power system and identify the requirements for synchronous condensers in the future. By doing so, Siemens A/S and DTU are ensuring that Denmark maintains a leading position in the integration of renewable energy.

раГ Эlectric Energy Systems
аБ Department of Electrical Engineering
аБ Center for Electric Power and Energy
аБ Siemens A/S
аБ Period: 01/10/2014 → 31/03/2018
аБ Number of participants: 3
аБ Acronym: SCAPP
аБ Project ID: ForsKEL 12196
аБ Number of related Ph.D. students: 2
аБ Project participant:
аБ Nielsen, Arne Hejde (Intern)
аБ Project Manager, academic:
аБ Yang, Guangya (Intern)
аБ Project applicant:
аБ Østergaard, Jacob (Intern)

Relations
аБ Activities:
аБ Studies on Low Inertia Systems and Application of Synchronous Condensers: Initial results from Danish Project SCAPP

раГ Wireless Communication for Custom Hearing Instruments
аБ Department of Electrical Engineering
аБ Period: 01/10/2014 → 03/05/2018
аБ Number of participants: 7
аБ Phd Student:
аБ Kammersgaard, Nikolaj Peter Brunvoll (Intern)
аБ Supervisor:
аБ Kvist, Søren Helstrup (Intern)
аБ Thayesen, Jesper (Intern)
аБ Main Supervisor:
аБ Jakobsen, Kaj Bjarne (Intern)
аБ Examiner:
аБ Skou, Niels (Intern)
аБ Johansson, Anders J. (Ekstern)
аБ Skrivervik, Anja K. (Ekstern)

 Financing sources
аБ Source: Internal funding (public)
аБ Name of research programme: Industrial PhD
аБ Project: PhD

Assessing hearing-aid signal processing based on variations of the Turing test
аБ Department of Electrical Engineering
аБ Period: 15/09/2014 → 21/08/2018
аБ Number of participants: 4
аБ Phd Student:
аБ Kowalewski, Borys (Intern)
Supervisor:
Fereczkowski, Michal (Intern)
MacDonald, Ewen (Intern)
Main Supervisor:
Dau, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

In DHBT Optimization for Millimeter-Wave Power Applications
Department of Electrical Engineering
Period: 01/09/2014 → 01/01/2018
Number of participants: 6
Phd Student:
Midili, Virginio (Intern)
Supervisor:
Nodjiadjim, Virginie (Ekstern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Jensen, Thomas (Intern)
Maneux, Cristell (Ekstern)
Weimann, Nils (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

InP DHBT MMIC Power Amplifiers for Millimeter-Wave Applications
Department of Electrical Engineering
Period: 01/09/2014 → 28/02/2018
Number of participants: 6
Phd Student:
Squartecchia, Michele (Intern)
Supervisor:
Dupuy, Jean-Yves (Ekstern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Jakobsen, Kaj Bjarne (Intern)
Bao, Mingquan (Ekstern)
Colantonio, Paolo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

MR Imaging of Weak Electric Currents
Department of Electrical Engineering
Period: 01/09/2014 → 06/12/2017
Number of participants: 6
Phd Student:
Göksu, Cihan (Intern)
Supervisor:
Hanson, Lars G. (Intern)
Main Supervisor:
Thielscher, Axel (Intern)
Examiner:
Petersen, Esben Thade (Intern)
Bieri, Oliver (Ekstern)
Ider, Yusuf Ziya (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

**Relations**
Publications:
A Novel Magnetic Resonance Imaging (MRI) Approach for Measuring Weak Electric Currents Inside the Human Brain

**Optimal Voltage Control of Distribution Networks with High Penetration of Distributed Energy Resources (DERs)**
Department of Electrical Engineering
Period: 01/09/2014 → 07/11/2018
Number of participants: 4
Phd Student:
Hermann, Alexander Niels August (Intern)
Supervisor:
Huang, Shaojun (Intern)
Kazempour, Jalal (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Fault-Tolerant Control with Coarse Models in industrial Application**
Department of Electrical Engineering
Automation and Control
Period: 15/08/2014 → 15/08/2017
Number of participants: 3
Fault-tolerant control, fault diagnosis, fault estimation, nonlinear control, nonlinear systems, industrial motors
Project participant:
Papageorgiou, Dimitrios (Intern)
Supervisor:
Niemann, Hans Henrik (Intern)
Main Supervisor:
Blanke, Mogens (Intern)

**Relations**
Activities:
2015 IEEE Multi-Conference on Systems and Control

**Fault-tolerance and reconfiguration for collaborating heterogeneous underwater robots**
Department of Electrical Engineering
Period: 15/08/2014 → 06/06/2018
Number of participants: 3
Phd Student:
High Accuracy Nonlinear Control and Estimation for Machine Tool Systems

Department of Electrical Engineering
Period: 15/08/2014 → 11/10/2017
Number of participants: 7
PhD Student:
Papageorgiou, Dimitrios (Intern)
Supervisor:
Nieman, Hans Henrik (Intern)
Richter, Jan H. (Ekstern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Santos, Ilmar (Intern)
Edwards, Christopher (Ekstern)
Johansen, Tor Arne (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet
Project: PhD

Portable Ultrasound Imaging

Department of Electrical Engineering
Period: 15/08/2014 → 06/12/2017
Number of participants: 6
PhD Student:
di Ianni, Tommaso (Intern)
Supervisor:
Villagómez Hoyos, Carlos Armando (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Traberg, Marie Sand (Intern)
Tang, Mengxing (Ekstern)
Van der Steen, Antonius Franciscus Wilhelms (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Relations
Publications:
High Accuracy Nonlinear Control and Estimation for Machine Tool Systems
Project: PhD
Robust HT-MEAs for Dynamic Operation under Smart Grid Conditions

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Department of Energy Conversion and Storage

Proton conductors
Period: 01/08/2014 → 01/08/2017
Number of participants: 3
Acronym: SmartMEA
Project participant:
Pensini, Alessandro (Intern)
Træholt, Chresten (Intern)
Project Manager, organisational:
Jensen, Jens Oluf (Intern)

Concepts, capacities and Methods for Testing EV Systems and their Interoperability within the Smart Grids
PhD project

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Period: 01/08/2014 → 01/08/2017
Number of participants: 4
Acronym: COTEVOS
Number of related Ph.D. students: 1
Project participant:
Træholt, Chresten (Intern)
Andersen, Peter Bach (Intern)
Marinelli, Mattia (Intern)
Phd Student:
Martinenas, Sergejus (Intern)
Project

Enabling Technologies for Smart Grid Integration of Electric Vehicles

Department of Electrical Engineering
Period: 01/08/2014 → 07/02/2018
Number of participants: 7
Phd Student:
Martinenas, Sergejus (Intern)
Supervisor:
Andersen, Peter Bach (Intern)
Marinelli, Mattia (Intern)
Main Supervisor:
Træholt, Chresten (Intern)
Examiner:
Gehrke, Oliver (Intern)
Belver, Inmaculada Zamora (Ekstern)
Putrus, Ghanim Alesha (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Relations

Publications:
Enabling Technologies for Smart Grid Integration and Interoperability of Electric Vehicles
Project: PhD

Hyperpolarized magnetic resonance: in vitro assay of cellular metabolism
Department of Electrical Engineering
Period: 01/07/2014 → 31/05/2015
Number of participants: 3
Phd Student:
Kjøller, Hans-Henrikk (Intern)
Supervisor:
Duus, Jens Ølgaard (Intern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Computational speech segregation inspired by principles of auditory processing
Department of Electrical Engineering
Period: 15/06/2014 → 07/03/2018
Number of participants: 7
Phd Student:
Bentsen, Thomas (Intern)
Supervisor:
Kressner, Abigail Anne (Intern)
May, Tobias (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Bleeck, Stefan (Ekstern)
Tchorz, Jürgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Reference architecture and infrastructure for modularity-based distributed control
Department of Electrical Engineering
Period: 01/06/2014 → 31/05/2017
Number of participants: 7
Phd Student:
Petersen, Bo Søborg (Intern)
Supervisor:
Poulsen, Bjarne (Intern)
You, Shi (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Andersen, Peter Bach (Intern)
Deconinck, Geert (Ekstern)
Olsen, Jesper Løvenstein (Ekstern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Fast Plane Wave Imaging**
Department of Electrical Engineering
Period: 01/05/2014 → 13/09/2017
Number of participants: 6
PhD Student:
Jensen, Jonas (Intern)
Supervisor:
Stuart, Matthias Bo (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Henneberg, Kaj-Åge (Intern)
Korte, Chris L. de (Ekstern)
Yu, Alfred C. H. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

**Relations**
Publications:
Fast Plane Wave Imaging
Project: PhD

**Bindevævs biomekanik og modellering**
Department of Electrical Engineering
Biomedical Engineering
Period: 07/04/2014 → 16/06/2014
Number of participants: 3
Project participant:
Traberg, Marie Sand (Intern)
Eriksen, Tine Alkjær (Intern)
Örn Jensson, Brynjar (Ekstern)
Documents:
Connective tissue biomechanics and modelling_FinalVersion
Project

**DynTopo**
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management
Period: 04/04/2014 → 18/09/2014
Number of participants: 3
Acronym: Dynamic Topology Data
Project participant:
Kosek, Anna Magdalena (Intern)
Phd Student:
Prostejovsky, Alexander Maria (Intern)
Project Manager, academic:
Gehrke, Oliver (Intern)
Relations

Activities:

Co-Simulation Hands-On Workshop with Use of Open-Source Tool Mosaik

Project

SALVAGE: Cyber-physicAl security for Low-VoltAGE grids

This project proposes research in cyber-security of the power system, aiming at model-based power system intrusion detection and probability of an event causing the ICT system security to be compromised. The alarms from both ICT and power system components need to be collected and fused into possible fault or intrusion suggestions. The system operator uses these suggestions to estimate the system state and assess if the system security and stability was compromised. This project considers the distribution power grid. The CEE part contributes power system model based estimation methods, to detect if false measurements are being fed to the system or if behaviour of components has been manipulated.

Center for Electric Power and Energy
Energy System Management
Department of Electrical Engineering
Automation and Control
KTH - Royal Institute of Technology
Wrocław University of Science and Technology
Period: 01/04/2014 → 01/04/2017
Number of participants: 4
cyber-physical security in power systems
Acronym: SALVAGE
Number of related Ph.D. students: 3
Project participant:
Gehrke, Oliver (Intern)
Heussen, Kai (Intern)
PhD Student:
Prostejovsky, Alexander Maria (Intern)
Project Manager, academic:
Kosek, Anna Magdalena (Intern)

Relations

Activities:

2016 Joint Workshop on Cyber-Physical Security and Resilience in Smart Grids
Intrusion detection systems for Smart Grid: model-based anomaly detection
NREL Cybersecurity & Resilience Workshop “Security and Resilience of Grid Integration with Distributed Energy Resources: Lessons Learned & Future Outlook”
Publications:
SALVAGE Report D2.1 Description of existing and extended smart grid component models for use in the intrusion detection system
Deliverable 1.1 Smart grid scenario
Project

Low power analog-to-digital conversion for hearing aid applications without sound artifacts

Department of Electrical Engineering
Period: 01/04/2014 → 13/04/2015
Number of participants: 2
PhD Student:
Haerizadeh, Seyediman (Intern)
Main Supervisor:
Jørgensen, Ivan Harald Holger (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD
Characterizing cochlear hearing impairment using electrophysical methods

Department of Electrical Engineering
Period: 15/02/2014 → 06/12/2017
Number of participants: 7
Phd Student: Encina-Llamas, Gerard (Intern)
Supervisor: Dau, Torsten (Intern)
Harte, James (Intern)
Main Supervisor: Epp, Bastian (Intern)
Examiner: Marozeau, Jeremy (Intern)
Bruce, Ian Christopher (Ekstern)
Schaette, Roland (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Activities:
Exaggerated temporal processing deficits as animals age after synaptopathic noise
Comparison of peripheral compression estimates using auditory steady-state responses (ASSR) and distortion product otoacoustic emissions (DPOAE)
A mouse model of the auditory nerve to study cochlear synaptopathy
Evaluation of peripheral compression and auditory nerve fiber intensity coding using Auditory Steady-State Responses (ASSR)
Temporal processing deficits due to noise-induced synaptopathy studied using envelope following responses
Hidden hearing loss with envelope following responses (EFRs): The off-frequency problem
Evaluation of cochlear processing and auditory nerve fiber intensity coding using Auditory Steady-State Responses (ASSR)
Publications:
Characterizing cochlear hearing impairment using advanced electrophysiological methods

Evaluation of a clinical auditory profile in hearing-aid candidates

Department of Electrical Engineering
Hearing Systems
University of Copenhagen
Rigshospitalet
Bispebjerg University Hospital
Period: 03/02/2014 → 19/12/2014
Number of participants: 3
Project participant: Santurette, Sébastien (Intern)
Thorup, Nicoline (Ekstern)
Supervisor:
Fris, Morten (Ekstern)

Relations
Activities:
Beyond the audiogram: How can we achieve better hearing rehabilitation?

Project
Unified testing procedures for wind turbines through inflow characterisation using nacelle lidars

UniTTe addresses the question of how best to characterise the wind when measuring the power and loads on modern wind turbines.

Current international standards require us to measure the wind from a mast, far in-front of the rotor and at the rotor centre height (hub-height). UniTTe proposes a radical change so that in the future we will measure with a lidar (laser...
anemometer) mounted on the nacelle, measure quite close to the rotor and measure over a range of heights. The advantages will be significant: avoiding erecting high masts (hugely expensive offshore), getting better correlation between the wind and the power and loads and achieving universal procedures that work equally well both offshore and in mountains.

UniTTe - Unified Turbine Testing

Department of Wind Energy

Test and Measurements

Department of Electrical Engineering

Aeroelastic Design

Residual Resource Engineering

Wind Turbines
Period: 01/01/2014 → 31/12/2017
Number of participants: 11
nacelle lidars, power performance, loads assessment, inflow, induction

Acronym: UniTTe
Number of related Ph.D. students: 2

Project participant:
Friis Pedersen, Troels (Intern)
Trolldborg, Niels (Intern)
Meyer Forsting, Alexander (Intern)
Bechmann, Andreas (Intern)
Courtney, Michael (Intern)
Borraccino, Antoine (Intern)
Vignaroli, Andrea (Intern)
Natarajan, Anand (Intern)
Sathe, Ameya (Intern)
Dimitrov, Nikolay Krasimirov (Intern)

Project Manager, academic:
Wagner, Rozenn (Intern)

Relations
Related projects:
Modeling of Wind Turbine Inflow
Activities:
EWEA Technology Workshop
Wind Europe Summit 2016
Perdigao NEWA meeting
11th EAWE PhD seminar on Wind Energy in Europe
Power curve measurement using $V_\infty$ estimates from nacelle lidars and its uncertainty
ISARS2016
12th German Wind Energy Conference DEWEK 2015
ECCOMAS Congress 2016
Predicting free-stream wind speed in complex terrain with lidar measurements
Power curve measurement using $\text{蘅} V_\infty$ estimates from nacelle lidars and its uncertainty

Publications:
Calibration report for Avent 5-beam Demonstrator lidar
Calibration report for ZephIR Dual Mode lidar (unit 351)
Generic methodology for calibrating profiling nacelle lidars

Project

Early detection of response to treatment in cancer by Hyperpolarized Metabolic MR

Department of Electrical Engineering
Phasor Measurement Unit Applications for Small Signal Stability Assessment and Improvement of Power Systems

Department of Electrical Engineering
Period: 01/01/2014 → 13/09/2017
Number of participants: 6
Phd Student:
Ghiga, Radu (Intern)
Supervisor:
Wu, Qiuwei (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Yang, Guangya (Intern)
Fu, Yong (Ekstern)
Uhlen, Kjetil (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Phasor Measurement Unit Test and Applications for Small Signal Stability Assessment and Improvement of Power System
Project: PhD

Predicting the consequences of hearing loss and hearing-aid signal processing on speech intelligibility

Department of Electrical Engineering
Period: 01/01/2014 → 07/02/2018
Number of participants: 6
Phd Student:
Scheidiger, Christoph (Intern)
Supervisor:
Zaar, Johannes (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Epp, Bastian (Intern)
Jürgens, Tim (Ekstern)
Lopez-Poveda, Enrique A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Advanced 3D ultrasound imaging
Department of Electrical Engineering
Period: 15/12/2013 → 08/03/2017
Number of participants: 7
Phd Student:
Bouzari, Hamed (Intern)
Supervisor:
Nikolov, Svetoslav (Intern)
Stuart, Matthias Bo (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Sams, Thomas (Intern)
Austeng, Andreas (Ekstern)
Yen, Jesse Tong-pin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
Advanced 3-D Ultrasound Imaging: 3-D Synthetic Aperture Imaging using Fully Addressed and Row-Column Addressed 2-D Transducer Arrays.
Project: PhD

Automatic ultrasound scanning
Department of Electrical Engineering
Period: 15/12/2013 → 12/04/2017
Number of participants: 7
Phd Student:
Moshavegh, Ramin (Intern)
Supervisor:
Hemmsen, Martin Christian (Intern)
Martins, Bo (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
D’Hooge, Jan (Ekstern)
Ranefall, Petter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
Automatic Ultrasound Scanning
Project: PhD
Control strategies and modelling of electric vehicles in the distribution network

Department of Electrical Engineering
Period: 15/12/2013 → 14/06/2017
Number of participants: 7
Phd Student: Knezovic, Katarina (Intern)
Supervisor: Andersen, Peter Bach (Intern)

Main Supervisor: Marinelli, Mattia (Intern)
Examiner: Træholt, Chresten (Intern)

Korpås, Magnus (Ekstern)
Paolone, Mario (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Galvanic isolated off-line VHF switch-mode power supplies

Department of Electrical Engineering
Period: 15/12/2013 → 12/04/2017
Number of participants: 6
Phd Student: Pedersen, Jeppe Arnsdorf (Intern)
Supervisor: Andersen, Michael A. E. (Intern)

Main Supervisor: Knott, Arnold (Intern)
Examiner: Zhang, Zhe (Intern)
Bertilsson, Kent (Ekstern)
Mathuna, Cian O (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications: Very High Frequency Galvanic Isolated Offline Power Supply
Project: PhD

Modular Robotics for Underwater Environments

Department of Electrical Engineering
Period: 15/12/2013 → 14/03/2017
Number of participants: 6
Phd Student: Furno, Lidia (Intern)
Supervisor: Christensen, David Johan (Intern)

Main Supervisor: Blanke, Mogens (Intern)
Examiner:
Niemann, Hans Henrik (Intern)
Ludvigsen, Martin (Ekstern)
Schultz, Ulrik Pagh (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Spectral and temporal processing in electric hearing
Department of Electrical Engineering
Period: 15/12/2013 → 04/03/2018
Number of participants: 6
Phd Student:
Guérit, François (Intern)
Supervisor:
Epp, Bastian (Intern)
Main Supervisor:
Marozeau, Jeremy (Intern)
Examiner:
MacDonald, Ewen (Intern)
Arenberg, Julie Gayle (Ekstern)
Macherey, Olivier (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

European Liaison on Electricity grid Committed Towards long-term Research Activities
European FP7 funded IRP project, which will develop radically new control schemes for the real time operation of the
2030 power system and provide support for the EERA Joint Programme on Smart Grids activity in order to realize the
European SET Plan objectives. The EERA JP on Smart Grids intends to facilitate and encourage European coordination
of member state research in the domain of Smart Grids

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Energy System Management
Automation and Control
Period: 01/12/2013 → 30/11/2017
Number of participants: 8
smart grid, Power systems
Acronym: ELECTRA
Project ID: 609687
Project participant:
Marinelli, Mattia (Intern)
Bindner, Henrik W. (Intern)
Heussen, Kai (Intern)
Gehrke, Oliver (Intern)
Hu, Junjie (Intern)
Prostejovsky, Alexander Maria (Intern)
Rezkalla, Michel Maher Naguib (Intern)
Pertl, Michael Gerold (Intern)

Financing sources
Source: EU research programme (public)
Name of research programme: EU FP7 IRP
Amount: 10,000,000.00 Euro
Year of approval: 2013

**Relations**

Related projects:
ELECTRA Top-Up

Activities:
Enhancing the role of EVs in the smart grid: Resources or threats to power system operation? Trends and research drivers in Europe

Publications:
Implementation of fuzzy logic for mitigating conflicts of frequency containment control
Supporting Control Room Operators in Highly Automated Future Power Networks
Scenario-based approach adopted in the ELECTRA project for deriving innovative control room functionality
Requirements for future control room and visualisation features in the Web-of-Cells framework defined in the ELECTRA project
Voltage and Frequency Control for Future Power Systems: the ELECTRA IRP Proposal
Distributed Framework for Prototyping of Observability Concepts in Smart Grids
Identification of observables for future grids – the framework developed in the ELECTRA project
Detailed requirements and constraints for the control of flexibility
Identification of Requirements for Distribution Management Systems in the Smart Grid Context
Reduction of Topological Connectivity Information in Electric Power Grids
The Pan-European Reference Grid Developed in the ELECTRA Project for Deriving Innovative Observability Concepts in the Web-of-Cells Framework
Key requirements for future control room functionality
A Novel Grid-Wide Transient Stability Assessment and Visualization Method for Increasing Situation Awareness of Control Room Operators
Trade-off Analysis of Virtual Inertia and Fast Primary Frequency Control During Frequency Transients in a Converter Dominated Network
Towards modeling future energy infrastructures - the ELECTRA system engineering approach
Enhanced Situational Awareness and Decision Support for Operators of Future Distributed Power Network Architectures
Grid Frequency Support by Single-Phase Electric Vehicles Employing an Innovative Virtual Inertia Controller
Grid Frequency Support by Single-Phase Electric Vehicles: Fast Primary Control Enhanced by a Stabilizer Algorithm
Toward Coordinated Robust Allocation of Reserve Policies for a Cell-based Power System
A Decision Support Tool for Transient Stability Preventive Control
Demonstration of visualization techniques for the control room engineer in 2030.
Description of the detailed Functional Architecture of the Frequency and Voltage control solution (functional and information layer)
Functional description of the monitoring and observability detailed concepts for the Pan-European Control Schemes
Adaptive Assessment of Future Scenarios and Mapping of Observability Needs. Deliverable D5.1

Documents:
CEE_Fact_sheet_ELECTRA_2015

**Custom Integrated Circuit Design for Ultrasound CMUT Array intended for a Handheld Scanner**

Department of Electrical Engineering
Period: 01/12/2013 → 08/03/2017
Number of participants: 6
PhD Student:
Llimos Muntal, Pere (Intern)
Supervisor:
Bruun, Erik (Intern)
Main Supervisor:
Jørgensen, Ivan Harald Holger (Intern)
Examiner:
Knott, Arnold (Intern)
Goes, João Carlos da Palma (Ekstern)
Lehmann, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Relations
Publications:
Custom Integrated Circuit Design for Portable Ultrasound Scanners
Project: PhD

Effects and Minimization of stray inductance in power electronics
Department of Electrical Engineering
Period: 01/12/2013 → 30/11/2016
Number of participants: 3
Phd Student:
Lindberg-Poulsen, Kristian (Intern)
Supervisor:
Andersen, Michael A. E. (Intern)
Main Supervisor:
Petersen, Lars Press (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

3D Vector Velocity Imaging
Department of Electrical Engineering
Period: 01/11/2013 → 08/02/2017
Number of participants: 6
Phd Student:
Holbek, Simon (Intern)
Supervisor:
Stuart, Matthias Bo (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Traberg, Marie Sand (Intern)
Liebgott, Hervé (Ekstern)
Tanter, Mickaël (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
3-D Vector Flow Imaging
Project: PhD

Direct drive High Temperature Superconducting generators for wind turbine
Department of Electrical Engineering
Period: 01/11/2013 → 14/06/2017
Number of participants: 7
Phd Student:
Song, Xiaowei (Andy) (Intern)
Early Warning for Cascading Outages in Electric Power Systems

Department of Electrical Engineering
Period: 01/11/2013 → 06/12/2017
Number of participants: 6
PhD Student:
Petersen, Pauli Fríðheim (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Wu, Qiuwei (Intern)
Repo, Sami Petteri (Ekstern)
Terzija, Vladimir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Superconducting generator for large wind turbines

The HTS-GEN project targets a major market opportunity by developing the first high temperature superconducting (HTS) generator for large wind turbines (WTs).

The specific objectives for the project period are:
1) To design and build a representative test segment of a HTS-based generator for a DD WT and measure thermal, mechanical and electromagnetic properties of such segment.
2) To study the performance of the test segment using the results to adjust and validate the analysis models and the design to be applied in manufacturing of generators to large WTs.

The overall success criterion for HTS-GEN is the construction and testing of a test segment of the generator – including validation of its thermal, mechanical and electromagnetic performance – in conformity with the selected design. In addition, the selected design shall allow clear technical, supply chain and cost advantages compared with current technology.

Department of Electrical Engineering
Center for Electric Power and Energy
Period: 01/10/2013 → 31/10/2016
Number of participants: 3
Superconducting machines, Wind turbines, Superconducting wind turbine generators
Acronym: HTS-GEN
Number of related Ph.D. students: 1
Project participant:
Mijatovic, Nenad (Intern)
Song, Xiaowei (Andy) (Intern)
Project Manager, academic:
**Congestion Management of Distribution Networks with High Penetration of Distributed Energy Resources (DERs)**

Department of Electrical Engineering  
Period: 01/10/2013 → 08/02/2017  
Number of participants: 6  
Phd Student:  
Huang, Shaojun (Intern)  
Supervisor:  
Nielsen, Arne Hejde (Intern)  
Main Supervisor:  
Wu, Qiuwei (Intern)  
Examiner:  
Træholt, Chresten (Intern)  
Hobbs, Benjamin F. (Ekstern)  
Repo, Sami Petteri (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet

**Relations**  
Publications:  
Congestion management of electric distribution networks through market based methods  
Project: PhD

**Ideal grid for all**  
The IDE4L project will define, develop and demonstrate the entire system of distribution network automation, IT systems and applications for active network management. Active distribution networks will utilize distributed energy resources (DERs) for network management including both real time operation and long-term network planning viewpoints. DERs consist of aggregated distributed generation, demand response and other controllable loads. The starting point of development are existing distribution networks, their management systems, future expectations of penetration of renewable energy sources and high expectations of customers for continuity of service. The research and development work done in the project integrates many existing automation and IT systems utilizing available standard protocols in an innovative way and develops new applications based on that system. Demonstrations of integrated automation system and applications will be realized in real life networks in different parts of Europe where are connected large and small scale PV, wind power, heat pumps and EVs located in urban and rural areas. The outcome of the project will be applicable in very near future in all over Europe. Integrated distribution network automation system will be capable of monitoring, controlling, managing fast changing conditions and integrating large number of DERs in distribution network. Technical solutions utilizing the automation system will enhance the reliability of distribution network by improving fault location, isolation and supply restoration, will increase the hosting capacity of distribution network for renewables by managing network congestion with DERs, will optimize the operation of DERs by aggregating DERs and coordinating these with distribution network management, and will monitor dynamic behaviour of distribution network for system management.

Department of Electrical Engineering  
Center for Electric Power and Energy  
Period: 01/09/2013 → 31/08/2016  
Number of participants: 1  
Acronym: IDE4L  
Project participant:  
Wu, Qiuwei (Intern)

**Effects of hearing aid signal processing on temporal auditory perception**

Department of Electrical Engineering  
Period: 01/09/2013 → 07/03/2018  
Number of participants: 7  
Phd Student:
Wiinberg, Alan (Intern)
Supervisor:
Epp, Bastian (Intern)
Jepsen, Morten Løve (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
MacDonald, Ewen (Intern)
Kates, James M. (Ekstern)
Kohlrusch, Armin (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

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**Exhaust Recirculation Control for Reduction of NOx from Large Two-stroke Diesel Engines**

Department of Electrical Engineering
Period: 01/09/2013 → 12/04/2017
Number of participants: 7
Phd Student:
Nielsen, Kræn Vodder (Intern)
Supervisor:
Hoffmann, Mark (Intern)
Laursen, Morten (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Galeazzi, Roberto (Intern)
Johansen, Tor Arne (Ekstern)
Theotokatos, Gerasimos (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Industrial PhD

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**Relations**
Publications:
Exhaust Recirculation Control for Reduction of NOx from Large Two-Stroke Diesel Engines
Project: PhD

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**Exploring Market Models for a European Electricity Grid With a High Penetration of Renewable Energy Sources**

Department of Electrical Engineering
Period: 01/09/2013 → 13/09/2017
Number of participants: 6
Phd Student:
Jensen, Tue Vissing (Intern)
Supervisor:
Greiner, Martin O. W. (Ekstern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Wu, Qiuwei (Intern)
Bjørndal, Mette Helene (Ekstern)
Papavasiliou, Anthony (Ekstern)

**Financing sources**
Source: Internal funding (public)
Holistic approach in monitoring, diagnosis of faults in modern wind turbines

Department of Electrical Engineering
Period: 01/09/2013 → 23/08/2017
Number of participants: 7
PhD Student:
Skrimpas, Georgios Alexandros (Intern)
Supervisor:
Hansen, Christian Sweeney (Ekstern)
Mijatovic, Nenad (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Agelidis, Vassilios (Intern)
Djurovic, Sinisa (Ekstern)
Niayesh, Kavah (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Static Security Assessment and PMU Data Validation

Department of Electrical Engineering
Period: 01/08/2013 → 12/04/2017
Number of participants: 6
PhD Student:
Møller, Jakob Glarbo (Intern)
Supervisor:
Jóhannsson, Hjörður (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Pinson, Pierre (Intern)
Huang, Zhenyu Henry (Ekstern)
Hug-Glanzman, Gabriela (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Improvement of cochlear implant stimulation strategies using auditory modeling

Department of Electrical Engineering
Period: 15/06/2013 → 12/04/2017
Number of participants: 6
PhD Student:
Joshi, Suyash Narendra (Intern)
Supervisor:
Dau, Torsten (Intern)
Main Supervisor:
Epp, Bastian (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Carlyon, Robert Paul (Ekstern)
Carney, Laurel H. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

**Optimal synthetic aperture duplex imaging**
Department of Electrical Engineering
Period: 15/06/2013 → 30/09/2016
Number of participants: 6
Phd Student: Villagómez Hoyos, Carlos Armando (Intern)
Supervisor: Stuart, Matthias Bo (Intern)
Main Supervisor: Jensen, Jørgen Arendt (Intern)
Examiner: Wilhjelm, Jens E. (Intern)
Løvstakken, Lasse (Ekstern)
Tortoli, Piero (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Synthetic Aperture Vector Flow Imaging
Project: PhD

**System-wide socio-economic and reliability impact of active management of distribution grids and distributed energy resources**
Department of Electrical Engineering
Period: 15/06/2013 → 30/09/2016
Number of participants: 8
Phd Student: Wang, Qi (Intern)
Supervisor: Morales González, Juan Miguel (Intern)
Meibom, Peter (Intern)
Pineda Morente, Salvador (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Yang, Guangya (Intern)
Bakirtzis, Anastasios (Ekstern)
Bessa, Ricardo Jorge Gomes Sousa Bento (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Real-time Trading Strategies for Proactive Distribution Company with Distributed Generation and Demand Response.
Project: PhD
**Nikola - Intelligent electric vehicle integration**

Nikola is a Danish research and demonstration project with a focus on the synergies between the electric vehicle (EV) and the power system. With sufficient control and communication it is possible to influence the timing, rate and direction of the power and energy exchanged between the EV battery and the grid. This ability can be used in a set of "services" that bring value to the power system, the EV owner and society in general. Nikola seeks to thoroughly investigate such services, to explore the technologies that can enable them and finally to demonstrate them through both simulations and in-field testing.

Department of Electrical Engineering
Center for Electric Power and Energy

**Distributed Energy Resources**

**Period:** 01/06/2013 → 31/05/2016
**Number of participants:** 5
**Smart Grid, Electric vehicles**
**Acronym:** Nikola
**Project participant:**
Marinelli, Mattia (Intern)
Andersen, Peter Bach (Intern)
Knezovic, Katarina (Intern)
Martinenas, Sergejus (Intern)
Træholt, Chresten (Intern)

**Relations**

**Activities:**
Enhancing the role of EVs in the smart grid: Resources or threats to power system operation? Trends and research drivers in Europe

**Publications:**
Comparative Analysis of Possible Designs for Flexible Distribution System Operation
Economic Comparison of Electric Vehicles Performing Unidirectional and Bidirectional Frequency Control in Denmark with Practical Validation
Standards for EV charging and their usability for providing V2G services in the primary reserve market
Enhancing the Role of Electric Vehicles in the Power Grid: Field Validation of Multiple Ancillary Services
Implementation and Demonstration of Grid Frequency Support by V2G Enabled Electric Vehicle
Analysis of Voltage Support by Electric Vehicles and Photovoltaic in a Real Danish Low Voltage Network
A Dynamic Behaviour Analysis on the Frequency Control Capability of Electric Vehicles
The Nikola project intelligent electric vehicle integration
Concurrent Provision of Frequency Regulation and Overvoltage Support by Electric Vehicles in a Real Danish Low Voltage Network
Electric vehicle data acquisition system
Distribution Grid Services and Flexibility Provision by Electric Vehicles: a Review of Options
Phase Balancing by Means of Electric Vehicles Single-Phase Connection Shifting in a Low Voltage Danish Grid
EV owner smart grid involvement
Electric Vehicle Smart Charging using Dynamic Price Signal

**Play for Children with Disabilities**

This Action aims at the creation of a novel and autonomous field of research and intervention on play for children with disabilities. The network has three main objectives: a) collecting and systematizing all existing competence and skills: educational researches, clinical initiatives, know-how of resources centers and users’ associations; b) developing new knowledge related to settings, tools and methodologies associated with the play of children with disabilities; c) disseminating the best practices emerging from the joint effort of researchers, practitioners and users.

Department of Electrical Engineering
Automation and Control

**Centre for Playware**

**Period:** 19/05/2013 → 18/05/2018
**Number of participants:** 1
Play, Disabilities
Acronym: LUDI
Project participant:
Jessen, Jari Due (Intern)

**Dynamic Coverage and Flow Coordination in Multi-Agent Networks**
Department of Electrical Engineering
Period: 15/05/2013 → 08/02/2017
Number of participants: 7
Phd Student:
Aabrandt, Andreas (Intern)
Supervisor:
Hansen, Vagn Lundsgaard (Intern)
Poulsen, Bjarne (Intern)
Main Supervisor:
Træholt, Chresten (Intern)
Examiner:
Wu, Qiuwei (Intern)
Jensen, Anders Nedergaard (Ekstern)
Scaglione, Anna (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Algebraic Varieties and System Design
Project: PhD

**Advanced Control of Smart Materials Applied to Sustainable Technology**
Department of Electrical Engineering
Period: 01/05/2013 → 07/09/2016
Number of participants: 7
Phd Student:
Theisen, Lukas Roy Svane (Intern)
Supervisor:
Galeazzi, Roberto (Intern)
Santos, Ilmar (Intern)
Main Supervisor:
Niemann, Hans Henrik (Intern)
Examiner:
Andreasen, Casper Schousboe (Intern)
Grigoriadis, Karolos M. (Ekstern)
Verhaegen, Michel (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Advanced Control of Active Bearings - Modelling, Design and Experiments
Project: PhD

**Analysis of the auditory system via synthesis of natural sounds, speech and music**
Department of Electrical Engineering
Period: 01/05/2013 → 14/06/2017
Number of participants: 5
Phd Student:
McWalter, Richard Ian (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
MacDonald, Ewen (Intern)
Chait, Maria (Ekstern)
Lorenzi, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Modelling Of Market-Based Cross-Border Exchange Of Balancing Power
Department of Electrical Engineering
Period: 01/05/2013 → 07/12/2016
Number of participants: 7
Phd Student:
Delikaraoglou, Stefanos (Intern)
Supervisor:
Morales González, Juan Miguel (Intern)
Heussen, Kai (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Rapke, Stefan (Intern)
Kirschen, Daniel (Ekstern)
Tomasgard, Asgeir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

RTLabOS: Phase I - Exploring software infrastructure for smart grid labs
The project RTLabOS: Phase I explored the evolving requirements of software infrastructure for smart grid labs. Best practice and gaps in the relevant state-of-the art have been identified through workshops, survey and analysis. By means of user survey, exploratory feasibility studies and structured use case documentation, the current practice, requirements and feasibility of next generation functionality of laboratory software infrastructure have been identified.

Department of Electrical Engineering
Automation and Control
Center for Electric Power and Energy
Energy System Management
Period: 01/04/2013 → 31/08/2014
Number of participants: 6
Laboratory software infrastructure, ICT, power systems, strategy formation
Acronym: RTLabOS
Project participant:
Kosek, Anna Magdalena (Intern)
Gehrke, Oliver (Intern)
Hu, Junjie (Intern)
Thavlov, Anders (Intern)
Project Manager, organisational:
Bindner, Henrik W. (Intern)
Project Manager, academic:
Heussen, Kai (Intern)

Relations
Activities:
Smart Grid Labs: Software Infrastructure
Software Ecosystems for Power System Integration Labs
Designing the Next Generation of Smart Grid Laboratories
Publications:
Model-driven development of smart grid services using SoaML
Fair division of generation profile and fuel consumption in isolated micro-grids
State of the Art Smart Grid Laboratories - A Survey about Software Use
Survey and Characterization of User Profiles and User Requirements
RTLabsOS Feasibility Studies
RTLabsOS Dissemination Activities
RTLabsOS Phase I: Software Infrastructure for Smart Grid Labs - Summary and Recommendations
Use Cases for Laboratory Software Infrastructure
Evaluation of smart grid control strategies in co-simulation - integration of IPSYS and mosaic
The Requirements Domain for Laboratory Software Infrastructure. RTLabsOS: Phase I – Deliverable 1.1

Project

5s - Future Electricity Markets
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Period: 01/04/2013 → 31/10/2017
Number of participants: 5
Project participant:
Pinson, Pierre (Intern)
Jensen, Tue Vissing (Intern)
Soares, Tiago (Intern)
Papakonstantinou, Athanasios (Intern)
Kazempour, Jalal (Intern)

Relations
Activities:
European conference for Operational Research 2015

Project

A novel electric motor drive using NANOPYME magnet for electric vehicle application
Department of Electrical Engineering
Period: 01/03/2013 → 30/04/2016
Number of participants: 7
Phd Student:
Fasil, Muhammed (Intern)
Supervisor:
Holbøll, Joachim (Intern)
Jensen, Bogi Bech (Intern)
Main Supervisor:
Mijatovic, Nenad (Intern)
Examiner:
Randewijk, Peter Jan (Intern)
Atallah, Kais (Ekstern)
Pyrhönen, Juha Jaakko (Ekstern)
Characterizing the auditory cues for the processing and perception of spatial sounds

Department of Electrical Engineering
Period: 01/03/2013 → 13/09/2017
Number of participants: 7
Phd Student:
Cubick, Jens (Intern)
Supervisor:
Laugesen, Søren (Intern)
Santurette, Sébastien (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Pulkki, Ville Topias (Intern)
Zahorik, Pavel (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Early Warning of Acute Diseases from Portable Vital Signs Monitoring and -Interpretation

Department of Electrical Engineering
Period: 01/03/2013 → 13/09/2017
Number of participants: 7
Phd Student:
Vilic, Adnan (Intern)
Supervisor:
Kjær, Troels Wesenberg (Ekstern)
Petersen, John Asger (Ekstern)
Main Supervisor:
Serensen, Helge Bjarup Dissing (Intern)
Examiner:
Jakobsen, Kaj Bjarne (Intern)
Karstoft, Henrik (Ekstern)
Mayer, Geert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Vital Signs Monitoring and Interpretation for Critically Ill Patients
Project: PhD

Modeling perceptual externalization in the normal, impaired and aided-impaired auditory system

Department of Electrical Engineering
Period: 01/03/2013 → 10/05/2017
Number of participants: 7
Phd Student:
Hassager, Henrik Gert (Intern)
Wide-Area Prosumption Modelling and Control

Department of Electrical Engineering
Period: 01/03/2013 → 12/04/2017
Number of participants: 6
Phd Student:
Wittrock, Martin Lindholm (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Sørensen, Poul Ejnar (Intern)
Erlich, István (Ekstern)
Glavic, Mevludin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Control and sensor techniques for PAD servo motor drives

Department of Electrical Engineering
Period: 15/02/2013 → 04/05/2016
Number of participants: 7
Phd Student:
Zsurzsan, Tiberiu-Gabriel (Intern)
Supervisor:
Andersen, Nils Axel (Intern)
Zhang, Zhe (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Radecker, Matthias (Ekstern)
Uchino, Kenji (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Advances in Piezoelectric Systems: An Application-Based Approach.
Energy Saving by Voltage Management
The main objective of this project is to develop and demonstrate two new energy optimization units whose aims are the reduction of the private household consumption and the improvement of distribution network power quality.

Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Energy System Management
Period: 01/02/2013 → 31/12/2015
Number of participants: 4
smart grid, Power distribution network
Acronym: ESVM
Project participant:
Marinelli, Mattia (Intern)
Bindner, Henrik W. (Intern)
Hu, Junjie (Intern)
Zecchino, Antonio (Intern)

Relations
Publications:
Experimental Testing and Model Validation of a Decoupled-Phase On-Load Tap Changer Transformer in an Active Network
Technical feasibility study of Voltage Optimization Unit
Coordinated voltage control of a decoupled three-phase on load tap changer transformer and photovoltaic inverters for managing unbalanced networks
Investigation of phase-wise voltage regulator control logics for compensating voltage deviations in an experimental low voltage network
Voltage Control for Unbalanced Low Voltage Grids Using a Decoupled-Phase On-Load Tap-Changer Transformer and Photovoltaic Inverters
Modeling and experimental testing activity of the Voltage Optimization Unit.

Room acoustic simulation tool for optimization of absorbent ceiling
Department of Electrical Engineering
Period: 01/02/2013 → 07/09/2016
Number of participants: 7
Phd Student:
Marbjerg, Gerd (Intern)
Supervisor:
Jeong, Cheol-Ho (Intern)
Nilsson, Erling (Ekstern)
Main Supervisor:
Brunskog, Jonas (Intern)
Examiner:
MacDonald, Ewen (Intern)
Le Bot, Alain (Ekstern)
Savioja, Lauri (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD
Real-Time Assessment of Voltage Stability (tentative)
Department of Electrical Engineering
Period: 15/01/2013 → 30/09/2016
Number of participants: 6
Phd Student:
Perez, Angel (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Træholt, Chresten (Intern)
Chow, Joe H. (Ekstern)
Uhlen, Kjetil (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Ensure a reliable operation of a sustainable future system
International network programme
Department of Electrical Engineering
Center for Electric Power and Energy
State Grid Electric Power Research Institute
Period: 01/01/2013 → 31/12/2013
Number of participants: 3
Project participant:
Østergaard, Jacob (Intern)
Nielsen, Arne Hejde (Intern)
Project Manager, academic:
Yang, Guangya (Intern)

Rammeaftale vedrørende udnyttelse af PowerlabDK's faciliteter
Department of Electrical Engineering
Center for Electric Power and Energy
Period: 01/01/2013 → 31/12/2017
Number of participants: 1
Acronym: FA ENDK
Project participant:
Wu, Qiuwei (Intern)

Modeling and Simulation of Wind Power & VSC-HVDC and Its Application in Offshore Wind Power Integration
Currently, large-scale wind power development is very fast in China. This project will enhance the long distance cooperation between the governments of China and Denmark. It will promote the ability on large-scale wind farm integration and application researches on VSC-HVDC based transmission technology and the capability on research the control strategies of wind turbines converter of China, and then ensure the power system safe and stable operation even with the large-scale wind power integrated. Through the implementation of the project it will speed up the wind power industry in China and meet the requirements of national renewable energy strategy and smart grid. Outcome of the project will give support for SGCC enterprise standard < Technical rule for connecting offshore wind farm to power grid >.

Partners: China Electric Power Research Institute, Aalborg University
Department of Electrical Engineering
**Integrated Microgrid Planning, Operation and Control System with Distributed Generation**

The purpose of the application is to enhance the collaboration between Denmark and China within the research area of optimal planning, operation and control of distribution networks with distributed generation (DG) by bringing scientific researchers in Denmark and China together to exchange research knowledge, experiences and ideas, and work together on new ideas and project proposals.

Partner: Tianjin University

Department of Electrical Engineering

Center for Electric Power and Energy
Period: 01/01/2013 → 31/12/2013
Number of participants: 1
Acronym: Int. Microgrid
Project participant:
Wu, Qiuwei (Intern)

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**Future Technologies for Wind Energy: Blade materials, Turbine reliability, Computation tools, and Experimental methods**

International Network Programme - USA & India

Department of Wind Energy

Composites and Materials Mechanics

Department of Electrical Engineering
Period: 01/01/2013 → 31/12/2013
Number of participants: 3
Wind Energy
Project ID: 12-132723
Project participant:
Raghavalu Thirumalai, Durai Prabhakaran (Intern)
Sørensen, Bent F. (Intern)
Mishnaevsky, Leon (Intern)

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**Energy Savings by Voltage Management**

The project seeks to develop and test a Digital Voltage Control (DVC) and a 10/04 Voltage Optimisation Unit (VOU). DVC is a digital transformer, designed to reduce voltage levels and thus power consumption in private households. 10/04 VOU is an on-load tap changing transformer, making it possible for the DNOs to monitor, regulate and control the voltage in the low voltage power grid.

Department of Electrical Engineering

Center for Electric Power and Energy

Energy System Management

PSS Energy A/S

DONG Energy A/S
Period: 01/01/2013 → 31/12/2014
Number of participants: 2
Project participant:
Bindner, Henrik W. (Intern)
Other:
Lyberth Barksmann, Trine (Intern)
**Financing sources**
Source: Public research programme (public)
Name of research programme: EUDP
Web address: http://www.ens.dk/ny-teknologi/eudp-energiteknologisk-udvikling-demonstration

**Relations**
Publications:
Technical feasibility study of Voltage Optimization Unit
Project

Integration of High Penetration of Renewable Energy Resources into the Industrial Power System with Microgrid Solution
The purpose of the project is to demonstrate integration of high penetration renewable energy in the industrial development zone of Laiyuan, Baoding, Hebei Province by applying a modular Microgrid Management System (MMS) including communication, control, operation and test platform to ensure secure operation of the network while optimizing the utilization of the available Renewable Energy (RE). Through this demonstration project, it is expected to promote a deep cooperation between China and Denmark in the field of developing renewable energy integration technology, e.g. Microgrid solution. The demonstration project also serves as a solid framework of the further collaboration between Denmark and China with respect to relevant technology development, commercialization and road mapping activities.

Department of Electrical Engineering
Center for Electric Power and Energy
Period: 01/01/2013 → 31/12/2014
Number of participants: 1
renewables integration, Microgrid Solution, Energy Management Systems, Industrial consumer
Acronym: IREMGS

Contact person:
Zong, Yi (Intern)
Project

**Novel MR contrast agent for angiography and perfusion: Hyperpolarized Water**

Department of Electrical Engineering
Period: 15/12/2012 → 11/01/2017
Number of participants: 6
Phd Student:
Lipsø, Hans Kasper Wigh (Intern)
Supervisor:
Hanson, Lars G. (Intern)
Main Supervisor:
Ardenkjær-Larsen, Jan Henrik (Intern)
Examiner:
Jensen, Pernille Rose (Intern)
Golman, Klaes (Ekstern)
Hövener, Jan-Bernd (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
A novel MR contrast agent for angiography and perfusion: Hyperpolarized water
Project: PhD

**Pitch representations in the impaired auditory system and implications for music perception**

Department of Electrical Engineering
Period: 15/12/2012 → 17/08/2016
Number of participants: 6
Phd Student:
Bianchi, Federica (Intern)
Supervisor:
Santurette, Sébastien (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
MacDonald, Ewen (Intern)
Johnsrude, Ingrid Suzanne (Ekstern)
Lorenzi, Christian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

**Relations**
Activities:
Effects of musical experience on pitch discrimination
Publications:
Complex-tone pitch representations in the human auditory system.
Project: PhD

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**Imaging of in-vivo pressure using ultrasound**
Department of Electrical Engineering
Period: 01/12/2012 → 17/02/2016
Number of participants: 6
Phd Student:
Olesen, Jacob Bjerring (Intern)
Supervisor:
Traberg, Marie Sand (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Hemmsen, Martin Christian (Intern)
Garcia, Damien (Ekstern)
Segers, Patrick (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
Imaging of In-Vivo Pressure using Ultrasound
Project: PhD

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**Interactive Modular Playware and Play Dynamics**
Department of Electrical Engineering
Period: 01/12/2012 → 15/03/2015
Number of participants: 3
Phd Student:
Fogh, Rune (Intern)
Supervisor:
Christensen, David Johan (Intern)
Main Supervisor:
Lund, Henrik Hautop (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Modular Robotic Playware
Department of Electrical Engineering
Period: 01/12/2012 → 07/09/2016
Number of participants: 6
Phd Student: Pacheco, Moises (Intern)
Supervisor: Christensen, David Johan (Intern)
Main Supervisor: Lund, Henrik Hautop (Intern)
Examiner: Andersen, Nils Axel (Intern)
Støy, Kasper (Ekstern)
Werfel, Justin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Modular Robotic Playware
Project: PhD

Motion-insensitive Magnetic Resonance Imaging
Department of Electrical Engineering
Period: 01/12/2012 → 16/03/2016
Number of participants: 6
Phd Student: Andersen, Mads (Intern)
Supervisor: Madsen, Kristoffer Hougaard (Intern)
Main Supervisor: Hanson, Lars G. (Intern)
Examiner: Thielscher, Axel (Intern)
Bowtell, Richard William (Ekstern)
Ringgaard, Steffen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Multi-port Bidirectional Current Controlled Power Supply
Department of Electrical Engineering
Period: 01/12/2012 → 15/06/2016
Number of participants: 6
Phd Student: Mira Albert, Maria del Carmen (Intern)
Supervisor: Knott, Arnold (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Ouyang, Ziwei (Intern)
On the Integration of Wide Band-gap Semiconductors in Single Phase Boost PFC Converters

Department of Electrical Engineering
Period: 01/12/2012 → 20/04/2016
Number of participants: 6
Phd Student:
Hernandez Botella, Juan Carlos (Intern)
Supervisor:
Petersen, Lars Press (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Knott, Arnold (Intern)
Balogh, Laszlo (Ekstern)
Prodic, Aleksandar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
On the Integration of Wide Band-gap Semiconductors in Single Phase Boost PFC Converters
Project: PhD

Planar antenna technology for broadband satellite-based communication at K/Ka-band and beyond

Department of Electrical Engineering
Period: 01/12/2012 → 31/10/2016
Number of participants: 3
Phd Student:
Hougs, Mikkel Dahl (Intern)
Supervisor:
Breinbjerg, Olav (Intern)
Main Supervisor:
Kim, Oleksiy S. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Playware for Welfare Technology

Department of Electrical Engineering
Period: 01/12/2012 → 30/09/2016
Number of participants: 5
Phd Student:
Jessen, Jari Due (Intern)
Main Supervisor:
Lund, Henrik Hautop (Intern)
Examiner:
Christensen, David Johan (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Evaluation and understanding of Playware Technology – trials with playful balance training.
Project: PhD

Reducing dependency of critical materials in rotating electrical machines by designing for recyclability and reusability
Department of Electrical Engineering
Period: 01/12/2012 → 14/06/2017
Number of participants: 8
PhD Student:
Hagberg, Stig (Intern)
Supervisor:
Bendixen, Flemming Buus (Ekstern)
Jensen, Bogi Bech (Intern)
Mijatovic, Nenad (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Randewijk, Peter Jan (Intern)
Polinder, Henk (Ekstern)
Pérez-Díaz, José Luis (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Sensorbaseret realtidsstyring af robotter
Department of Electrical Engineering
Period: 01/12/2012 → 15/06/2016
Number of participants: 6
PhD Student:
Andersen, Thomas Timm (Intern)
Supervisor:
Andersen, Nils Axel (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Christensen, David Johan (Intern)
Nielsen, Kurt (Ekstern)
Robertsson, Anders Robert Karol (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

WETMATE – a 33kV Subsea Wet-Mateable Connector for Offshore Renewable Energy
Department of Electrical Engineering
Center for Electric Power and Energy

Electric Equipment Technologies
Period: 01/12/2012 → 30/09/2015
Number of participants: 2
Acronym: WetMate
Project participant:
Sverrisson, Sverrir Ingi (Intern)
Project Manager, academic:
Holbell, Joachim (Intern)

Advanced techniques for EMI control and EMC optimization in miniaturized devices
Department of Electrical Engineering
Period: 15/11/2012 → 16/03/2016
Number of participants: 6
Phd Student:
Ruaro, Andrea (Intern)
Supervisor:
Thaysen, Jesper (Intern)
Main Supervisor:
Jakobsen, Kaj Bjarne (Intern)
Examiner:
Johansen, Tom Keinicke (Intern)
Johansson, Anders J. (Ekstern)
Vardaxoglou, Yiannis C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Market Design and Network Planning for distribution Grid
Department of Electrical Engineering
Period: 15/11/2012 → 16/03/2016
Number of participants: 6
Phd Student:
Zhang, Chunyu (Intern)
Supervisor:
Ding, Yi (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Nielsen, Arne Hejde (Intern)
Wen, Fushuan (Ekstern)
Zhang, Xiao-Ping (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Market Design and Strategy Making for Proactive Distribution Grid with DERs
Project: PhD

Pan European Climate Data
ENTSO-E funded project aimed at evaluating photovoltaic and wind hourly production on regional scale in the whole Europe
Emergency Control in Power Transmission

Department of Electrical Engineering
Period: 01/11/2012 → 20/01/2016
Number of participants: 7
PhD Student:
Pedersen, Andreas Sandegaard (Intern)
Supervisor:
Jóhannsson, Hjörtur (Intern)
Tabatabaeipour, Mojtaba (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Niemann, Hans Henrik (Intern)
Erlich, István (Ekstern)
Stoustrup, Jakob (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Non-magnetic driver for piezo actuators

Department of Electrical Engineering
Period: 01/11/2012 → 04/05/2016
Number of participants: 6
PhD Student:
Ekhtiari, Marzieh (Intern)
Supervisor:
Zhang, Zhe (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Carazo, Alfredo Vazquez (Ekstern)
Foster, Martin Paul (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**PV Inverter and control**
Department of Electrical Engineering  
Period: 01/11/2012 → 20/01/2016  
Number of participants: 6  
Phd Student:  
Anthon, Alexander (Intern)  
Supervisor:  
Zhang, Zhe (Intern)  
Main Supervisor:  
Andersen, Michael A. E. (Intern)  
Examiner:  
Knott, Arnold (Intern)  
Lomonova, Elena A. (Ekstern)  
Nee, Hans-Peter (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

**Damage an healing processes for voice health; High Speed Camera and biomecanical models**
Department of Electrical Engineering  
Period: 15/10/2012 → 30/09/2016  
Number of participants: 6  
Phd Student:  
Granados, Alba (Intern)  
Main Supervisor:  
Brunskog, Jonas (Intern)  
Examiner:  
Epp, Bastian (Intern)  
Epp, Bastian (Intern)  
Ternström, Sten (Ekstern)  
Ternström, Sten (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**  
Publications:  
Modeling and imaging of the vocal fold vibration for voice health.

**Optimal Operation of Distribution Networks with Electrification of Transport and Heating in Nordic Region**
Department of Electrical Engineering  
Period: 01/10/2012 → 16/03/2016  
Number of participants: 6  
Phd Student:  
Liu, Zhaoxi (Intern)  
Supervisor:  
Wu, Qiuwei (Intern)  
Main Supervisor:  
Nielsen, Arne Hejde (Intern)  
Examiner:  
Træholt, Chresten (Intern)
Sun, Hongbin (Ekstern)
Wang, Lingfeng (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Validation of Control Services in Future Sustainable Power Systems
Department of Electrical Engineering
Period: 15/09/2012 → 10/05/2017
Number of participants: 7
Phd Student:
Bondy, Daniel Esteban Morales (Intern)
Supervisor:
Heussen, Kai (Intern)
Niemann, Hans Henrik (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Wu, Qiuwei (Intern)
Kamphuis, René (Ekstern)
Mathieu, Johanna L. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

A Brain Computer Interface (BCI) System for Neuro-rehabilitation
Department of Electrical Engineering
Period: 01/09/2012 → 07/09/2016
Number of participants: 8
Phd Student:
Ordikhani-Seyedlar, Mehdi (Intern)
Supervisor:
Kjaer, Troels Wesenberg (Ekstern)
Sams, Thomas (Intern)
Sørensen, Helge Bjarne Dissing (Ekstern)
Main Supervisor:
Puthusserypady, Sadasivan (Intern)
Examiner:
Sams, Thomas (Intern)
Karstoft, Henrik (Ekstern)
Klonowski, Wlodzimierz (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Electrophysiological dynamics of covert and overt visual attention.
Project: PhD

Characterization and prediction of perceptual consequences of individual hearing loss
Department of Electrical Engineering
Modeling the consequences of hearing loss and hearing-aid processing on consonant perception
Department of Electrical Engineering
Period: 01/09/2012 → 02/11/2016
Number of participants: 5
Phd Student:
Zaar, Johannes (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Cooke, Martin (Ekstern)
Dubno, Judy R. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

Offshore Wind Park Control Assessment Methodologies to Assure Robustness and Fault tolerance
Department of Electrical Engineering
Period: 01/09/2012 → 20/01/2016
Number of participants: 9
Phd Student:
Gryning, Mikkel Peter Sidoroff (Intern)
Supervisor:
Andersen, Karsten Hvalkof (Intern)
Niemann, Hans Henrik (Intern)
Sørensen (fratrådt), Troels (Intern)
Wu, Qiuwei (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Cutululis, Nicolaos Antonio (Intern)
Erlich, István (Ekstern)
Stoustrup, Jakob (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Optimal sizing and control of balancing power in the future European system considering transmission system constraints

1 PROBLEM DESCRIPTION

It is a well-established fact that the future European power system will require an increasing amount of balancing power capability, in form of what today is called secondary and tertiary control reserves, in order to accommodate the increasing amount of fluctuating power producers, i.e. primarily wind power and photo-voltaic. In a sustainable scenario this balancing power must be provided by renewable energy sources in order to fulfill the energy policies of EU and other European countries, e.g. Norway and Switzerland. There are in principle five possible means to reduce the need for balancing power or to provide the needed balancing power in a sustainable way:

1. Improved forecasts of power production from fluctuating power sources.
2. Increased controllability of the fluctuating power sources
3. Designated storage devices close to the fluctuating power producers, e.g. Battery Energy Storage Systems (BESS)
4. Hydro power from a storage reservoir, possibly pumped storage
5. Demand Side Participation (DSP), i.e. load management

The first action is obvious and would lead to that the accuracy in the power production forecasts are improved, which will reduce the need for balancing power. The second one of these means would imply that the power plants are not operating at optimal efficiency and would consequently lead to energy losses of these power plants, which could be substantial. Local energy storage would lead to a higher energy output from the power plants but requires an additional investment. The advantage of items two and three above is that the balancing power is provided locally and the transmission system is not utilized to supply the needed balancing power. For the first three means above one does not provide more balancing power but rather decreases the need for additional balancing power and storage.

2 PROJECT OBJECTIVES

Hydro power, possibly with pumping capabilities, is a well proven effective source of sustainable balancing power. In Europe hydro power is of limited capacity and is located in a few geographical areas, i.e. basically in Scandinavia and in the Alps, implying that a certain power transmission capacity be required. This is particularly obvious for the Scandinavian hydro power, which requires HVDC cables in order to be integrated in the balancing power scheme of the continental system, but this is also the case for the hydro power in the Alps. Demand Side Participation (DSP) is an instrument that hitherto has not been utilized as balancing power to any larger extent. The potential available is deemed to be significant and various concepts how it should be implemented have been proposed. Also for DSP power transmission capacity is needed for its utilization.

It is thus clear that the need for more balancing power will also introduce additional requirements on the transmission system. These requirements are concerning demands on transmission capabilities but also concerning the management and control of the transmission grid. Both these aspects must be addressed in order to obtain a viable and effective solution for handling balancing power in the European system. The overall objectives are to address the problems related to balancing power in a future European system with a substantial part of the power generation in form of fluctuating renewable power sources. More specifically the following aspects will be addressed:

1. Estimation of the need of balancing power in different scenarios
2. Assessment of the different methods listed above to provide balancing power including the limitations imposed by the transmission system with regard to technical and economic criteria. Environmental issues will also be considered.
3. Development of planning methods and operational strategies for the future European system incorporating the needs of balancing power.

Department of Electrical Engineering

Electric Energy Systems

Centre for Electric Technology

Automation and Control

Swiss Federal Institute of Technology

Norwegian University of Science and Technology

Swissgrid - Transmission system operator of Switzerland

Period: 01/09/2012 → 01/09/2015

Number of participants: 3

Acronym: BPES

Project participant:

Østergaard, Jacob (Intern)
Heussen, Kai (Intern)

Project Manager, academic:

Andersson, Goran (Ekstern)
**Nordic power road map 2050: Strategic choices towards carbon neutrality**

The Nordic region has sufficient RES potential to develop a fully carbon neutral electricity system, even if demand increases due to electrification of transport and the heating sector. However, investment lead times are very long and there is no common knowledge basis among Nordic countries how, and through what policies, carbon neutrality will be pursued. Furthermore, how the system develops and which challenges will emerge are dependent on the approach taken towards Europe. A more open approach might result in opportunities and development in the Nordic countries beyond what would happen with a Nordic focus alone.

The overall objective is to build knowledge and understanding among politicians and decision makers and actors in the power industry about possible carbon neutral futures for an integrated Nordic power system in a time perspective up to 2050. The knowledge and understanding is based on qualitative scenario analysis of impacts on the electricity, the transport and the heating system combined with the necessary governance aspects to enable the transformation.

**Partners:** SINTEF Energy Research, Stockholm Environmental Institute

**Department of Electrical Engineering**

Center for Electric Power and Energy

Period: 15/08/2012 → 14/08/2016

Number of participants: 1

Acronym: NOSTRAT

Project participant:

Wu, Qiuwei (Intern)

**Modelling of demand response and its impact on a distribution grid using field trail data of household appliance control at multiple consumers**

Department of Electrical Engineering

Period: 01/06/2012 → 17/08/2016

Number of participants: 7

Phd Student:

Venkatachalam, Venkatachalam (Intern)

Supervisor:

Gehrke, Oliver (Intern)

Kosek, Anna Magdalena (Intern)

Main Supervisor:

Bindner, Henrik W. (Intern)

Examiner:

Nielsen, Arne Hejde (Intern)

Georghiou, George E. (Ekstern)

Korpås, Magnus (Ekstern)

**Financing sources**

Source: Internal funding (public)

Name of research programme: Offentlig finansiering

**Relations**

Publications:

Demand Response on domestic thermostatically controlled loads

Project: PhD
PhD scholarship in IPower, integration of embedded generation

Department of Electrical Engineering
Period: 01/06/2012 → 15/06/2016
Number of participants: 5
Phd Student:
Han, Xue (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Yang, Guangya (Intern)
Burt, Graeme M. (Ekstern)
Repo, Sami Petteri (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Very High Frequency Switch-Mode Power Supplies

Department of Electrical Engineering
Period: 01/06/2012 → 18/09/2015
Number of participants: 6
Phd Student:
Madsen, Mickey Pierre (Intern)
Supervisor:
Knott, Arnold (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Zhang, Zhe (Intern)
Kazimierczuk, Marian K. (Ekstern)
Redl, Richard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Superconducting Drive Train

Project vision:
The trend in the wind turbine development is illustrated in the Fig.1. Permanent magnets (PM) have enabled progress of technology in many areas and most recently, the wind turbines drive trains. The cost of Rare Earth Elements (RE) is increasing steadily with the demand, and it is expected that this will continue in coming years. Fig.2 illustrates the disproportion of the need for RE from application to application. With the amount of RE used in one PM direct drive 3MW wind turbine the equivalent RE usage would correspond to several hundred all-electric cars, thousands of IT (electronics and LCDs) units or kilometers and kilometers of optical fibers. Thus, RE usage will be a critical element in the development of low cost clean energy.

The fact that a Superconducting drive train intended for a large offshore wind turbine will use at the most 1000 times less RE than an equivalent PM drive train and in addition will have higher power density, represents the unique opportunity being explored with this project. It is a shared vision of the partners of this application that the RE independence of the Superconducting drive train is the enabling factor towards a stable low cost of clean energy.

Purpose of the project:
The increase in the size of the turbines is a necessity grounded in the economy of the offshore market. Yet, conventional drive trains (including PM drive train) have failed to provide a suitable solution so far. After analysis of the turbine market, it is concluded that the drive train solution based on RE has inherent risks with supply chain and cost insurance. This project proposes a new machine type, a machine with Superconducting windings, as a way of increasing the power density of the whole drive train with nearly no RE requirements. By studying performance and characterization of superconductors available on the market, this project will create a pool of knowledge on available High Temperature Superconductors (HTS), coils and machine designs. The performance of the proposed design for an HTS coil and HTS winding structure shall be experimentally tested and verified on a laboratory scale HTS machine setup inherited from the Superwind project. All gained hands-on experience and knowledge learned in the process of design and construction of
the experiments will be applied to the full size fully defined HTS design of the drive train for 4MW to 10MW wind turbines.

Outcome:
The final outcome of the project is a full-size fully defined design of Superconducting drive train for a large wind turbine. A scaled down prototype will also be presented, after which it will be decided if construction of the full-size prototype should proceed. A number of recommendation/design proposals will be generated and verified in the experimental and design phase of the project which may be patentable. Thus, it is expected that the project will contribute to the maturity of the superconducting drive train and superconducting machine design technology in general.

Department of Electrical Engineering
Electric Components
Centre for Electric Technology
Envision Energy ApS
Period: 01/05/2012 → 30/04/2015
Number of participants: 2
Project participant:
Mijatovic, Nenad (Intern)
Project Manager, academic:
Jensen, Bogi Bech (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: Højteknologifonden
Amount: 3,326,000.00 Danish Kroner
Year of approval: 2012

Innovation consortium Real time Controlled Robots for the Meat Industry
Department of Electrical Engineering
Automation and Control
Department of Automation
Danish Technological Institute
University of Copenhagen
Robotcenter Danmark A/S
IHFood A/S
LINCO Food Systems A/S
Butina A/S
Rose Poultry A/S
Lantmännen Danpo A/S
Tican Fresh Meat A/S
Danish Crown A/S
Period: 01/05/2012 → 30/04/2016
Number of participants: 4
Acronym: RealRobot
Project participant:
Ravn, Ole (Intern)
Andersen, Nils Axel (Intern)
Wu, Haiyan (Intern)
Phd Student:
Andersen, Thomas Timm (Intern)
Transient conditions and protection in HVDC offshore grids

Department of Electrical Engineering
Period: 01/05/2012 → 07/12/2016
Number of participants: 6
Phd Student: El-Khatib, Walid Ziad (Intern)
Supervisor: Rasmussen, Tonny Wederberg (Intern)
Main Supervisor: Holbøll, Joachim (Intern)
Examiner: Nielsen, Arne Hejde (Intern)
Jensen, Kim Høj (Intern)
Undeland, Tore (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Computational auditory scene analysis based on a model of human binaural processing

Department of Electrical Engineering
Period: 01/04/2012 → 20/01/2016
Number of participants: 6
Phd Student: Chabot-Leclerc, Alexandre (Intern)
Supervisor: MacDonald, Ewen (Intern)
Main Supervisor: Dau, Torsten (Intern)
Examiner: Marozeau, Jeremy (Intern)
Culling, John (Ekstern)
vан de Par, Steven (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Performance Monitoring, Diagnosis and Advanced Control for Bio-Refinery

Department of Electrical Engineering
Period: 01/04/2012 → 17/02/2016
Number of participants: 7
Phd Student: Prunescu, Remus Mihail (Intern)
Supervisor: Jakobsen, Jon Geest (Intern)
Sin, Gürkan (Intern)
Main Supervisor: Blanke, Mogens (Intern)
Examiner: Huusom, Jakob Kjæbsted (Intern)
Lidén, Gunnar (Ekstern)
Skogstad, Sigurd (Ekstern)

Financing sources
Source: Internal funding (public)
Demand Side Optimization via Direct Load Control in Smart Grids

Department of Electrical Engineering
Period: 01/03/2012 → 09/12/2015
Number of participants: 5
Phd Student:
Costanzo, Giuseppe Tommaso (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Lehnhoff, Sebastian (Ekstern)
Palensky, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Demand Side Management in the Smart Grid
Project: PhD

Innovative Permanent Magnet Production, Recovery and Reuse

Strong permanent magnets are essential, e.g. in future transport, wind energy and water management applications. High performance magnets require the use of rare earth elements (REE), which have increased in price by a factor of ten over the last 18 months - partly due to the fact that China controls 97% of the global production of REE. In the light of possibly reduced levels of exports due to Chinese trade restrictions resulting in the uncertain long-term availability of these elements, there is a need to focus research on improving the magnet production and recycling technologies with reduced dependency of scarce elements from a single source, without compromising their functional performance. Magnets with better temperature characteristics, hard permanent magnets with a high magnetisation and high coercivity must be investigated. Also issues such as lifetime assessment and new coating strategies must be considered.

Additionally, substantial mining activity is restarting outside China, and the production capacity in 2015 is expected to be of
the same order of magnitude as the current Chinese production volume. Thus, it is relevant to review the entire supply chain of (Nd, Dy, Pr)FeB permanent magnets in a European context and to examine whether the magnets can be improved by innovative new production methods. Here large deposits of rare earth elements found in Greenland will serve as a base for an investigation of precursors, processing of alloys, production of the magnets, applications and finally the reuse and recycling of magnet materials. The impact will be a market leading industry for the next generation of permanent magnet solutions.

In REEgain we will focus on recycling REE-based magnets and we seek to re-establish an REE industry outside China. Thus, the aim of the innovation consortium is to establish a group of private companies, knowledge institutions and universities for the development of high performance permanent magnets with a reduced dependency on critical materials. The project goals include:
- Establish a secure supply chain of rare earth elements for permanent magnets from deposits in Greenland – and from reuse and recycling.
- Improve magnet performance and reduce the usage of critical raw materials by optimisation of microstructure and introduction of nano-domains
- Introduce advanced process technologies, enabling complex geometries and large magnets beyond state-of-the-art
- Improve reliability and lifetime of magnets by adopting new corrosion protection strategies based on coupled analysis of environment and functionality

As a part of the consortium, a research and knowledge-based environment will be established at an international level in the area of permanent magnet properties, usage and production. The activities will support new production and commercialisation activities in the field.

The project idea was initiated by R&D manager Peter Kjeldsteen, Sintex A/S, as the company meets new challenges on
1. Increased costs on raw materials,
2. Demand for cradle-to-cradle solutions by the customers and
3. Demand for new high performance magnets.

Peter was also helpful by suggesting relevant industrial partners. The project concept was validated at a TI-workshop in September 2011.

Department of Electrical Engineering
Electric Components
Centre for Electric Technology
Center for Electric Power and Energy
Envision Energy ApS
FJ Industries
Holm Magnetics ApS
TECHNOFLEX A/S
HJ Hansen A/S
Sintex A/S
Tanbreez Mining Greenland A/S
Danish Technological Institute
University of Southern Denmark
Period: 01/03/2012 → 01/03/2016
Number of participants: 2
Acronym: REEgain
Phd Student: Hagberg, Stig (Intern)
Project Manager, academic: Jensen, Bogi Bech (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: Højteknologifonden
Amount: 42,000,000.00 Danish Kroner
Year of approval: 2011
Low Power High Dynamic Range A/D Conversion Channel

Department of Electrical Engineering
Period: 01/03/2012 → 09/11/2015
Number of participants: 6
Phd Student: Marker-Villumsen, Niels (Intern)
Supervisor: Rombach, Pirmin (Intern)
Main Supervisor: Bruun, Erik (Intern)
Examiner: Knott, Arnold (Intern)
Andreani, Pietro (Intern)
Nielsen, Jannik Hammel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Modern Electricity Distribution Grids with High Share of Solar Energy

Department of Electrical Engineering
Period: 15/01/2012 → 04/05/2016
Number of participants: 5
Phd Student: Hashemi Toghroljerdi, Seyedmostafa (Intern)
Main Supervisor: Østergaard, Jacob (Intern)
Examiner: Bindner, Henrik W. (Intern)
Strauss, Philipp (Ekstern)
Teodorescu, Remus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Secure Operation of Sustainable Power Systems
Funded by the Danish Council for strategic research (DSF)

The project period spans four years, starting in January 2012. The total budget for the project is approximately 30.2 million DKK, which covers among others the funding of 5 PhD and 3 PostDoc positions. The project is managed by prof. Jacob Østergaard, head of Centre for Electric Technology.

The SOSPO project focuses on a critical, difficult and not yet treated problem regarding how secure operation of future sustainable power systems (based on wind and solar energy) can be ensured.

The research in the SOSPO project focuses on methods that enable system stability and security assessment in real-time and on methods for automatically determining control actions that regain system security when an insecure operation has been detected.

Centre for Electric Technology
Department of Electrical Engineering
Electric Energy Systems
Automation and Control
Ken M Consulting  
Period: 01/01/2012 → 31/12/2015  
Number of participants: 13  
Stability sustainable power system  
Acronym: SOSPO  
Number of related Ph.D. students: 5  
Project participant:  
Nielsen, Arne Hejde (Intern)  
Garcia-Valle, Rodrigo (Intern)  
Yang, Guangya (Intern)  
Lind, Morten (Intern)  
Blanke, Mogens (Intern)  
Zhang, Xinxin (Intern)  
Phd Student:  
Wickesser, Johannes Tilman Gabriel (Intern)  
Wittrock, Martin Lindholm (Intern)  
Møller, Jakob Glarbo (Intern)  
Perez, Angel (Intern)  
Pedersen, Andreas Søndergaard (Intern)  
Project Manager, academic:  
Østergaard, Jacob (Intern)  
Jóhannsson, Hjörtur (Intern)  

Relations  
Publications:  
Identification of Critical Transmission Limits in Injection Impedance Plane  
Investigation of Suitability of Cascading Outage Assessment Methods for Real-Time Assessment  
Improved method for considering PMU's uncertainty and its effect on real-time stability assessment methods based on Thévenin equivalent  
Derivation and application of sensitivities to assess transient voltage sags caused by rotor swings  
Convex Relaxation of Power Dispatch for Voltage Stability Improvement  
Improved method for considering PMU's uncertainty and its effect on real-time stability assessment methods based on Thévenin equivalent  
Thevenin Equivalent Method for Dynamic Contingency Assessment  
Early Prediction of Transient Voltage Sags caused by Rotor Swings  
Evaluation of enhancements to Thevenin equivalent based methods for real-time voltage stability assessment  
Real-Time Thevenin Impedance Computation  
Sensitivity based Assessment of Transient Voltage Sags caused by Rotor Swings  
Computation of Steady State Nodal Voltages for Fast Security Assessment in Power Systems  
Fast assessment of the effect of preventive wide area emergency control  
SW-platform for R&D in Applications of Synchrophasor Measurements for Wide-Area Assessment, Control and Visualization in Real-Time  
Wide Area Prosumption Control and Sensitivities of Aperiodic Small Signal Stability Indicators  
Early Prevention Method for Power Systems Instability

Addressing the security of a future sustainable power system: The Danish SOSPO project

Real-Time Stability Assessment based on Synchrophasors

Wind farms generation limits and its impact in real-time voltage stability assessment

Early Prevention Method for Power System Instability

Wide-Area Assessment of Aperiodic Small Signal Rotor Angle Stability in Real-Time

Technical Resource Potential of Non-disruptive Residential Demand Response in Denmark

Evaluation of HVDC interconnection models for considering its impact in real-time voltage stability assessment

Uncertainty in real-time voltage stability assessment methods based on Thevenin equivalent due to PMU’s accuracy

Stabiliser Fault Emergency Control using Reconfiguration to Preserve Power System Stability

Method of determining remedial control actions for a power system in an insecure state

Influence of current limitation on voltage stability with voltage sourced converter HVDC

Wide-Area Assessment of Aperiodic Small Signal Rotor Angle Stability in Real-Time

Early Prevention of Instability - Use of Self Propagating Graph for the Fast Search for Optimal Grid Nodes to Apply Countermeasures

Impact of Model Detail of Synchronous Machines on Real-time Transient Stability Assessment

Critical machine cluster identification using the equal area criterion

Assessment of the impact that individual voltage source has on a generator’s stability

Investigation of the Adaptability of Transient Stability Assessment Methods to Real-Time Operation

Early prevention of instability - search for optimal grid nodes for applying countermeasures

Suitability of voltage stability study methods for real-time assessment

System security assessment in real-time using synchrophasor measurements

Documents:
SOSPO Public Fact Sheet 2013

Project

Switch-Mode Power Amplifiers for Current Controlled Loudspeakers

Department of Electrical Engineering

Period: 15/12/2011 → 20/08/2015

Number of participants: 6

Phd Student:
Schneider, Henrik (Intern)

Supervisor:
Knott, Arnold (Intern)

Main Supervisor:
Andersen, Michael A. E. (Intern)

Examiner:
Bruun, Erik (Intern)

Bard, Delphine (Ekstern)

Risbo, Lars (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Nordic Electrical Vehicle Interoperability Center

With the increasing propagation of Electric Vehicles (EVs), the need arises to ensure that all the EVs effortlessly can be charged on all charging posts regardless of car brand, EV infrastructure operator or national origin. This wide compatibility between technical components as well as operators is known as interoperability. To facilitate the development in the standards, and to support the industry, thereby creating a higher consumer acceptance, the NEVIC centre has been launched.

Initial experiences, tests and concepts will be developed together with the prominent EV operators: Better Place, ChoosEV and CleanCharge (RWE). The relevant standards will be identified and the requirements for the interoperability tests will
be specified. An independent test platform will be established and test procedures and facilities for EV charging infrastructure will be developed and verified through prototype testing. The NEVIC test centre will be located at DTU Electrical Engineering at Risø Campus.

The standards are currently under development and furthermore the operators may have different ways to implement their solutions. Interoperability in NEVIC at this stage is focusing on the technical side of the interoperability, i.e. the ability for the operator to identify the EV to be charged, and the capability to charge the EV from the charging posts. In this way it is ensured that the communication between the EVs, the charging post and the operators back-end systems are compatible.

Department of Electrical Engineering

Center for Electric Power and Energy
Period: 01/12/2011 → 01/06/2012
Number of participants: 2
Acronym: NEVIC
Number of related Ph.D. students: 0
Project participant:
Sørensen, Thomas Meier (Intern)
Project Manager, organisational:
Jensen, Marianne Brunnt (Intern)

Correlations between physical and perceptual parameters of acoustic scenarios. Implications for auditory modelling and sound field design

Department of Electrical Engineering
Period: 01/12/2011 → 02/11/2016
Number of participants: 7
Phd Student:
Käsbach, Johannes (Intern)
Supervisor:
Epp, Bastian (Intern)
May, Tobias (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
MacDonald, Ewen (Intern)
Tchorz, Jürgen (Ekstern)
Whitmer, William McAllister (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Electricity market design for distributed energy resources and flexible demand

Department of Electrical Engineering
Period: 01/12/2011 → 09/12/2015
Number of participants: 7
Phd Student:
Larsen, Emil Mahler (Intern)
Supervisor:
Ding, Yi (Intern)
Østergaard, Jacob (Intern)
Main Supervisor:
Pinson, Pierre (Intern)
Examiner:
Kok, Koen (Intern)
Biskas, Pandelis (Ekstern)
Gibescu, Madeleine (Ekstern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**High efficiency reversible fuel cell power converter**
Department of Electrical Engineering
Period: 01/12/2011 → 27/02/2015
Number of participants: 6
Phd Student:
Pittini, Riccardo (Intern)
Supervisor:
Zhang, Zhe (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Ferreira, Jan Abraham (Ekstem)
Nee, Hans-Peter (Ekstem)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**High Performance Solar Array Simulator**
Department of Electrical Engineering
Period: 01/12/2011 → 07/05/2015
Number of participants: 6
Phd Student:
Nguyen-Duy, Khiem (Intern)
Supervisor:
Knott, Arnold (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Zhang, Zhe (Intern)
Kyyrä, Jorma (Ekstem)
Wolf, Christian (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**Reconfigurable Microwave Filters for Communication Systems**
Department of Electrical Engineering
Period: 01/12/2011 → 17/08/2016
Number of participants: 7
Phd Student:
Acar, Öncel (Intern)
Supervisor:
Nørgaard, Thomas Gerner (Ekstem)
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Jensen, Thomas (Intern)
Gevorgian, Spartak (Ekstern)
Nosich, Alexander I. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

High Power DEAP actuator drive for wind turbine flaps
Department of Electrical Engineering
Period: 15/11/2011 → 27/02/2015
Number of participants: 6
Phd Student:
Thummala, Prasanth (Intern)
Supervisor:
Zhang, Zhe (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Hurley, William Gerard (Ekstern)
Lomonova, Elena A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Renewable Energy Sources and Storage for Integrated Control in electric distribution system
This project run under the specified Transnational Access to the SYSLAB DER research infrastructure at Risø DTU, Denmark, under the DERri project and supported by the European Commission under FP7.

The project is aimed at describing the models of generation sources, such as wind and solar, and storage systems for implementing integrated control strategies of the whole renewable generation park.
The main aim of the project is to validate models of small wind turbines and storage systems and integrated control strategies of the whole resulting system thus describing and testing the benefits that the storage system can provide.
The storage system is characterized from an electrochemical and thermal perspective, while the wind turbines have an electro-mechanical characterization and the solar photovoltaic system an electrical characterization. The purpose of the energy storage system is to be coupled to the wind generation system in order to realize different tasks: to have the generation output power smoothed and to grant no power transfer, for a certain period on Distribution System Operator (DSO) request, at the point of common coupling (PCC) in any battery state-of-charge condition.
Moreover the already acquired experience and the results from the previous DERRI experience (W&S_IC) in the Risø facility are a stimulus to prosecute the validation of the storage system model within new measurements (i.e. thermal characterization) and to test new integrated control strategies of the whole resulting system (i.e. storage plus wind turbine and storage plus pv system).

Department of Electrical Engineering
Intelligent Energy Systems
Period: 14/11/2011 → 29/03/2012
Number of participants: 2
Wind turbine, Storage System, Control System
Acronym: RESSIC
Project participant:
Marinelli, Mattia (Intern)
Baccino, Francesco (Ekstern)
Documents:
DERRI_TA_UNIGE_SYSLAB_report_Ressic_18_04_12_final.pdf
Project
**Integrated magnetics for high power density, high efficiency power converters**

With the development of modern power electronics requiring higher power density and higher efficiency dc-dc converters, Flux A/S and DTU have a clear vision of the vital role of integrated magnetics (IM) technique. The shared vision of the partners is that new integrated magnetics (IM) designs will enable unprecedented performance of dc-dc power converters, thereby creating a unique and highly competitive solution for certain markets, such as the automotive, aerospace and renewable energy sectors.

The project has three shared, overall success criteria. First, a possibility of integrated magnetics approach utilized in a family of 1-10 kW dc-dc converters needs to be investigated. Secondly, a 2-kW converter module with a goal of 98% efficiency and 60 W/in³ power density using proposed IM approaches needs to be developed. Comparison between the developed prototypes and the benchmarking will be analyzed to show the proposed IM technology in this industrial postdoc project is advanced to presently available technologies. Finally, multiple inputs dc-dc converters for renewable energy use, employing a new geometry magnetic core with IM technique, need to be investigated. Revolutionary advancements can be demonstrated by exploiting the next generation of IM technique with new geometry cores. Prototype demonstration of a family of multiple inputs dc-dc converters employing the new geometry magnetic core is a major success criterion for this project.

Department of Electrical Engineering

**Electronics**

Period: 01/11/2011 → 14/11/2013
Number of participants: 1
Project participant:
Ouyang, Ziwei (Intern)

**Custom-made MMIC reciver front-end for x-band radar, with focus on low phase and 1/f-noise**

Department of Electrical Engineering

Period: 01/11/2011 → 04/05/2016
Number of participants: 6
Phd Student:
Michaelsen, Rasmus Schandorph (Intern)
Supervisor:
Tamborg, Kjeld (Ekstern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Skou, Niels (Intern)
Bao, Mingguan (Ekstern)
Leuzzi, Giorgio (Ekstern)

**Financing sources**

Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Low power DEAP actuator drive for heating valves**

Department of Electrical Engineering

Period: 01/11/2011 → 27/02/2015
Number of participants: 6
Phd Student:
Huang, Lina (Intern)
Supervisor:
Zhang, Zhe (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Jørgensen, Ivan Harald Holger (Intern)
Sun, Jian (Ekstern)
Zhao, Zhengming (Ekstern)

**Financing sources**
Radio frequency switch-mode power supplies
Department of Electrical Engineering
Period: 01/11/2011 → 22/04/2015
Number of participants: 6
Phd Student:
Kovacevic, Milovan (Intern)
Supervisor:
Knott, Arnold (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Zhang, Zhe (Intern)
Bertilsson, Kent (Ekstern)
Foster, Martin Paul (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Coordinated Control of Wind Power Plants and Energy Storage Systems
Department of Electrical Engineering
Period: 15/10/2011 → 27/02/2015
Number of participants: 6
Phd Student:
Zhao, Haoran (Intern)
Supervisor:
Rasmussen, Claus Nygaard (Intern)
Main Supervisor:
Wu, Qiuwei (Intern)
Examiner:
Træholt, Chresten (Intern)
Pöller, Markus (Ekstern)
Zhang, Boming (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Energy storage and energy system integration
Department of Electrical Engineering
Period: 01/10/2011 → 06/07/2017
Number of participants: 7
Phd Student:
Pensini, Alessandro (Intern)
Supervisor:
Rasmussen, Claus Nygaard (Intern)
Yang, Guangya (Intern)
Main Supervisor:
Træholt, Chresten (Intern)
Examiner:
Bindner, Henrik W. (Intern)
Investigating the Feasibility of Direct Drive Wind Turbine Generator Topologies that are Independent of Rare Earth Elements

Department of Electrical Engineering
Period: 15/09/2011 → 09/11/2015
Number of participants: 6
Phd Student:
Henriksen, Matthew Lee (Intern)
Supervisor:
Jensen, Bogi Bech (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Abrahamsen, Asger Bech (Intern)
Rasmussen, Peter Omand (Ekstern)
Zhu, Zi-Qiang (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Micromachined Integrated Transducers for Ultrasound Imaging

Department of Electrical Engineering
Period: 15/09/2011 → 26/01/2015
Number of participants: 6
Phd Student:
lacour, Mette Funding (Intern)
Supervisor:
Thomsen, Erik Vilain (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Jensen, Flemming (Intern)
Almqvist, Monica (Ekstern)
Savoia, Alessandro Stuart (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Relations
Publications:
Micromachined Integrated Transducers for Ultrasound Imaging
Project: PhD

Enhanced Ancillary Services from Wind Power Plants - EASE WIND

Department of Electrical Engineering
Intelligent Energy Systems
Characterization of early and mature electrophysiological biomarkers for Alzheimer’s and Parkinson’s patients

Department of Electrical Engineering  
Period: 01/09/2011 → 20/08/2015  
Number of participants: 8  
Phd Student:  
Christensen, Julie Anja Engelhard (Intern)  
Supervisor:  
Arvastson, Lars Johan (Intern)  
Christensen, Søren Rahn (Ekstern)  
Jennum, Poul (Ekstern)  
Main Supervisor:  
Sørensen, Helge Bjarup Dissing (Intern)  
Examiner:  
Sams, Thomas (Intern)  
Karstoft, Henrik (Ekstern)  
Mayer, Geert (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.

Relations  
Publications:  
Characterization of early and mature electrophysiological biomarkers of patients with Parkinson’s disease

On-line Dynamic Security Assessment in Power Systems

Department of Electrical Engineering  
Period: 01/09/2011 → 07/05/2015  
Number of participants: 6  
Phd Student:  
Weckesser, Johannes Tilman Gabriel (Intern)  
Supervisor:  
Jóhannsson, Hjörður (Intern)  
Main Supervisor:  
Østergaard, Jacob (Intern)  
Examiner:  
Pinson, Pierre (Intern)  
Glavic, Mevludin (Ekstern)  
Kundur, Prabha (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU) Samf.  
Project: PhD

Piezoelectric transformer based LED lighting

Department of Electrical Engineering  
Period: 01/08/2011 → 27/02/2015  
Number of participants: 7  
Phd Student:
Nielsen, Dennis (Intern)
Supervisor:
Kjærgaard, Claus (Intern)
Knott, Arnold (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Mouton, Hendrik du T. (Ekstern)
Pfaffinger, Gerhard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

31 US-Denmark Summer Program
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
University of California, Santa Cruz
University of California at Davis
Aalborg University
Period: 24/07/2011 → 31/12/2016
Number of participants: 1
Summer school, summer workshop, master course, 4 week intensive
Project participant:
Træholt, Chresten (Intern)

Design and evaluation of individualized hearing-aid signal processing and fitting
Department of Electrical Engineering
Period: 15/07/2011 → 18/09/2015
Number of participants: 7
Phd Student:
Fereczkowski, Michal (Intern)
Supervisor:
Dau, Torsten (Intern)
Jepsen, Morten Løve (Intern)
Main Supervisor:
MacDonald, Ewen (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Lopez-Poveda, Enrique A. (Ekstern)
Plack, Christopher John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Lightning Protection of Flap System for Wind Turbine Blades
Department of Electrical Engineering
Ambitious targets have been set in Europe and elsewhere, including the Nordic countries, to meet societal goals for the transformation of energy systems to a more sustainable state. There are incentive mechanisms in place in many countries and regions that lead to large scale introduction of renewable and variable sources of electricity, typically wind and/or solar. At the same time, the European energy market is undergoing changes with the intent of creating a common internal market for electricity, similar to that of other goods and services. These two developments coupled with the increasing dependence of society on reliable supply of electricity for critical infrastructure poses a number of challenges for the uninterrupted operation and control of power transmission grids. As a result of these factors, power flows will be less predictable, and exhibit larger deviations with increasingly shorter time cycles, from predictable variations over the hours of a day, to large changes in power flow within minutes. At the same time, these changes must not impact the safe and reliable operation of the transmission grid. In addition, the continued increase of less predictable generation will put a burden of cross-border flows. To meet the future challenges the Nordic TSOs have made ambitious plans for transmission system investments in the next decade. Several new transmission lines are planned in the Nordic countries, in addition to HVDC connections within the Nordic grid and to the neighboring synchronous interconnections. As a result the future transmission networks will be more tightly interconnected, and potentially also more controllable as power electronic devices (such as VSC-HVDC and FACTS) continue to be deployed. As a result, more efficient and flexible ways of controlling and coordinating transmission system operation become necessary. In sum this leads to a requirement for better tools for planning and operation of interconnected power grids that work across traditional national boundaries. Such tools may become available through the development and application of phasor measurements for wide-area monitoring and control in the Nordic power grid.

This project deals with the development and implementation of GPS-synchronized phasor measurement (PMU) applications, and supporting information and communication technologies, for wide area monitoring and control in the Nordic power grid that will enable an orderly transition of the transmission system into a Smart Grid.

**METHOD AND WORK PLAN**

The project will leverage the different competences in the Nordic countries to address the challenges in power system operation and control identified above; these challenges are key issues that respond to NER’s call for proposals by
"creating more intelligent and improved grids".

Interconnected power systems spread through large geographical areas, and their real-time control imposes stringent requirements on reliable synchronized measurement systems, information delivery and data stream management. Observe that due to the colossal size of transmission networks, there are many challenges to develop scalable and reliable information and control systems architectures that can provide the necessary performance for real-time control. Such architectures have not been previously employed in today's power networks.

The project is interdisciplinary because it involves not only competences related to power system analysis and control which will develop phasor data applications, but also expert proficiencies necessary to develop the supporting ICT systems enabling these applications. Moreover, for the sustainable and reliable operation of the power systems of the future we have realized that not only technological advances are necessary, it is also important to increase the stream of trained professionals that can exploit these technological advances, a challenge that continues to be more apparent in the Nordic region.

Therefore, the proposed method comprises the development and exploitation of competences in three pillars, these pillars are the bastions for a "STRONgrid": people, technology and applications.

- People:

This pillar is of much relevance due to the eminent aging of the power grid workforce in the Nordic Region. The project will provide PhD/Postdoc education, Nordic/international Workshops, and the establishment of the "Nordic Synchrophasor Group (NSG)", which will supply trained experts in Smart Transmission to the Nordic Region. With these elements we aim to establish leadership both in the Nordic region and Europe.

A Nordic Synchrophasor Group (NSG) will act as a meeting place for industry, academia, and others interested in the sustainable and continued development of technologies and applications of synchrophasors. We have already started this process by organizing a first meeting that gathered representatives from the different transmission system stakeholders. In this meeting the needs of the industry where clearly outlined to the academic partners, and this dialog served as our main driver for responding to this call for proposals from NER. A webpage containing the meeting's presentations is available at: http://nsg.ets.kth.se/

- Technology:

The project will establish a common Wide-area system development platform leveraging open source software solutions. The development platform consists of a software/hardware system allowing reception of PMU measurements, real-time processing of measurement data and power system data; and output of analysis, decisions and control actions as determined by PMU data applications.

In addition, this platform will be designed to deal with ICT infrastructure challenges regarding scalability, data delivery considering quality of service, and real-time performance. This platform will therefore provide a strong foundation for a new generation of wide-area monitoring and control systems.

- Applications:

The main objective of STRONgrid is the development of wide-area monitoring and control applications and their implementation in a common platform. These applications and their availability in a common Nordic platform will help to ensure the safe operation of the transmission as the applications and knowledge are phased into industry. This development will be pursued in close collaboration with TSOs, DSOs and manufacturers. The applications will include:

- Monitoring applications for improved situational awareness including novel state estimators paradigms and stability risk indicators (on-line power oscillation damping, voltage instability prediction, etc.), and appropriate visualization methods.
- Control applications (stabilizers, system protections, coordinated voltage controls)
- Data management for off-line analysis, and research on data compression and data mining applications.

- Deliverables:

1. Establishment of a common Nordic wide-area system development platform, PMU-data applications, and to address challenges in ICT regarding WAMS and WACS.
2. Training of PhD students and post-docs that can move directly into Nordic the power industry.
3. Bringing the latest technology developments into the industry through training programs, arranged during yearly workshops. The work plan therefore has been set up as follows:
   1. Wide-area development platform (Main responsible partner: KTH):
      Establishment and maintenance of a common, and open-source software Wide area system development platform comprised by PMUs, ICT infrastructure and application software leveraging open-source software solutions.
   2. Wide are monitoring and control (Main responsible: Aalto):
      Development and testing of applications in monitoring and control
4. Project management and coordination (Main responsible: DTU):
   Management, coordination, and competence building for the Nordic Synchrophasor Group. Transition of the NSG into a permanent council gathering industry, developed human and technology competences after the project is finished.

PROJECT OBJECTIVE, EXPECTED PROJECT RESULTS

The GENERAL OBJECTIVE is to provide better tools for planning and operation of interconnected power grids that work across traditional national boundaries. These tools are becoming of critical need to meet societal goals for transformation of energy systems to a more sustainable state, and to enable large-scale introduction of renewable and variable sources of electricity. It is our vision that such tools can be developed by advancing phasor measurement technology and applications in wide area monitoring and control. Moreover, Nordic leadership in this area can be attained by establishing
a common Nordic wide area system development platform. Working with the different stakeholders of the transmission system allows the STRONgrid participants to directly test the developments with the primary users, and therefore allow for a straightforward adoption of the developed tools and thus “creating more intelligent and improved grids”. To reach this objective we will build three strong-pillars: people, technology, and applications; these are the bastions of the STRONgrid project.

More specifically, our common Nordic R&D platform will enable us to address the following SPECIFIC OBJECTIVES:

1. To innovate in power transmission monitoring and control through development of synchrophasor data applications and related technology
2. To addressing challenges and implement new approaches beyond the state of the art in ICT supporting infrastructure for data applications, such approaches will be based on QoS concepts which can guarantee scalability and performance of these systems
3. To provide Nordic added value by exploiting a common platform that fully utilizes the different competences in power engineering and ICT engineering, that address common operation and control challenges in power transmission.
4. To develop a strategic R&D potential by working closely with TSOs, DSOs and manufacturers to implement promising results from ICT and developed PMU-applications
5. To build competence through education and dissemination of results through Nordic and international workshops.

RESULTS and APPLICABILITY
The project results and applicability are directly related to the project deliverables. The expected results and related applicability of the results can be listed and explained as follows:

a. Establishment of a common Nordic wide-area system development platform.
   a.1: At a first stage the platform will be comprised by a power system emulator currently being purchased by KTH, PMUs, phasor data concentrators, and specialized software. Within this platform applications can be developed and tested through reproducible experiments. To this end the emulator allows to reproduce scenarios for testing the performance and effectiveness of the developed applications.
   a.2: At a second stage, when testing in the platform and emulator have been finalized, the applications will be tested with real measurement data from a university network of PMUs.
   a.3: At a final stage the applications can be tested with TSOs involved in the STRONgrid project. Observe that these stages are not necessarily sequential, and can be carried out at different stages of the application development. This gives direct applicability of the developed applications within the TSOs.

b. Development PMU-data applications for:
   b.1: Monitoring: improved situational awareness through novel state estimators paradigms and stability risk indicators (online power oscillation damping, voltage instability prediction, etc.), and novel visualization methods.
   b.2: Control: develop and apply techniques to exploit controllers such as stabilizers, VSC-HVDC, and FACTS; and to coordinate the control of these devices to enhance security.
   b.3: Protection: wide-area protection schemes and special protection schemes exploiting synchrophasors
   b.4: Off-line analysis: develop tools for disturbance analysis, and exploit techniques in data compression and mining which can provide metrics for risk indicators for use in on-line analysis. This has direct applicability and use within the TSOs involved with STRONgrid.

c. Defining and solving challenges in ICT for new generation WAMS and WACS.
   c.1: Data delivery and architecture: due to the colossal size of transmission networks, there are many challenges to develop scalable and reliable information and control systems architectures that can provide the necessary performance for real-time control. QoS approaches will be used to develop the appropriate ICT infrastructure for real-time control. The applicability of this is direct in the common platform architecture and the application development. Therefore it will also have application within the TSOs by providing technologies with scalable architectures that guarantee performance for real-time control.
   d. Education and dissemination by annual workshops, training programs and PhD studies that provide direct applicability into the Nordic workforce of the future:
   d.1: Training of PhD students and post-docs that can move directly into Nordic the power industry. This result will have applicability to the Nordic region by providing a stream of highly trained Smart Transmission experts and simultaneously ease the problematic of the aging Nordic workforce in power engineering.
   d.2: Bringing the latest technology developments into the industry through training programs, arranged during yearly workshops. This result has direct applicability in updating current professionals with the advancements in the synchronized phasor measurements field and Smart Transmission Grids in general.
University of Iceland
Period: 01/07/2011 → 30/06/2015
Number of participants: 6
Acronym: STRONgrid
Project participant:
Garcia-Valle, Rodrigo (Intern)
Vanfretti, Luigi (Ekstern)
Haarla, Liisa (Ekstern)
Palsson, Magni Thor (Ekstern)
Project Manager, academic:
Fosso, Olav Bjarte (Ekstern)
Uhlen, Kjetil (Ekstern)

Financing sources
Source: Public research programme (public)
Name of research programme: NORDEN
Web address: http://www.nordicenergy.org/
Amount: 24,000,000.00 Danish Kroner
Year of approval: 2011

Homogenization and Realization of Periodically Structured Materials
Department of Electrical Engineering
Period: 01/06/2011 → 18/03/2015
Number of participants: 6
Phd Student:
Clausen, Niels Christian Jerichau (Intern)
Supervisor:
Arslanagic, Samel (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Lavrinenko, Andrei (Intern)
Bilotti, Filiberto (Ekstern)
Sihvola, Ari Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Wind power and storage modeling and integrated control in electric distribution systems
This project run under the specified Transnational Access to the SYSLAB DER research infrastructure at Risø DTU, Denmark, under the DERri project and supported by the European Commission under FP7.

The project is aimed at describing the models of generation sources and storage systems for implementing integrated control strategies of a renewable generation park composed by wind turbines and batteries. The storage system is characterized from an electrochemical and thermal perspective, while the wind turbines have an electro-mechanical characterization. The purpose of the energy storage system is to be coupled to the wind generation system in order to realize different tasks: to have the generation output power smoothed and to grant no power transfer, for a certain period on Distribution System Operator (DSO) request, at the point of common coupling in any battery state-of-charge condition. The goal of the activity (still in progress in the national context) is to develop simulation models for MV grids with renewable and Distributed Generation (DG) for different operation conditions: interconnected to the distribution grid, islanding mode with privileged loads supplied and in transient conditions (when the plant forms an intentional island and when it is connected again to the public grid). These simulations also aim to look for critical automation strategies before implementing them and to test them in test facilities available in large research centers. These models are likely to become simulation instruments used to support the electric utilities in the forecasting of their grid behaviours after a significant DG penetration.

The main aim of the project is to validate models of wind turbine and storage systems and integrated control strategies of the whole resulting system thus describing the benefits that the storage system can provide.

The main aim of the project is to validate models of wind turbine and storage systems and integrated control strategies of
the whole resulting system thus describing the benefits that the storage system can provide.

Department of Electrical Engineering

Intelligent Energy Systems
Period: 01/05/2011 → 13/05/2011
Number of participants: 1

Wind turbine, Storage System, Control System
Acronym: W&S_IC
Project participant:
Marinelli, Mattia (Intern)
Documents:
DERRI_TA_UNIGE_SYSLAB_report_VRB_modeling_and_control_24_05_11_.pdf

Optimal low power microelectronic implementation for single-use ECG arrhythmia detection device

Department of Electrical Engineering
Period: 01/05/2011 → 07/05/2015
Number of participants: 8
Phd Student:
Saadi, Dorthe Bodholt (Intern)
Supervisor:
Andersen, Gunnar B. (Ekstern)
Egstrup, Kenneth (Ekstern)
Hoppe, Karsten (Intern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Karstoft, Henrik (Ekstern)
Van Huffel, Sabine (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Design of Low Power Algorithms for Automatic Embedded Analysis of Patch ECG Signals
Project: PhD

Temporal Coherence in the Perceptual Organization of Auditory Scenes in Normal, Impaired, and Aided-Impaired Hearing

Department of Electrical Engineering
Period: 15/04/2011 → 12/12/2014
Number of participants: 6
Phd Student:
Christiansen, Simon Krogholt (Intern)
Supervisor:
Jepsen, Morten Løve (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
MacDonald, Ewen (Intern)
Brown, Guy Jason (Ekstern)
Shamma, Shihab (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD
Two stage beam forming methods for 3D imaging

Department of Electrical Engineering
Period: 15/04/2011 → 15/11/2014
Number of participants: 5
Phd Student:
Rasmussen, Morten Fischer (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Sams, Thomas (Intern)
Jansson, Tomas (Ekstern)
Zemp, Roger J. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed

Relations
Publications:
Advanced 3-D Ultrasound Imaging.
Project: PhD

EcoGrid EU - Large scale Smart Grids demonstration of real time market-based integration of DER and DR

The EcoGrid EU project proposal offers Europe a "fast track" evolution towards Smart Grid dissemination and deployment in the distributed electricity grid.

The aim is to contribute to the European 20-20-20 goals by showing that it is possible to operate a distribution power system (on the Danish island of Bornholm) with more than 50 % renewable energy sources (RES) making active use of new communication technology and innovative market solutions.

The EcoGrid EU concept will contribute to the operation of the transmission system by offering the TSOs additional balancing and ancillary services. EcoGrid EU is a large-scale demonstration of a complete power system including the following key elements:
- The total distributed grid with all resources up to 60 kV, 28,000 customers, 55 MW peak load, 268 GWh electricity consumption and 500 GWh heat demand
- All distributed RES including wind power, photo voltaic, biomass, biogas, five units with heat accumulation tanks for district heating and electric vehicles (EVs)
- ICT systems and a new information architecture allowing all units of distributed energy resources (RES) and demand response (DR) to participate in the power market. There will be a communication and information system and new operational procedures
- Full market participation utilizing all parts of the existing power market and developing a new near real-time market for deliverance of ancillary services both from RES and DR
- "Smart" Meters, "Smart" Controllers and E-mobility by using electric vehicles as an integrated part of the total concept
- Storage of energy will be demonstrated using heat appliances as well as batteries of the electric vehicles

The EcoGrid EU-project will combine knowledge from previous EU funded projects into a large-scale demonstration where the outcome is substantial contribution to a "Road map for European Smart Grids deployment".

Centre for Electric Technology
Department of Electrical Engineering

Electric Energy Systems

Center for Electric Power and Energy

Energy Analytics and Markets
Period: 01/04/2011 → 30/09/2015
Number of participants: 15
Acronym: EcoGrid EU
Project participant:
Pedersen, Anders Bro (Intern)
Ding, Yi (Intern)
Feng, Donghan (Intern)
Financing sources
Source: EU research programme (public)
Name of research programme: EU FP7
Amount: 178,725,000.00 Danish Kroner
Year of approval: 2011

Relations
Activities:
EcoGrid EU Market Concept: Large-scale Smart Grid demonstration of real time market-based integration of distributed energy resources (DER) and demand response (DR)

Press / Media items:
CLEAN REVOLUTION: Denmark is striving to become the world’s first carbon-neutral nation

Documents:
Fact sheet EcoGrid EU 2015

Project

Application of smart grid in photovoltaic power systems
The 20% renewable in 2020 - goals set by the European Commission give rise to the stress on the existing transmission and distribution networks, due to distributed power generation. This burden can be mitigated either by upgrading the networks, or by introducing the SmartGrid technology, or the combination. The development of the essence of SmartGrid is still at infancy, and many projects regarding SmartGrid are currently in progress or are being initiated, in order to develop the required technologies and standards, and demonstrate the current state.

The background for the PVNET.dk project is the ongoing EcoGrid EU project, the Danish Cell Project, and Photovoltaic (PV) Island Bornholm project, in which the target is to install app. 5 MWp of PV on the island of Bornholm corresponding to a penetration of 9% which again is close to the EPIA (European Photovoltaic Industry Association) goal of 12% PV power for entire Europe in 2020.

The PV systems are to be installed as rooftop systems on private buildings, on buildings/facilities of the municipality of Bornholm and a single or few larger PV power plants. The PV plants are configured so that they can be integrated into a Virtual Power Plant (VPP) on Bornholm.

The target of the proposed project is to study how to integrate large amount of PV (and other Renewable Energy Sources (RES)) into the network, without having to reinforce the network. This is done by examining different types of grid voltage control, applying Smart Grid functionalities and introducing other ancillary services integrated into the RES. Besides, other aspects of high penetration of RES, such as frequency stability, sub-synchronous oscillations, etc. will also be investigated. It will be ensured that the developed solutions are compliant with the EcoGrid EU SmartGrids-concept, which is expected to be rolled out at Bornholm in parallel with this project.

The knowledge gained in the project is later on to be used for paving the road for high penetration of RES into the networks.

Department of Electrical Engineering
Electric Energy Systems
Centre for Electric Technology
Center for Electric Power and Energy
Danfoss A/S

EnergiMidt A/S

Østkraft A/S
Period: 01/04/2011 → 01/04/2014
Number of participants: 5
Acronym: PVNET.dk
Project ID: 55802
Number of related Ph.D. students: 1
Project participant:
Østergaard, Jacob (Intern)
Mihet-Popa, Lucian (Intern)
Pedersen, Thomas Henrik (Intern)
Phd Student:
Hashemi Toghroljerdi, Seyedmostafa (Intern)
Project Manager, academic:
Yang, Guangya (Intern)

Financing sources
Source: Public research council
Name of research programme: ForskEL
Web address: https://www.forskel.dk
Amount: 9,849,000.00 Danish Kroner
Year of approval: 2010

Relations
Related projects:
EcoGrid DK: 50% wind power in the Danish Electric Power System
Publications:
Smart integration of photovoltaic power systems on the island of Bornholm
Application of SmartGrid in Photovoltaic Power Systems on the Island of Bornholm–PVNET.dk

Deconvolution of seismic transient: A model-based signal processing approach
Department of Electrical Engineering
Period: 15/03/2011 → 30/09/2014
Number of participants: 6
Phd Student:
Oh, Geok Lian (Intern)
Supervisor:
Agerkvist, Finn T. (Intern)
Main Supervisor:
Brunskog, Jonas (Intern)
Examiner:
Jensen, Jakob Søndergaard (Intern)
Mosegaard, Klaus (Intern)
Rydén, Nils (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

OffshoreDC - DC grids for integration of large scale wind power
Department of Wind Energy
Wind Energy Systems
Risø National Laboratory for Sustainable Energy
OffshoreDC DC grids for integration of large scale wind power

Active Power Control with Undead-Band Voltage & Frequency Droop for HVDC Converters in Large Meshed DC Grids
Active power control with undead-band voltage & frequency droop applied to a meshed DC grid test system
Influence of current limitation on voltage stability with voltage sourced converter HVDC
Voltage margin control for offshore multi-use platform integration
Coordinated system services from offshore wind power plants connected through HVDC networks
HVDC Connected Offshore Wind Power Plants: Review and Outlook of Current Research
An Assessment of Converter Modelling Needs for Offshore Wind Power Plants Connected via VSC-HVDC Networks
Dynamic Active Power Control with Improved Undead-Band Droop for HVDC Grids
Alternatives for Primary Frequency Control Contribution from Wind Power Plants Connected to VSC-HVDC Intertie
Generic Models of Wind Turbine Generators for Advanced Applications in a VSC-based Offshore HVDC Network
Modular Multilevel Converter Modelling, Control and Analysis under Grid Frequency Deviations
DC grids for integration of large scale wind power

Characterization of early and mature electrophysiological biomarkers for Alzheimer's and Parkinson's patients

Department of Electrical Engineering
Period: 01/02/2011 → 30/06/2011
Number of participants: 4
PhD Student:
Sørensen, Gertrud Laura (Intern)
Supervisor: Christensen, Søren Rahn (Ekstern)
Jennum, Poul (Ekstern)
Main Supervisor: Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Electric vehicle integration in a real-time market
Department of Electrical Engineering
Period: 01/02/2011 → 18/03/2015
Number of participants: 7
Phd Student: Pedersen, Anders Bro (Intern)
Supervisor: Gantenbein, Dieter (Ekstern)
Poulsen, Bjarne (Intern)
Main Supervisor: Østergaard, Jacob (Intern)
Examiner: Wu, Qiuwei (Intern)
Jørgensen, Preben (Ekstern)
Kempton, Willett (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Electric vehicle integration in a real-time market
Project: PhD

High Performance Solar Array Simulator
Department of Electrical Engineering
Period: 01/02/2011 → 31/08/2011
Number of participants: 3
Phd Student: Zhao, Shen (Intern)
Supervisor: Knott, Arnold (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Network and control of future intelligent power system
Department of Electrical Engineering
Period: 01/02/2011 → 20/08/2014
Number of participants: 6
Phd Student:
Hu, Junjie (Intern)
Supervisor:
Lind, Morten (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Træholt, Chresten (Intern)
Kok, J. Koen (Ekstern)
Lehnhoff, Sebastian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Playful Human-Robot Interaction based on Adaptive Modular Playware

Department of Electrical Engineering
Period: 01/02/2011 → 31/01/2013
Number of participants: 3
PhD Student:
Moghadam, Mikael (Intern)
Supervisor:
Christensen, David Johan (Intern)
Main Supervisor:
Lund, Henrik Hautop (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Characterization of Early and Mature Electrophysiological Markers for Alzheimer's and Parkinson's Patients

Biomedical Engineering
Department of Electrical Engineering
H. Lundbeck A/S
Copenhagen University Hospital
Period: 01/01/2011 → 01/01/2014
Number of participants: 1
Project participant:
Sørensen, Helge Bjarup Dissing (Intern)

Optimal Low power Implementation for Single Use ECG Arrhythmia Detection Device

Biomedical Engineering
Department of Electrical Engineering
DELTA
Odense University Hospital
Period: 01/01/2011 → 01/01/2014
Number of participants: 1
Project participant:
Sørensen, Helge Bjarup Dissing (Intern)
Thermal Modelling and Analysis of a Wind Turbine Generator

The generator is one of the critical components in a wind turbine. This will become even more true in the future direct drive wind turbines, where the component count has been reduced by 50%. The generator in a wind turbine is the place where mechanical power of the turbine rotor is converted into electrical power. It is therefore extremely important to utilise the generator optimally, such that maximum power can be extracted from the wind without exceeding the thermal limits of the generator. Overheating of the generator will lead to a shortened lifetime and hence a less economical wind turbine. In the worst case, overheating could result in instantaneous failure of the generator. Overheating is typically caused by either overloading of the generator or by large currents during faults.

Many of the wind turbine manufacturers are going towards permanent magnet generators. This includes Vestas with their V112 model and Siemens Wind Power with their SWP 3.0 101 model and their recently announced 6MW model. Overheating in a permanent magnet generator could result in demagnetisation of the permanent magnets which cannot be repaired onsite. Furthermore if the generator is a direct drive generator incorporated into the nacelle structure, then the entire rotor (blades and hub) as well as most of the nacelle would have to be removed during repairs. The generator in a permanent magnet direct drive wind turbine is therefore one of the most critical components, and should have maximum protection against overheating at any given time.

The purpose of this project is to develop thermal models for wind turbine generators, based on which a non-intrusive condition monitoring scheme, using thermal imaging, will be proposed. The thermal models will be developed using both thermal networks and finite element analysis, and will be validated against a prototype previously built at Newcastle University, Newcastle upon Tyne, United Kingdom. Both transient and steady state conditions will be modelled. In this way the proposed condition monitoring scheme, which uses the developed models as a reference, will be able to give control action to the wind turbine. This control action will ensure that the wind turbine can be optimally loaded during normal operation and thermally protected during faults. The expected outcome is that validated thermal models will have been developed, that can be used as a reference in a non-intrusive continuous condition monitoring scheme using thermal imaging. Such a condition monitoring scheme would ensure that the wind turbine is protected against overheating during faults, but would also allow temporary overloading of the generator with monitored temperatures to avoid overheating.

The work in this project will therefore lay the foundations for a continuous condition monitoring scheme, which will increase the power extraction from the wind, without exceeding the thermal limits of the generator, and increase the lifetime of the wind turbine, by ensuring the thermal limits are not exceeded.

The intention is to include master students in this project, such that they can experience research lead teaching in the area of electrical machines. Such students could work with thermal models and see these validated against experimental measurements.
Department of Electrical Engineering
Electric Components
Centre for Electric Technology

DONG Energy A/S
Period: 01/12/2010 → 01/12/2011
Number of participants: 2
Project participant:
Hosseini, Seyed Mohsen (Intern)
Project Manager, academic:
Jensen, Bogi Bech (Intern)

Financing sources
Source: Public research programme (public)
Name of research programme: PSO
Amount: 918,000.00 Danish Kroner
Year of approval: 2010

Smart Modelling of Optimal Integration of High Penetration of PV
Smooth PV is a PV-ERAnet project coordinated by Energynautics and with participation from KTH-Sweden, EWI, Nord-Rhein Westphalen, TUE-Netherlands and DTU Elektro-DK. The project contains two main activities: large scale integration of PV in Europe and integration of PV into the distribution grid.

Department of Electrical Engineering
KTH - Royal Institute of Technology
Energynautics GmbH
Period: 01/12/2010 → 01/12/2012
Number of participants: 2
PV Simulation Model, System Integration of PV
Acronym: Smooth PV
Project ID: 10580
Project participant:
Mihet-Popa, Lucian (Intern)
Bindner, Henrik W. (Intern)

Computational protein aggregation
Department of Electrical Engineering
Period: 01/12/2010 → 30/09/2011
Number of participants: 2
Phd Student:
Tian, Pengfei (Intern)
Main Supervisor:
Ferkinghoff-Borg, Jesper (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Control Strategies for price based control of demand side units
Department of Electrical Engineering
Period: 01/12/2010 → 20/08/2014
Number of participants: 7
Phd Student:
Sossan, Fabrizio (Intern)
Supervisor:
Future Deep Sea Wind Turbine Technologies
DeepWind is a 4 year project, funded by FP7 - Future Emerging Technologies, and runs from 1 October 2010 to 30 September 2014. Offshore wind energy will play a steadily increasing role and calls for dedicated technology rather than being based on onshore technology that in principle just is transported to sea environments. The hypothesis of this project is that a new wind turbine concept developed specifically for offshore application has potentials for better cost efficiency than existing offshore technology. Based on this hypothesis the project has the overall objective to explore the technologies needed for development of a new and simple floating offshore concept with a vertical axis rotor and a floating and rotating foundation. Additionally, the objective is to develop calculation and design tools for development and evaluation of very large wind turbines based on this concept.

Department of Electrical Engineering
Department of Wind Energy
Risø National Laboratory for Sustainable Energy
Wind Energy Division
Period: 01/10/2010 → 30/09/2014
Number of participants: 1
Acronym: DEEPWIND
Project Coordinator:
Schmidt Paulsen, Uwe (Intern)

Relations
Activities:
VAWTs for offshore applications
Retrospective aspects of DeepWind (ANFSCD) by Uwe Schmidt Paulsen
Publications:
A novel concept for floating offshore wind turbines
Project

Acoustic array methods for identification of noise sources in vehicles
Department of Electrical Engineering
Period: 01/10/2010 → 26/01/2015
Number of participants: 7
Phd Student:
Tiana Roig, Elisabet (Intern)
Supervisor:
Agerkvist, Finn T. (Intern)
Jacobsen, Finn (Intern)
Main Supervisor:
Jeong, Cheol-Ho (Intern)
Examiner:
Juhl, Peter Møller (Intern)
Rafaely, Boaz (Ekstern)
Song, Wookeun (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Integrated Communication and Electric Power Distribution System Design**
Department of Electrical Engineering
Period: 01/10/2010 → 18/06/2014
Number of participants: 6
Phd Student: Douglass, Philip James (Intern)
Supervisor: Nyeng, Preben (Intern)
Main Supervisor: Østergaard, Jacob (Intern)
Examiner: Rasmussen, Claus Nygaard (Intern)
Infield, David (Ekstern)
Kempton, Willett (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**Predicting the intelligibility of processed noisy speech based on the signal-to-noise ratio in the modulation domain**
Department of Electrical Engineering
Period: 15/09/2010 → 19/02/2014
Number of participants: 5
Phd Student: Jørgensen, Søren (Intern)
Main Supervisor: Dau, Torsten (Intern)
Examiner: Brunskog, Jonas (Intern)
Cooke, Martin (Ekstern)
Culling, John (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**Dynamic Load Optimization in a Cable Based Transmission Grid**
Department of Electrical Engineering
Period: 15/08/2010 → 19/02/2014
Number of participants: 6
Phd Student: Olsen, Rasmus Schmidt (Intern)
Supervisor: Gudmundsdottir, Unnur Stella (Ekstern)
Main Supervisor: Holbøll, Joachim (Intern)
Examiner: Rasmussen, Claus Nygaard (Intern)
Rakowska, Aleksandra (Ekstern)
Sørensen (fratrådt), Troels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Characterizing human auditory processing in reverberant environments with multiple sound sources

Department of Electrical Engineering
Period: 01/08/2010 → 12/12/2014
Number of participants: 7
Phd Student:
Marschall, Marton (Intern)
Supervisor:
Buchholz, Jörg (Intern)
MacDonald, Ewen (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Brunskog, Jonas (Intern)
Pulkki, Ville Topias (Intern)
Spors, Sascha (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Nonlinear balanced armature receivers

Department of Electrical Engineering
Period: 01/07/2010 → 15/11/2014
Number of participants: 6
Phd Student:
Jensen, Joe (Intern)
Supervisor:
Harte, James (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)
Examiner:
Brunskog, Jonas (Intern)
Bard, Delphine (Ekstern)
Klippel, Wolfgang (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Non-linear SA Imaging

Department of Electrical Engineering
Period: 01/07/2010 → 14/05/2014
Number of participants: 5
Phd Student:
Rasmussen, Joachim (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Tissue Harmonic Synthetic Aperture Imaging
Project: PhD

FlexPower – a market design project
Department of Electrical Engineering
Intelligent Energy Systems
Period: 01/06/2010 → …
Number of participants: 1
Acronym: FlexPower
Project participant:
Xydis, George (Intern)
Project

Assessment and Development of Microwave Imaging for Breast Cancer Detection
Department of Electrical Engineering
Period: 01/06/2010 → 24/09/2014
Number of participants: 7
Phd Student:
Jensen, Peter Damsgaard (Intern)
Supervisor:
Rubæk, Tonny (Intern)
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Mohr, Johan Jacob (Intern)
Examiner:
Dall, Jørgen (Intern)
Helbig, Marko (Ekstern)
Vrba, Jan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Methods for Early Warning and Early Prevention of Voltage Instability
Department of Electrical Engineering
Period: 01/06/2010 → 26/11/2013
Number of participants: 7
Phd Student:
Dmitrova, Evgenia (Intern)
Supervisor:
Jóhannsson, Hjórtur (Intern)
Jóhannsson, Hjórtur (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Compatibility of Electrical Main Components in Wind Turbines

Department of Electrical Engineering
Period: 01/05/2010 → 26/09/2014
Number of participants: 7
Phd Student:
Holdyk, Andrzej (Intern)
Supervisor:
Jensen, Asger (Ekstern)
Koldby, Erik (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Rasmussen, Tonny Wederberg (Intern)
Hans Kristian, Høidalen (Ekstern)
Lund, Torsten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Modulær Platform til Kommercielle Mobile Robotter

Department of Electrical Engineering
Period: 01/05/2010 → 26/11/2013
Number of participants: 7
Phd Student:
Kjærgaard, Morten (Intern)
Supervisor:
Andersen, Nils Axel (Intern)
Kristensen, Peter A. (Ekstern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Lund, Henrik Hautop (Intern)
Jacobsen, Niels Jul (Ekstern)
Stonier, Daniel (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Transmission system operation with large penetration of Wind and other renewable Electricity sources In Networks by means of innovative Tools and Integrated Energy Solutions

Department of Electrical Engineering
Intelligent Energy Systems
Period: 01/04/2010 → …
Number of participants: 1
**TWENTIES** - Transmission system operation with large penetration of Wind and other renewable Electricity sources in Networks by means of innovative Tools and Integrated Energy Solutions

A group of 6 Transmission System Operators (Belgium, Denmark, France, Germany, The Netherlands and Spain) with 2 generator companies, 5 manufacturers and research organisations, propose 6 demonstration projects to remove, in 3 years, several barriers which prevent the electric system from welcoming more wind electricity, and wind electricity from contributing more to the electric system. The full scale demonstrations aim at proving the benefits of novel technologies (most of them available from manufacturers) coupled with innovative system management approaches. The contribution of wind energy to the system will show how aggregated wind farms can provide system services (voltage and frequency control) in Spain. The aggregation of wind farms with flexible generation and loads will be demonstrated in Denmark using a scalable IT platform developed by a generator. Increasing the flexibility of transmission networks will be tested in Belgium (existing sensors and coordinated power flow control devices avoiding possible large scale instabilities induced by wind farms in the CWE region) and in Spain (dynamic wind power evacuation capacity using real-time computations based on short-term generation forecasts and use of a mobile Overload Line Controller). Off-shore wind farms are addressed from a security viewpoint. Secure HVDC meshed networks will be validated in France using simulations and full scale experiments of two different HVDC circuit breaker technologies. Off-shore wind farm shut downs under stormy conditions will be demonstrated in Denmark using the world largest off-shore wind farm with balancing power provided by the Norwegian hydro capacities through a HVDC link. The experimental results will be integrated into European impact analyses to show the scalability of the solutions: routes for replication will be provided with benefits for the pan European transmission network and the European electricity market as soon as 2014, in line with the SET plan objectives.

**Risø National Laboratory for Sustainable Energy**

Department of Wind Energy

Department of Electrical Engineering

Period: 01/04/2010 → 31/03/2013

Number of participants: 5

Wind power, TSO, Demonstration, Storm control, Wind turbines, Wind farms

**Acronym: TWENTIES**

Project participant:

Sørensen, Poul Ejnar (Intern)

Cutululis, Nicolaos Antonio (Intern)

Maule, Petr (Intern)

Litong-Palima, Marisciel (Intern)

Altiparmakis, Argyrios (Intern)

**Relations**

Publications:

Market and system security impact of the storm demonstration in task-forces TF2. Deliverable: D16.6

Wind power variability and power system reserve requirements at 2020 at 2030 scenarios for offshore wind power in Northern Europe

Report with data for system behaviour at storm passage with original (uncoordinated) and coordinated control

Impact of High Wind Speed Shut-down in the Danish Power System

North Sea Offshore Wind Power Variability in 2020 and 2030

Technical and economic impact analysis of the demonstrations in task-forces TF2 - Deliverable D15.2

Economic impact analysis of the demonstrations in task-forces TF1 and TF3 - Deliverable D15.1

Offshore Variability in Critical Weather Conditions in Large-Scale Wind Based Danish Power System

Offshore Wind Power Data

Spectral structure of mesoscale winds over the water

Offshore Wind Power Production in Critical Weather Conditions

Assessment of storm forecast

Offshore wind power integration in TWENTIES and beyond

Managing Critical Weather Conditions in a Large-Scale Wind Based European Power System - The TWENTIES Project
Metamaterial Homogenization and Antenna Miniaturization

Department of Electrical Engineering
Period: 01/04/2010 → 15/01/2014
Number of participants: 7
Phd Student:
Hansen, Troels Vejle (Intern)
Supervisor:
Arslanagic, Samel (Intern)
Kim, Oleksiy S. (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Mark, Jesper (Intern)
Gustafsson, Mats (Ekstern)
Yaghjian, Arthur D. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

New measurement techniques: Optical methods for characterizing sound fields

Department of Electrical Engineering
Period: 01/04/2010 → 19/03/2014
Number of participants: 6
Phd Student:
Torras Rosell, Antoni (Intern)
Supervisor:
Barrera Figueroa, Salvador (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)
Examiner:
Jeong, Cheol-Ho (Intern)
Gazengel, Bruno (Ekstern)
Humphrey, Victor F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Triple-Band Maritime Satellite Communication Antenna

Department of Electrical Engineering
Period: 01/04/2010 → 26/09/2013
Number of participants: 8
Phd Student:
Smith, Thomas Gunst (Intern)
Supervisor:
Gothelf, Ulrich (Ekstern)
Kim, Oleksiy S. (Intern)
Larsen, Niels Vesterdal (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Viskum, Hans-Henrik (Ekstern)
Perruisseau-Carrier, Julien (Ekstern)
Toso, Giovanni (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Speech intelligibility enhancement using modern envelope and phase manipulations
Department of Electrical Engineering
Period: 15/02/2010 → 19/11/2013
Number of participants: 7
Phd Student:
Decorsière, Remi Julien Blaise (Intern)
Supervisor:
MacDonald, Ewen (Intern)
Søndergaard, Peter Lempel (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Agerkvist, Finn T. (Intern)
Ghitza, Oded (Ekstern)
Stone, Michael A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Methods for enabling utilisation of the potential flexibility in power production and consumption of entities connected in the low voltage network in a Virtual Power Plants framework
Department of Electrical Engineering
Period: 01/02/2010 → 28/09/2015
Number of participants: 6
Phd Student:
Thavlov, Anders (Intern)
Supervisor:
Hilger, Klaus Baggesen (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Pinson, Pierre (Intern)
Ferrarini, Luca (Ekstern)
Nordström, Lars Martin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Tidlig Diagnosticering af Neurodegenerative Sygdomme
Department of Electrical Engineering
Period: 01/02/2010 → 15/08/2013
Number of participants: 6
Phd Student:
Kempfner, Jacob (Intern)
Supervisor:
Jennun, Poul (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Karstoft, Henrik (Ekstern)
Mayer, Geert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Tidlig Diagnosticering af Neurodegenerative Sygdomme
Project: PhD

Distance perception in impaired and aided-impaired hearing
Department of Electrical Engineering
Period: 15/01/2010 → 26/01/2015
Number of participants: 6
Phd Student:
Catic, Jasmina (Intern)
Supervisor:
Santurette, Sébastien (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Marozeau, Jeremy (Intern)
Seeber, Bernhard (Ekstern)
vand Par, Steven (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Broadband relaxation processes in polar liquids
Terahertz Technologies and Biophotonics
Department of Photonics Engineering
Electromagnetic Systems
Department of Electrical Engineering
Roskilde University
Period: 01/01/2010 → 31/12/2011
Number of participants: 5
Contact person:
Jepsen, Peter Uhd (Intern)
Dyre, Jeppe (Ekstern)
Breinbjerg, Olav (Intern)
Project participant:
Nielsen, Albena (Ekstern)
Bjørstorp, Jeppe Majlund (Intern)

Financing sources
Source: Forsk. Private danske - Fonde
Name of research programme: Forsk. Private danske - Fonde
Amount: 500,000.00 Danish Kroner
Project
Early Diagnosis of Neurodegenerative Diseases

Biomedical Engineering
Department of Electrical Engineering
Copenhagen University Hospital
Period: 01/01/2010 → 01/01/2013
Number of participants: 1
Project participant:
Sørensen, Helge Bjarup Dissing (Intern)

Pædagogisk projekt indenfor sundhedsteknologi.

Center for Bachelor of Engineering Studies
Center for Information Technology and Electronics
Department of Electrical Engineering
Center for Continuing Education
Period: 01/01/2010 → 31/12/2010
Number of participants: 4
Project participant:
Sørensen, John Aasted (Intern)
Baden-Kristensen, Keld (Intern)
Munck-Fairwood, Roger (Intern)
Jørgensen, Ian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Dansk Center for Ingeniøruddannelse
Amount: 60,000.00 Danish Kroner
Project

Styrkelse af samarbejdet mellem ingeniørhøjskoler (IHA og IHK) og virksomheder.

Center for Bachelor of Engineering Studies
Center for Information Technology and Electronics
Department of Electrical Engineering
Period: 01/01/2010 → 01/01/2012
Number of participants: 2
Project participant:
Sørensen, John Aasted (Intern)
Besenbacher, Bente (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Undervisningsministeriet
Amount: 300,000.00 Danish Kroner
Project

Microwave Activation of Drug Release

Department of Electrical Engineering
Period: 01/11/2009 → 18/06/2015
Number of participants: 6
Phd Student:
Jónasson, Sævar Pór (Intern)
Supervisor:
Zhurbenko, Vitaliy (Intern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Mohr, Johan Jacob (Intern)
Mikkelsen, Jan Hvolgaard (Ekstern)
Persson, Mikael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

NANoMEChanical sensors and actuators, fundamentals and new directions (NAMEC) : Cantilever based microwave biosensors
Electromagnetic Systems
Department of Electrical Engineering
Center for Nanoteknologi
MT-LAB VKR Centre of Excellence
Period: 01/11/2009 → 31/10/2011
Number of participants: 0
Acronym: NAMEC
Project

Accurate Modeling of Advanced Reflectarrays
Department of Electrical Engineering
Period: 15/10/2009 → 21/02/2013
Number of participants: 7
Phd Student:
Zhou, Min (Intern)
Supervisor:
Jørgensen, Erik (Intern)
Kim, Oleksiy S. (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Gothelf, Ulrich (Ekstern)
Legay, Hervé (Ekstern)
Rengarajan, Sembiam R. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Antennas and Propagation for Body-Centric Wireless Communications
Department of Electrical Engineering
Period: 15/10/2009 → 19/02/2014
Number of participants: 6
Phd Student:
Kvist, Søren Helstrup (Intern)
Supervisor:
Thaysen, Jesper (Intern)
Main Supervisor:
Jakobsen, Kaj Bjarne (Intern)
Examiner:
Larsen, Jan (Intern)
Johansson, Anders J. (Ekstern)
Vardaxoglou, Yiannis C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Electric vehicles in the Electric Power System with high penetration of Wind Power - Charge/discharge infrastructure

Department of Electrical Engineering
Period: 01/10/2009 → 15/08/2013
Number of participants: 6
Phd Student:
Marra, Francesco (Intern)
Supervisor:
Larsen, Esben (Intern)
Main Supervisor:
Træholt, Chresten (Intern)
Examiner:
Bindner, Henrik W. (Intern)
Bollen, Math (Ekstern)
Lopes, João A. Peças (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

PMU application project : Model verification of Synchronous Generator Excitation System via PMU signal

Department of Electrical Engineering

Centre for Electric Technology
Period: 01/10/2009 → 30/09/2010
Number of participants: 3
Project ID: 55664
Project participant:
Østergaard, Jacob (Intern)
Nielsen, Arne Hejde (Intern)
Project Manager, organisational:
Yang, Guangya (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,000,000.00 Danish Kroner
Project

Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks
The EDISON project is an international research project partly publicly funded through the Danish transmission system operator (TSO) Energinet.dk's research programme FORSKEL. The total budget is approximately 49 million DKK, where 33 million come from FORSKEL.

In the EDISON project Danish and international competences will be utilised to develop optimal system solutions for EV system integration, including network issues, market solutions, and optimal interaction between different energy technologies. Furthermore, the Danish electric power system provides an optimal platform for demonstration of the developed solutions.

Electric vehicles (EVs) provide a unique opportunity to reduce the CO2 emissions from the transport sector. At the same time, EVs have the potential to play a major role in an economic and reliable operation of an electricity system with a high penetration of renewable energy. EVs will be a very important balancing measure to enable the Danish government’s
energy strategy, which implies 50% wind power penetration in the electric power system. An EV will be a storage device for smoothing power fluctuations from renewable resources especially wind power and provide valuable system services for a reliable power system operation. With the proper technology the cars can run on wind power and at the same time enable an increased share of RES in the power system for supply of the conventional electricity demand, and thereby, provide an overall economic, reliable, and sustainable energy system.

Department of Electrical Engineering

Center for Electric Power and Energy
Period: 01/09/2009 → 01/03/2012
Number of participants: 1
Acronym: EDISON
Project participant:
Pedersen, Anders Bro (Intern)
Project:

Intelligent Electric Vehicle Integration - Domain Interfaces and Supporting Informatics

Department of Electrical Engineering
Number of participants: 7
Phd Student:
Andersen, Peter Bach (Intern)
Supervisor:
Gantenbein, Dieter (Ekstern)
Poulsen, Bjarne (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Bindner, Henrik W. (Intern)
Lopes, João A. Peças (Ekstern)
Mølbak, Tommy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Synthetic aperture flow imaging using a dual beamformer approach

Department of Electrical Engineering
Period: 01/09/2009 → 18/12/2012
Number of participants: 5
Phd Student:
Li, Ye (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
D’Hooge, Jan (Ekstern)
Sörnmo, Leif (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Synthetic Aperture Flow Imaging Using a Dual Beamformer Approach
Project: PhD
3D Vector Flow Imaging
Department of Electrical Engineering
Period: 15/08/2009 → 22/11/2012
Number of participants: 6
Phd Student:
Pihl, Michael Johannes (Intern)
Supervisor:
Nikolov, Svetoslav (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Wilhelm, Jens E. (Intern)
Jansson, Tomas (Ekstern)
Nygaard, Hans (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
3D vector flow imaging
Project: PhD

Real-Time Analysis of an Active Distribution Network - Coordinated Frequency Control for Islanding
Department of Electrical Engineering
Period: 01/08/2009 → 04/04/2013
Number of participants: 6
Phd Student:
Cha, Seung-Tae (Intern)
Supervisor:
Wu, Qiuwei (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Træholt, Chresten (Intern)
Marnay, Chris (Ekstern)
Repo, Sami Petteri (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Real-Time Analysis of an Active Distribution Network - Coordinated Frequency Control for Islanding Operation
Project: PhD

Controller IC-design for piezoelectric transformer based power supply
Department of Electrical Engineering
Period: 01/07/2009 → 25/01/2013
Number of participants: 5
Phd Student:
Rødgaard, Martin Schøler (Intern)
Supervisor:
Bruun, Erik (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Carazo, Alfredo Vazquez (Ekstern)
Foster, Martin Paul (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Design of digital audio Class-D output stage with feedback - emphasis on hearing aid application
Department of Electrical Engineering
Period: 01/07/2009 → 26/09/2013
Number of participants: 6
Phd Student:
Pracný, Peter (Intern)
Supervisor:
Andersen, Michael A. E. (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Puthusserypady, Sadasivan (Intern)
Bogason, Gudmundur (Intern)
Wisland, Dag T. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Implementation of synthetic aperture ultrasound methods
Department of Electrical Engineering
Period: 01/07/2009 → 27/09/2012
Number of participants: 5
Phd Student:
Hansen, Jens Munk (Intern)
Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Hanson, Lars G. (Intern)
Holm, Sverre (Ekstern)
Tanter, Mickaël (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed

Relations
Publications:
Synthetic Aperture Compound Imaging
Project: PhD

Situation Assessment for Mobile Robots
Department of Electrical Engineering
Period: 01/07/2009 → 21/06/2013
Number of participants: 7
Phd Student:
Beck, Anders Billesø (Intern)
Supervisor:
Fejldiagnose og fejlhåndtering til autonome fly

Department of Electrical Engineering
Period: 01/06/2009 → 21/02/2013
Number of participants: 6
PhD Student:
Hansen, Søren (Intern)
Supervisor:
Adrian, Jens (Ekstern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Niemann, Hans Henrik (Intern)
Gustafsson, Fredrik (Ekstern)
Henry, David (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Microwave Instrument for Vital Signs Detection and Monitoring

Department of Electrical Engineering
Period: 01/06/2009 → 25/01/2013
Number of participants: 6
PhD Student:
Jensen, Brian Sveistrup (Intern)
Supervisor:
Krozer, Viktor (Intern)
Main Supervisor:
Johansen, Tom Keinicke (Intern)
Examiner:
Skou, Niels (Intern)
Høst-Madsen, Anders (Ekstern)
Jacob, Arne F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Piezoelectric transformer based power supply for DEAP

Department of Electrical Engineering
Pre-standardisation of wind power modelling
The purpose of the project is to support the standardisation work in IEC Technical Committee 88 (TC88) Working Group 27 (WG27) on electrical simulation models for wind power generation. This work is done in cooperation between DTU and industry partners. The role of DTU has been to implement the IEC models in Power Factory, and in cooperation with industry to parametrise and validate the models against test results.

Department of Wind Energy
Wind Energy Systems
Department of Electrical Engineering
Center for Electric Power and Energy

Relations
Activities:
IEC TC88 WG27: Wind Turbines - Electrical Simulation Models (External organisation)
Publications:
Implementation of IEC Standard Models for Power System Stability Studies
Implementation of IEC Generic Model Type 1A using RTDS
Wind turbine standard models
Modular structure of wind turbine models in IEC 61400-27-1
IEC work on modelling - generic model development. IEC 61400-27 - expected outcome
IEC 61400-27 standard on electrical simulation models for wind power generation
IEC 61400-27. Electrical simulation models for wind power generation

Protein dynamics at millisecond timescales
Department of Electrical Engineering

Protein dynamics at millisecond timescales
Department of Electrical Engineering

IEC work on modelling - generic model development. IEC 61400-27 - expected outcome
IEC 61400-27 standard on electrical simulation models for wind power generation
IEC 61400-27. Electrical simulation models for wind power generation
Methods of measuring impulse responses in architectural acoustics: Master's Thesis

New methods of measuring impulse responses based on carefully designed deterministic signals can further improve the performance offered by classical methods. In fact, these methods are particularly interesting when measuring long impulse responses as the ones analyzed in architectural acoustics. However, the effects of background and impulsive noise, distortion and time-variance are known rather qualitatively. For this reason, the ISO 18233 encourages to develop a deeper understanding of the theoretical bases of these techniques. In this sense, this project presents an in depth analysis of two different methods of measuring impulse responses: the linear convolution of sweep signals with the inverse filter and the circular crosscorrelation of maximum length sequences (MLS) and inverse repeated sequences (IRS). The results of this work reveal that the sweep technique can provide significant reduction of distortion compared to MLS/IRS technique but, unlike what is explained in the literature, sweep signals cannot reject all distortion artifacts from the causal part of the impulse response. Besides, it is proved that IRS sequences are immune to distortion of even order. On the other hand, it is confirmed that synchronous averaging procedure improves the SNR at the microphone position by 3 dB per doubling the number of averages. Alternatively, it is also proved that the noise contaminating the measured impulse response is reduced by 3 dB every time that the length of the excitation signal is doubled. In terms of impulsive noise, the sweep technique only contaminates specific frequency bands of the system's impulse response, whereas the MLS/IRS technique uniformly distributes all impulsive noise artifacts over the entire measured impulse response. Finally, it is also shown that MLS/IRS measurements are more vulnerable to time-varying systems than sweep measurements.
Electric vehicles in a Distributed and Integrated market using Sustainable energy and Open Networks

Electric vehicles (EVs) provide a unique opportunity to reduce the CO2 emissions from the transport sector. At the same time, EVs have the potential to play a major role in an economic and reliable operation of an electricity system with a high penetration of renewable energy. EVs will be a very important balancing measure to enable the Danish government’s energy strategy, which implies 50% wind power penetration in the electric power system. An EV will be a storage device for smoothing power fluctuations from renewable resources especially wind power and provide valuable system services for a reliable power system operation. With the proper technology the cars can run on wind power and at the same time enable an increased share of RES in the power system for supply of the conventional electricity demand, and thereby, provide an overall economic, reliable, and sustainable energy system.

Denmark does not have a car industry, and the Danish background for development of EVs themselves is limited. On the other hand Danish companies and research institutions have a very strong knowledge and competence regarding design, development, and operation of power systems with high penetration of distributed generation. Furthermore, Danish industry is involved in technologies, which are critical to a widespread use of EVs such as strategy for optimised battery charging/discharging, and power electronics related to battery charging/discharging. This forms an ideal base for development of systems and integration solutions for EVs.

The Danish competence can be utilised to develop optimal system solutions for EV system integration, including network issues, market solutions, and optimal interaction between different energy technologies. Furthermore, the Danish electric power system provides an optimal platform for demonstration of the developed solutions, and thereby, provides the commercial basis for Danish technology export. Furthermore, the advantage of being a “first mover” constitutes a business advantage, as well as, a possibility of a strong Danish influence on future standards for system integration of EVs, whereby optimal utilization of the EVs in the power system is obtained.

Department of Electrical Engineering
Center for Electric Power and Energy
Period: 02/03/2009 → 31/12/2012
Number of participants: 1
Acronym: EDISON
Project participant:
Wu, Qiuwei (Intern)

High efficiency PFC frontend for class-D amplifiers

Department of Electrical Engineering
Period: 01/03/2009 → 20/09/2012
Number of participants: 8
Phd Student:
Li, Qingnan (Intern)
Supervisor:
Frium, Mads P. (Ekstern)
Hansen, Lars B. R. (Ekstern)
Thomsen, Ole Cornelius (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Petersen, Lars Press (Intern)
Kyyrä, Jorma (Ekstern)
Wolf, Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Modelling human auditory-evoked brain responses to complex sounds

Department of Electrical Engineering
Period: 01/03/2009 → 25/01/2013
Number of participants: 7
Phd Student:
Rønne, Filip Munch (Intern)
Vacuum Devices for Terahertz Applications
Department of Electrical Engineering
Period: 01/03/2009 → 31/03/2010
Number of participants: 2
Phd Student:
Kotiranta, Mikko (Intern)
Main Supervisor:
Krozer, Viktor (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Detection and Prediction of Epileptic Seizures
Department of Electrical Engineering
Period: 01/02/2009 → 04/04/2013
Number of participants: 7
Phd Student:
Duun-Henriksen, Jonas (Intern)
Supervisor:
Kjær, Troels Wesenberg (Ekstern)
Thomsen, Carsten E. (Intern)
Main Supervisor:
Serensen, Helge Bjarup Dissing (Intern)
Examiner:
Sams, Thomas (Intern)
Karstoft, Henrik (Ekstern)
Van Huffel, Sabine (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Evolving Electricity Market Design for further integration of wind energy
Both Denmark and China have ambitious plans to increase wind energy within electric power sectors. E.g. the Danish national energy strategy suggests 50% electricity supplied by wind by 2025, while in China the Renewable Energy Law is recently passed and accordingly 30 GW wind installation capacity is set as the national target for 2020. A key prerequisite for further integration of wind power is an integrated and effective electricity market system that can enable bulk power trading without prejudices against traditional or wind-like distributed and renewable generation resources and compromise
to the security of supply. As a leading country of wind energy, about 20% electricity (2007 data) is supplied from wind in Denmark, and bulk electricity is traded through a day-ahead plus an hourly balancing market system. With the increase of penetration level, operating the Danish power system has experienced a variety of difficulties and a high cost for ancillary services, due to the very limited predictability and high intermittence of the wind. This indicates that the current market structure is not optimal in terms of economy and system operation, particularly for the future where large amount (>30%) of fluctuating wind and other renewables will be integrated. It is therefore the objective of this project is to join the research forces in Denmark and China towards development a (near) real time electricity market framework that can facilitate further and better integration of wind power into the electric power systems therefore contributing to the wind energy development in both countries. By collaboration between Danish and Chinese partners in this project, it is expected a formal project application on the subject will be produced ready for submission to relevant funding organisations in Denmark, China or EU.

Department of Electrical Engineering
Centre for Electric Technology

Zhejiang University
Period: 01/02/2009 → 31/10/2009
Number of participants: 2
Acronym: EMWind
Project ID: 55583
Contact person:
Xu, Zhao (Intern)
Gan, Deqiang (Ekstern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 150,000.00 Danish Kroner

Source identification with acoustic array technology based on new acoustic transducers

Department of Electrical Engineering
Period: 15/01/2009 → 21/08/2012
Number of participants: 5
Phd Student:
Fernandez Grande, Efren (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Juhl, Peter Møller (Intern)
Svensson, Peter (Ekstern)
Williams, Earl G. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Detection and Prediction of Epileptic Seizures

Biomedical Engineering
Department of Electrical Engineering
Hypo-Safe A/S

Copenhagen University Hospital
Period: 01/01/2009 → 01/01/2012
Number of participants: 1
Project participant:
Sørensen, Helge Bjarup Dissing (Intern)
Diagnosis of heel pad injuries

Department of Electrical Engineering
Period: 01/01/2009 → 23/05/2012
Number of participants: 6
Phd Student: Matteoli, Sara (Intern)
Supervisor: Torp-Pedersen, Søren T. (Ekstern)
Main Supervisor: Wilhelmsen, Jens E. (Intern)
Examiner: Hanson, Lars G. (Intern)
Jurvelin, Jukka Sakari (Ekstern)
Simonsen, Erik Bruun (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Diagnosis of heel pad injuries
Project: PhD

Experimental and theoretical investigation of signaling in Quorum Sensing of Pseudomonas Aeruginosa

Department of Electrical Engineering
Period: 01/01/2009 → 04/04/2013
Number of participants: 5
Phd Student: Claussen, Anetta (Intern)
Supervisor: Givskov, Michael Christian (Intern)
Main Supervisor: Sams, Thomas (Intern)
Examiner: Irbäck, Anders (Ekstern)
Jalkanen, Karl J. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Experimental and Theoretical Investigation of Signaling in Quorum Sensing of Pseudomonas Aeruginosa
Project: PhD

Prediction of speech perception based on auditory processing models

Department of Electrical Engineering
Period: 01/01/2009 → 18/12/2012
Number of participants: 5
Phd Student: Jespersgaard, Claus Forup Corlin (Intern)
Main Supervisor: Dau, Torsten (Intern)
Examiner:
Flexible power module for fuel cell hybrid power system in a forklift

Department of Electrical Engineering
Period: 15/12/2008 → 27/09/2012
Number of participants: 6
Phd Student: Sen, Gokhan (Intern)
Supervisor: Thomsen, Ole Cornelius (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Nymand, Morten (Intern)
Ferreira, Jan Abraham (Ekstern)
Sun, Jian (Ekstern)

Innovative magnetic-less high power density switch-mode power supplies based on piezoelectric transformers

Department of Electrical Engineering
Period: 15/12/2008 → 27/03/2012
Number of participants: 2
Phd Student: Meyer, Kaspar Sinding (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)

Planar Magnetics for High Grade Converters

Department of Electrical Engineering
Period: 15/12/2008 → 16/01/2012
Number of participants: 6
Phd Student: Ouyang, Ziwei (Intern)
Supervisor: Thomsen, Ole Cornelius (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Wolf, Christian (Intern)
Hurley, William Gerard (Ekstern)
Sun, Jian (Ekstern)
Modelling and validation of Siemens Wind Power VS wind turbines and park controllers for dynamic RMS simulations using DlgSILENT PowerFactory simulation program

This project is scheduled from February to July 2009 and to be conducted between the wind turbine manufacturer Siemens Wind Power AS and the Centre for Electric Technology (CET), Department of Electrical Engineering, Technical University of Denmark, targeting development, validation and documentation of Siemens Wind Power VS wind turbines and park controllers in the DlgSILENT PowerFactory simulation environment. The wind turbines utilize full-rating frequency converters which is the main technology of Siemens Wind Power. The project must benefit both participants with accessing each other’s know how on modelling and control of modern, Megawatt class wind turbines, frequency converters and large windfarms. The activity must strength the development and knowledge of the CET within the main research and education areas of wind power integration into power systems. The developed models and results of this project remain property of Siemens Wind Power.

Active performance assessment and system monitoring for refrigeration systems

Department of Electrical Engineering
Period: 01/12/2008 → 27/09/2012
Number of participants: 7
Phd Student:
Green, Torben (Intern)
Supervisor:
Izadi-Zamanabadi, Roozbeh (Intern)
Skovrup, Morten Juel (Intern)
Main Supervisor:
Niemann, Hans Henrik (Intern)
Examiner:
Ravn, Ole (Intern)
Hägglund, Tore (Ekstern)
Stetter, Ralf (Ekstern)

Digital DC-AC Boost Amplification for Portable Audio

Department of Electrical Engineering
Period: 01/12/2008 → 31/05/2011
Number of participants: 3
Phd Student:
Bolten Maizonave, Gert (Intern)
Overvoltages and protection in offshore wind power grids

Department of Electrical Engineering
Period: 01/12/2008 → 22/06/2012
Number of participants: 8
Phd Student:
Arana Aristi, Ivan (Intern)
Supervisor:
Jensen, Kim Høj (Intern)
Nielsen, Arne Hejde (Intern)
Sørensen (fratrådt), Troels (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Rasmussen, Tonny Wederberg (Intern)
Lund, Torsten (Intern)
Thiringer, Erik Torbjörn Valdemar (Ekstern)

Wireless Communication for Hearing Aid Systems

Department of Electrical Engineering
Period: 01/12/2008 → 20/09/2012
Number of participants: 7
Phd Student:
Nour, Baqer (Intern)
Supervisor:
Mortensen, N. Asger (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Meincke, Peter (Intern)
Kabacik, Pawel (Ekstern)
Nosich, Alexander I. (Ekstern)

Communication architecture for service based control of distributed power systems

Department of Electrical Engineering
Period: 01/11/2008 → 15/06/2016
Number of participants: 5
Phd Student:
Kullmann, Daniel (Intern)
Main Supervisor:
Bindner, Henrik W. (Intern)
Examiner:
Træholt, Chresten (Intern)
Jørgensen, Bo Nørregaard (Ekstern)
Sonnenschein, Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Computational management of stent-graft based minimally invasive aortic aneurysm repairs
Department of Electrical Engineering
Period: 01/11/2008 → 21/02/2012
Number of participants: 7
Phd Student:
Traberg, Marie Sand (Intern)
Supervisor:
Jensen, Jørgen Arendt (Intern)
Lönn, Lars (Ekstern)
Main Supervisor:
Henneberg, Kaj-Åge (Intern)
Examiner:
Hanson, Lars G. (Intern)
Cinthio, Per Axel Magnus (Ekstern)
Stålhand, Jonas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Elektriske hovedkomponenter i vindmøller - påvirkninger, kompatibilitet og specifikationer
Department of Electrical Engineering
Period: 01/10/2008 → 30/09/2009
Number of participants: 3
Phd Student:
Leweson, Mette Sofie (Intern)
Supervisor:
Nielsen, Arne Hejde (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Department of Electrical Engineering
Period: 01/10/2008 → 18/12/2012
Number of participants: 8
Phd Student:
Knüppel, Thyge (Intern)
Supervisor:
Dixon, Andrew (Ekstern)
Detection of Epileptic Seizures with Multimodal Signal Processing

Department of Electrical Engineering
Period: 01/09/2008 → 22/06/2012
Number of participants: 8
Phd Student:
Conradsen, Isa (Intern)
Supervisor:
Beniczky, Sándor (Ekstern)
Sams, Thomas (Intern)
Wolf, Peter (Ekstern)
Main Supervisor:
Serensen, Helge Bjarup Dissing (Intern)
Examiner:
Henneberg, Kaj-Åge (Intern)
Karstoft, Henrik (Ekstern)
Van Huffel, Sabine (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Relations
Publications:
Detection of Epileptic Seizures with Multi-modal Signal Processing
Project: PhD

Electrical structure of future offshore wind turbine farms with a DC transmission connection

Department of Electrical Engineering
Period: 01/09/2008 → 16/01/2012
Number of participants: 8
Phd Student:
Sharma, Ranjan (Intern)
Supervisor:
Akhmatov, Vladislav (Intern)
Andersen, Michael A. E. (Intern)
Jensen, Kim Høj (Intern)
Main Supervisor:
Rasmussen, Tonny Wederberg (Intern)
Examiner:
Undeland, Tore (Ekstern)
Kjærgaard, Jens Peter (Ekstern)
Thiringer, Erik Torbjörn Valdemar (Ekstern)

Financing sources
Development of High Power Amplifiers for Space and Ground-based Applications

Department of Electrical Engineering  
Period: 01/08/2008 → 21/06/2013  
Number of participants: 5  
Phd Student:  
Hernández, Carlos Cilla (Intern)  
Main Supervisor:  
Vidkjaer, Jens (Intern)  
Examiner:  
Johansen, Tom Keinicke (Intern)  
Deborgies, Francois (Ekstern)  
Van Vliet, Frank E. (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

Image processing in medical ultrasound

Department of Electrical Engineering  
Period: 01/08/2008 → 14/12/2011  
Number of participants: 7  
Phd Student:  
Hemmsen, Martin Christian (Intern)  
Supervisor:  
Kortbek, Jacob (Intern)  
Martins, Bo (Intern)  
Main Supervisor:  
Jensen, Jørgen Arendt (Intern)  
Examiner:  
Hanson, Lars G. (Intern)  
Jansson, Tomas (Ekstern)  
Tortoli, Piero (Ekstern)

Financing sources  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

Online stability assessments in networks with high penetration of decentralized production

Department of Electrical Engineering  
Period: 01/08/2008 → 16/04/2013  
Number of participants: 3  
Phd Student:  
Isleifsson, Fridrik Rafn (Intern)  
Supervisor:  
Nielsen, Arne Hejde (Intern)  
Main Supervisor:  
Bindner, Henrik W. (Intern)
**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut/centerfinansieret  
Project: PhD

**Energy Optimized Photovoltaic Module**  
Department of Electrical Engineering  
Period: 01/07/2008 → 17/04/2013  
Number of participants: 2  
Phd Student:  
Variath, Reshmi C (Intern)  
Main Supervisor:  
Andersen, Michael A. E. (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**Speakers comfort and increase of their voice level in lecture rooms**  
Department of Electrical Engineering  
Period: 15/06/2008 → 16/01/2012  
Number of participants: 6  
Phd Student:  
Pelegrin Garcia, David (Intern)  
Supervisor:  
Poulsen, Torben (Intern)  
Main Supervisor:  
Brunskog, Jonas (Intern)  
Examiner:  
Christiansen, Thomas Ulrich (Intern)  
Bradley, John S. (Ekstern)  
Ternström, Sten (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Eksternt finansieret virksomhed  
Project: PhD

**Non-linear ultrasound imaging**  
Department of Electrical Engineering  
Period: 01/06/2008 → 28/09/2011  
Number of participants: 6  
Phd Student:  
Du, Yigang (Intern)  
Supervisor:  
Jensen, Henrik (Ekstern)  
Main Supervisor:  
Jensen, Jørgen Arendt (Intern)  
Examiner:  
Ferkinghoff-Borg, Jesper (Intern)  
Torp, Hans (Ekstern)  
Willatzen, Morten (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU

**Relations**
Publications:
Non-linear Ultrasound Imaging
Project: PhD

P-Band HPA Technology Assessment - ESA/ITT AO/1-5583/07/NL/JA : Evaluations and Recommendations
Department of Electrical Engineering
Period: 25/05/2008 → 30/05/2011
Number of participants: 1
Acronym: P-Band HPA
Project Manager, organisational:
Vidkjaer, Jens (Intern)

P-Band HPA Technology Assessment - ESA/ITT AO/1-5583/07/NL/JA : HPA Assembly Report
Department of Electrical Engineering
Period: 25/05/2008 → 30/05/2011
Number of participants: 1
Acronym: P-Band HPA
Project Manager, organisational:
Vidkjaer, Jens (Intern)

Diplomingeniøruddannelse i Sundhedsteknologi
Udvikling af Diplomingeniøruddannelse i Sundhedsteknologi.

Relations:
Activities: Sundhedsteknologi - metoder, praksis og perspektiver
Center for Bachelor of Engineering Studies
Center for Information Technology and Electronics
Department of Electrical Engineering
Department of Applied Mathematics and Computer Science
Center for Continuing Education
Office for Study Programmes and Student Affairs
Center for Business and Innovation
Period: 01/05/2008 → 31/12/2012
Number of participants: 13
Sundhedsteknologi, Telemedicin, Nye teknologiske platforme
Project participant:
Sørensen, John Aasted (Intern)
Baden-Kristensen, Keld (Intern)
Holst-Christensen, Bo (Intern)
Sørensen, John Kryger (Intern)
Munck-Fairwood, Roger (Intern)
Bechmann, Henrik (Intern)
Hauge, Anders (Intern)
Olesen, Per (Intern)
Jeppesen, Lau (Ekstern)
Tolstrup, Jytte (Ekstern)
Pilegaard, Marianne (Ekstern)
Working partner:
Lausten, Anette Kjeldal (Ekstern)
Besenbacher, Bente (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ingeniørhøjskolen i København
Amount: 1,200,000.00 Danish Kroner
Project

Enhancing Lifelong Learning for the Electrical and Information Engineering Community
Enhancing LLL for the electrical and information engineering society

Project webpage: Greenelleiec.eu
Center for Bachelor of Engineering Studies
Center for Information Technology and Electronics
Department of Electrical Engineering
Period: 01/05/2008 → 31/03/2012
Number of participants: 1
Project participant:
Friesel, Anna (Intern)

Superconducting Wind Turbine Generators

Department of Electrical Engineering
Period: 01/05/2008 → 21/08/2012
Number of participants: 7
Phd Student:
Mijatovic, Nenad (Intern)
Supervisor:
Abrahamsen, Asger Bech (Intern)
Træholt, Chresten (Intern)
Main Supervisor:
Jensen, Bogi Bech (Intern)
Examiner:
Nielsen, Arne Hejde (Intern)
Masson, Philippe J. (Ekstern)
Polinder, Henk (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Globaliseringsmidler
Project: PhD

Communication Requirements for Flexible Control of Distr. Pow. Systems

In order to meet the challenges posed by the distribution of energy resources, the liberalisation of energy markets and increasing generation from renewable sources, a variety of new concepts for power system structure and control are being discussed and actively researched on. These range from simple aggregation - for example through virtual power plants - towards more radical approaches, such as replacing traditional distribution systems by collections of microgrids, or the decentralisation of control. It is an open question how future grids will be operated, and what kind of new features will be feasible and desirable. Given the long-term nature of infrastructure investments, it is of utmost importance that the devices and technologies deployed in the short term do not restrict progress in the medium and long term. With respect to
communication and data exchange between power system components, it is important to ensure that the communication standards are able to grow and be extended as new intelligent devices, control paradigms and power system components appear. Communication standards should therefore avoid assumptions about the structure of the control system. The three main limitations of the current standards are: • Insufficient separation of concerns. Immutable properties (such as nameplate information), configuration (such as device-subdevice relations), state (such as the cycle count of a circuit breaker) role (such as the present operating mode of a power plant) and application scope (such as substation automation) are mixed. • The lack of a single, unified model of the power system and its components. In today's power system, communication protocols are tightly tied to an application (see Figure 1). Interfacing between the device-centric view of SCADA systems (for which the IEC61850 family of standards was created) and the system-oriented view of EMS applications is still a challenge, because the underlying data model is different. • Limited extensibility. The growing number of DER connected to the power system will create a need to delegate control tasks away from the system level towards local control structures (The different operating modes of the Horns Rev windfarm are an example for such a delegation). The protocols of the IEC61850 series use predefined lists (enumerations) to describe types of behaviour, which is difficult to adapt to new developments. The project aims at producing a conceptual framework for the unified and extensible representation and exchange of power system information and data. While the development of a standard is explicitly not one of the goals of the project, a proof-of-concept implementation will be undertaken for demonstration purposes. It is very difficult to test the full functionality of a new communication protocol on a real power system, as e.g. results from the NextGen project have shown. Not all potential operating modes of a unit can be tested without interfering with the control of the overall grid. Therefore, the implementation will be tested in the isolated environment of the SYSLAB grid at Risø. Results from the project will be published as a technical report, to provide input to the standardization work under IEC TC57.

Risø National Laboratory for Sustainable Energy
Department of Electrical Engineering
Centre for Electric Technology
Eurisco Aps.
Period: 01/04/2008 → 31/03/2010
Number of participants: 4
flexcom, communication, flexible, power, systems
Acronym: FlexCom
Project ID: 55560
Project participant:
Gehrke, Oliver (Intern)
Østergaard, Jacob (Intern)
Andersen, Claus Amtrup (Intern)
Project Manager, organisational:
Bindner, Henrik W. (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 194,000.00 Danish Kroner

Control Architecture for Future Power Systems
Department of Electrical Engineering
Period: 01/04/2008 → 21/02/2012
Number of participants: 6
Phd Student:
Heussen, Kai (Intern)
Supervisor:
Lind, Morten (Intern)
Main Supervisor:
Niemann, Hans Henrik (Intern)
 Examiner:
Østergaard, Jacob (Intern)
Jiang, Jin (Ekstern)
Rehtanz, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

Modelling structural acoustic properties of loudspeaker

Department of Electrical Engineering
Period: 15/02/2008 → 24/08/2011
Number of participants: 7
Phd Student:
Luan, Yu (Intern)
Supervisor:
Bech, Søren (Intern)
Jacobson, Finn (Intern)
Main Supervisor:
Ohlrich, Mogens (Intern)
Examiner:
Brunskog, Jonas (Intern)
Gibbs, Barry Marshall (Ekstern)
Kropp, Wolfgang (Ekstern)

Financing sources
Source: Internal funding (public)

Name of research programme: ErhvervPhD-ordningen VTU
Project: PhD

Robotic Manipulation of Offshore Drilling Equipment

Department of Electrical Engineering
Period: 01/02/2008 → 19/04/2012
Number of participants: 6
Phd Student:
Choux, Martin (Intern)
Supervisor:
Hovland, Geir (Ekstern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Andersen, Torben Ole (Intern)
Egeland, Olav (Ekstern)

Financing sources
Source: Internal funding (public)

Name of research programme: Stipendie fra udlandet
Project: PhD

El til vejtransport, fleksible el-systemer og vindkraft

Centre for Electric Technology
Risø National Laboratory for Sustainable Energy
Systems Analysis Division
Department of Electrical Engineering
Electronics
Wind Energy Division
RAM-lose
Energinet.dk
Dansk Energi
Period: 17/01/2008 → 31/12/2010
Number of participants: 14
Project ID: 55563
Contact person:
Larsen, Esben (Intern)
Hansen, Lars (Ekstern)
Project participant:
Morthorst, Poul Erik (Intern)
Jørgensen, Kaj (Intern)
Meibom, Peter (Intern)
Andersen, Nina Juul (Ekstern)
Horstmann, Jørgen (Ekstern)
Ravn, Hans V. (Intern)
Anderson, Anton (Ekstern)
Nørgaard, Per H. (Intern)
Hansen, Anders Bavnhøj (Ekstern)
Pedersen, Jens (Ekstern)
Abildgaard, Hans (Ekstern)
Project Manager, academic:
Nielsen, Lars Henrik (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 501,000.00 Danish Kroner
Documents:
ris-r-1804

Vind i Øresund - EU Interreg IV A
Vind i Øresund (EU - INTERREG IV, 2008-2011), one of the primary goals of this project is to demonstrate forecasting tools for an efficient integration of wind power in power systems. The project has also identified the necessary framework in the form of changes in energy taxes, dynamic tariffs, and new forms of multi-pronged energy. It is important that both the regional and national political decision-makers relatives as soon as possible involved in providing these conditions through necessary structural and regulatory changes. These changes are necessary to enable us to meet the policy objectives of reducing CO2 emissions, and to realize the region's goal of new industrial growth in green technology.

Department of Electrical Engineering
Center for Electric Power and Energy
Period: 01/01/2008 → 31/12/2012
Number of participants: 1
Project participant:
Wu, Qiuwei (Intern)

Antenna Miniaturization in Complex Environments
Department of Electrical Engineering
Period: 01/01/2008 → 28/09/2011
Number of participants: 7
Phd Student:
Zhang, Jiaying (Intern)
Supervisor:
Mortensen, N. Asger (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Detection of Epileptic Seizures with Multimodal Signal Processing
Biomedical Engineering
Department of Electrical Engineering
Epilepsy Hospital Filadelfia
Period: 01/01/2008 → 01/01/2012
Number of participants: 1
Project participant:
Sørensen, Helge Bjarup Dissing (Intern)

Processing of spatial sounds in the impaired auditory system
Department of Electrical Engineering
Period: 01/01/2008 → 14/09/2011
Number of participants: 6
Phd Student:
Arweiler, Iris (Intern)
Supervisor:
Dau, Torsten (Intern)
Main Supervisor:
Buchholz, Jörg (Intern)
Examiner:
Poulsen, Torben (Intern)
Festen, Joost M. (Ekstern)
Tchorz, Jürgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

V2G Siemens Feasibility Study (Preproject) : Vehicle to Grid
Recently, there has been a lot of discussion about the possibility of using electric drive vehicles (plug-in hybrids or all electric or fuel cell) for rendering services to the electric utility (using the on board vehicle storage and power electronic systems). Such a scheme, where in the electric drive vehicle is used to provide grid service, is commonly referred to as Vehicle to Grid (V2G). The main aim of this project is to examine the feasibility of the V2G technology by identifying the driving factors and the bottle necks in developing such a technology. This study also discusses the different vehicle to grid technologies, the key participants/stake holders and analyzes the interaction between different players/stake holders of this technology. Although, a few architectures and business models are being proposed, so far no comprehensive study has been made to analyze the manner in which different stake holders interact. Hence, the scope of this project is to examine and discuss the various business models and their interaction with different key players. The evaluation of various business models and architectures will be made keeping in view some of the special features of the Danish System. One of the key features of the Danish system is high wind power penetration in the electricity networks (Installed wind power capacity is about 20% of the total load) and this penetration level is expected to increase to 50% in the near future. Hence, it is important to investigate technologies which will ensure secure, reliable and economic operation of the power system with such a high wind power penetration. This project investigates the manner in which electric drive vehicle could be used (in a cost effective manner-both for utility and vehicle owners) to ensure security and reliability of systems with high penetration of renewable energy.

Department of Electrical Engineering
Centre for Electric Technology

Siemens
Siemens Corporate Technology
Period: 01/01/2008 → 31/05/2008
Number of participants: 7
Vehicle, Grid
Project ID: 55526
Contact person:
Horstmann, Jørgen Peter Frederik (Intern)
Project participant:
Chandrashekhara, Divya K (Intern)
Larsen, Esben (Intern)
Kern, Claus (Intern)
Wittmann, Tobias (Ekstern)
Weinhold, Michael (Intern)
Project Manager, organisational:
Østergaard, Jacob (Intern)

**Financing sources**
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 580,000.00 Danish Kroner

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**Coordinated frequency control of wind turbines in power systems with high wind power penetration**

Department of Electrical Engineering
Period: 01/12/2007 → 27/09/2012
Number of participants: 7
Phd Student:
Tarnowski, Germán Claudio (Intern)
Supervisor:
Kjær, Philip Carne (Ekstern)
Sørensen, Poul Ejnar (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Nielsen, Arne Hejde (Intern)
Erlich, István (Ekstern)
Pöller, Markus (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

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**High Quality Active Earphone System**

Department of Electrical Engineering
Period: 01/12/2007 → 30/04/2009
Number of participants: 3
Phd Student:
Blanchard, Lola Justine Kydia Olivia (Intern)
Supervisor:
Jacobsen, Finn (Intern)
Main Supervisor:
Agerkvist, Finn T. (Intern)

**Financing sources**
**Design of Integrated Circuits Approaching Terahertz Frequencies**

Department of Electrical Engineering  
Period: 01/10/2007 → 04/04/2013  
Number of participants: 5  
Phd Student: Yan, Lei (Intern)  
Main Supervisor: Johansen, Tom Keinicke (Intern)  
Examiner: Vidkjær, Jens (Intern)  
Hansen, Flemming (Intern)  
Kalffass, Ingmar (Ekstern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Generic Virtual Power Plant for Micro Combined Heat and Power Units**

Department of Electrical Engineering  
Period: 01/10/2007 → 23/03/2011  
Number of participants: 6  
Phd Student: You, Shi (Intern)  
Supervisor: Poulsen, Bjarne (Intern)  
Main Supervisor: Træholt, Chresten (Intern)  
Examiner: Rasmussen, Claus Nygaard (Intern)  
Kempton, Willett (Intern)  
Mølbak, Tommy (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: DTU, Samfinansiering  
Project: PhD

**Powering the future data centre**

Department of Electrical Engineering  
Period: 01/10/2007 → 19/01/2011  
Number of participants: 6  
Phd Student: Zhang, Zhe (Intern)  
Supervisor: Andersen, Michael A. E. (Intern)  
Nielsen, Henning Roar (Ekstern)  
Main Supervisor: Thomsen, Ole Cornelius (Intern)  
Examiner: Kjærgaard, Claus (Ekstern)  
Sun, Jian (Ekstern)

**Financing sources**
Neural coding and perception of pitch in the normal and impaired human auditory system

Department of Electrical Engineering
Period: 15/08/2007 → 24/08/2011
Number of participants: 6
Phd Student: Santurette, Sébastien (Intern)
Supervisor: Buchholz, Jörg (Intern)
Main Supervisor: Dau, Torsten (Intern)
Examiner: Poulsen, Torben (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-loennet stipendie
Project: PhD

Calibrated modelling of ultrasonic fields using Field II

Department of Electrical Engineering
Period: 01/08/2007 → 24/11/2010
Number of participants: 6
Phd Student: Bæk, David (Intern)
Supervisor: Willatzen, Morten (Intern)
Main Supervisor: Jensen, Jørgen Arendt (Intern)
Examiner: Sams, Thomas (Intern)
Persson, Hans W. (Ekstern)
Stepinski, Tadeusz (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-loennet stipendie
Project: PhD

Relations
Publications:
Modeling of ultrasound transducers
Project: PhD

PowerLabDK : An Experimental Research Platform for Electric Power and Energy

National forskningsplatform, PowerLabDK, inden for elteknik, vedvarende energi og fremtidens elsystemer. Energi står øverst på den politiske agenda, ikke mindst i Europa, og Danmark har valgt at sætte sig i spidsen med vedtagelse af en ambitiøs national energiplan med særdeles udfordringsmålsætning af fremtidens elsystem. Energiforsyning på lang sikt kræver en omfattende transformering af dagens net- og styringsarkitekturer, og der krævesмел, at vi kan skabe en bedre forståelse af, hvordan vi kan integrere fluktuerende og uforudsigelige produktioner i systemet med elektriske komponenter og udstyr. Der er akkurat behov for at udvikle og test komplette løsninger i laboratorier, som er helt på forhånd med udviklingen – kun derigennem kan vi opnå overlegne løsninger og teknologier, som kan hjælpe med at gøre fremtidens elsystem mere effektivt og bæredygtigt. Der er stor behov for forskning og udvikling i det område, og det er vigtigt at iværksætte denne transformering nu, når vi stadig fortsætter med at undersøge de forskellige løsninger og teknologier, der kan bidrage til et bedre elsystem i fremtiden.
Models for Nordic Wind Energy

The power production from wind energy in the world is growing very fast and the Nordic countries are performing an important role in it, not only taking advantage of their renewable resources but also developing the suitable technology for that. During the last 20 years the wind energy technology has been strongly developed, increasing from single 55kW wind turbines to single 2MW and 3MW wind turbines installed in large wind farms. Within a few years several wind farms of hundreds of MW and high number of wind turbines will be under construction on the Baltic Sea, the North Sea and on shore in the Nordic countries. Consequently, large amounts of energy and power coming from wind will be injected into the Nordic grid. Nevertheless, increasing the penetration level of wind power generation into the power system produces impacts on the power system performance, operation and control. Hence, more careful studies on wind power generation and its interaction with the power system stability need to be done for finding suitable solutions and making the power system reliable. This project is aimed at performing these studies. The main objective into the project is to develop reliable models suitable for studying the implications of operating the Nordic grid with a large amount of energy and power coming from wind farms.

Department of Electrical Engineering
EcoGrid DK: 50% wind power in the Danish Electric Power System
The object of the EcoGrid.dk research programme is to develop new long term technologies and market solutions for power systems with an increased share of distributed generation and renewable energy sources while maintaining the reliability of supply. The programme will focus on the identification and evaluation of new architectures and structures for the power system and development of new solutions for enhanced customer participation and pioneering concepts of system control and operation. The EcoGrid programme will cover research and development activities within related areas, and the programme will initiate and coordinate these activities. EcoGrid.dk will look for global solutions with reference to the Danish power system and the new Danish energy policy the objective of which is at least 30% renewable energy in the overall energy system in 2025, and indications that wind power can cover 50% of electricity demand in 2025.

Department of Electrical Engineering

Centre for Electric Technology

Chalmers University of Technology

SINTEF

VTT - Technical Research Centre of Finland

Tallinn University of Technology

Period: 01/05/2007 → 01/07/2008
Number of participants: 13

Wind power, electric power system, architectures, market, measures

Acronym: EcoGrid

Project ID: 55486

Project participant:
Nyeng, Preben (Intern)
Xu, Zhao (Intern)
Chandrashekhara, Divya K (Intern)
Poulsen, Bjarne (Intern)
Horstmann, Jørgen Peter Frederik (Intern)
Chen, Yu (Intern)
Jóhannsson, Hjörtur (Intern)
Saleem, Arshad (Intern)
You, Shi (Intern)
Garcia-Valle, Rodrigo (Intern)
Vlachogiannis, Ioannis (John) (Intern)

Project Manager, organisational:
Østergaard, Jacob (Intern)

Financing sources

Source: Forsk. Andre offentlige og private - Nordiske
Amount: 960,000.00 Danish Kroner

Project
New Strategies for Feedback Suppression in Hearing Instruments
Department of Electrical Engineering
Period: 01/05/2007 → 01/09/2010
Number of participants: 7
Phd Student:
Guilin, Ma (Intern)
Supervisor:
Agerkvist, Finn T. (Intern)
Gran, Fredrik (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Buchholz, Jörg (Intern)
Kates, James M. (Ekstern)
Rubak, Per (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Nonlinear Methods for Spacecraft Orbit Control using an Electrodynamic Tether
Department of Electrical Engineering
Period: 01/05/2007 → 30/09/2010
Number of participants: 5
Phd Student:
Larsen, Martin Birkelund (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Santos, Ilmar (Intern)
Ortega, Romeo (Ekstern)
Wisniewski, Rafal (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Development of PMU-based early Warning Detection System for the Electric Power System
Department of Electrical Engineering
Period: 01/04/2007 → 24/08/2011
Number of participants: 6
Phd Student:
Jóhannsson, Hjörtur (Intern)
Supervisor:
Østergaard, Jacob (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Bruun, Erik (Intern)
Andersson, Göran (Ekstern)
Kundur, Prabha S. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

**Fault Diagnosis for Identification of Deviant Behavior**
Department of Electrical Engineering
Period: 01/04/2007 → 22/06/2011
Number of participants: 7
Phd Student:
Jónsson, Ragnar Ingi (Intern)
Supervisor:
Højsgaard, Søren (Ekstern)
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Madsen, Henrik (Ekstern)
Gustafsson, Fredrik (Ekstern)
Mol, Rudolfus M. de (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

**Future Network and information architecture in electric power systems with ditributed generation**
Department of Electrical Engineering
Period: 01/04/2007 → 24/11/2010
Number of participants: 6
Phd Student:
Chen, Yu (Intern)
Supervisor:
Xu, Zhao (Intern)
Main Supervisor:
Østergaard, Jacob (Intern)
Examiner:
Nielsen, Arne Hejde (Intern)
Hatzigiroyiou, Nikos (Ekstern)
Samuelsson, Olof (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

**Improvement of out-of-band Behaviour in Switch Mode Amplifiers and Power Supplies by their Modulation Topology**
Department of Electrical Engineering
Period: 01/04/2007 → 29/09/2010
Number of participants: 6
Phd Student:
Knott, Arnold (Intern)
Supervisor:
Pfaffinger, Gerhard (Ekstern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
**Examiner:**
Kjærgaard, Claus (Ekstern)
Kyyrä, Jorma (Ekstern)
Petersen, Lars Press (Intern)

**Financing sources**
-
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**PhD on Implementation Problems Pertaining to use of very high Voltage AC Cables in Transmission Systems**

Department of Electrical Engineering
Period: 01/04/2007 → 30/09/2008
Number of participants: 2
Phd Student:
Rahimi, Saeed (Intern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)

**Financing sources**
-
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

**Agent Based Control of Electric Power Systems with Distributed Energy Resources**

Department of Electrical Engineering
Period: 15/03/2007 → 21/12/2010
Number of participants: 5
Phd Student:
Saleem, Arshad (Intern)
Main Supervisor:
Lind, Morten (Intern)
Examiner:
Østergaard, Jacob (Intern)
Almeida do Vale, Zita Maria (Ekstern)
McArthur, Stephen (Ekstern)

**Financing sources**
-
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

**Agentbaserede styringsstrukturer i elsystemer med betydelig decentral produktion : PSO-projekt**

Department of Electrical Engineering
Wind Energy Division
Risø National Laboratory for Sustainable Energy
Centre for Electric Technology
Syd Energi, Syd Energi Net A/S,
NESA A/S
Period: 01/03/2007 → 31/03/2010
Number of participants: 6
Project ID: 55388
Project participant:
Nielsen, Arne Hejde (Intern)
Saleem, Arshad (Intern)
Bindner, Henrik W. (Intern)
Andreasen, Jacob (Ekstern)
Nielsen, Lars Bai (Ekstern)
Project Manager, organisational:
Lind, Morten (Intern)

**Financing sources**
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 2,003,000.00 Danish Kroner

**Sensorbaseret overvågning i byggeriet**
Department of Electrical Engineering
Alexandra Instituttet A/S
Lund University
Sensor Technology Center A/S
Statens Byggeforskningsinstitut
Teknologisk Institut
Aarhus University
Arbejdernes Andels Boligforening
Develco A/S
Expan A/S
Femern A/S
KPC Byg
Forsikring & Pension
Mjølner Informatics A/S
Rambøll Danmark A/S
Betonelement
Tempress A/S
Vejdirektoratet
Period: 01/03/2007 → 31/12/2010
Number of participants: 1
Acronym: SensoByg
Project Manager, organisational:
Jakobsen, Kaj Bjarne (Intern)

**Financing sources**
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 27,020,600.00 Danish Kroner

**Investigating the Auditory Mechanisms Underlying the Enhancement of Speech Intelligibility by early Reflections**
Department of Electrical Engineering
Period: 15/01/2007 → 01/09/2010
Number of participants: 5
Phd Student:
Favrot, Sylvain Emmanuel (Intern)
Supervisor:

Coherent Energy and Environmental System Analysis
Department of Electrical Engineering  
Period: 01/01/2007 → 22/09/2010  
Number of participants: 6  
Phd Student:  
Sørensen, Thomas Kjærsgaard (Intern)  
Supervisor:  
Mikkelsen, Seren Damsgaard (Ekstern)  
Main Supervisor:  
Holbøll, Joachim (Intern)  
Examiner:  
Træholt, Chresten (Intern)  
Heidalen, Hans Kristian (Ekstern)  
Sørensen (fratrådt), Troels (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Ansat eksternt  
Project: PhD

Adaptiv Fokusering i Medicinsk Ultralyd  
Department of Electrical Engineering  
Period: 01/12/2006 → 26/05/2010  
Number of participants: 6  
Phd Student:  
Voxen, Iben Holfort (Intern)  
Supervisor:  
Gran, Fredrik (Intern)  
Main Supervisor:  
Jensen, Jørgen Arendt (Intern)  
Examiner:  
Sørensen, Helge Bjarup Dissing (Intern)  
Nikolov, Svetoslav (Intern)  
Walker, William F. (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: DTU, Samfinansiering

Relations  
Publications:  
Adaptive Beamforming for Medical Ultrasound Imaging  
Project: PhD

Characterising temporal nonlinear processes in the human cochlea using otoacoustic emissions  
Department of Electrical Engineering  
Period: 01/12/2006 → 01/09/2010  
Number of participants: 6  
Phd Student:  
Verhulst, Sarah (Intern)  
Supervisor:  
Harte, James (Intern)  
Main Supervisor:  
Dau, Torsten (Intern)  
Examiner:  
Buchholz, Jörg (Intern)  
Kemp, David Thomas (Ekstern)
Non-invasive characterization of stored silage by acoustic means

Department of Electrical Engineering
Period: 01/12/2006 → 31/10/2007
Number of participants: 4
Phd Student:
Green, Ole (Intern)
Supervisor:
Ohlrich, Mogens (Intern)
Segaard, Henning Tangen (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)

Objective assessment of audio quality of hearing aid processed sound using an auditory processing model

Department of Electrical Engineering
Period: 15/10/2006 → 30/06/2010
Number of participants: 7
Phd Student:
Jepsen, Morten Løve (Intern)
Supervisor:
Bramsløw, Lars (Ekstern)
Pedersen, Michael Syskind (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Poulsen, Torben (Intern)
Kollmeier, Birger (Ekstern)
Meddis, Raymond (Ekstern)

Seizure Prediction

Department of Electrical Engineering
Period: 01/10/2006 → 01/10/2006
Number of participants: 2
Phd Student:
Yu, Xin (Ekstern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)
Fault-tolerant Guidance for Precision Farming using 2D/3D Vision and Computer-Based Learning

Department of Electrical Engineering
Period: 01/09/2006 → 30/06/2010
Number of participants: 6
Phd Student:
Blas, Morten Rufus (Intern)
Supervisor:
Madsen, Tommy Ertbølle (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Lind, Morten (Intern)
Christensen, Henrik Iskov (Ekstern)
Schilling, Klaus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Modular opbygning af effektelektroniske konvertere med galvanisk isolering i effektrådet 1-10kW

Department of Electrical Engineering
Period: 01/09/2006 → 22/09/2010
Number of participants: 5
Phd Student:
Nymand, Morten (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Thomsen, Ole Cornelius (Intern)
Kolar, Johann Walter (Ekstern)
Smedley, Keyue (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Autonomous Supervision and Control to Prevent Parametric Resonance

Department of Electrical Engineering
Period: 01/08/2006 → 03/03/2010
Number of participants: 6
Phd Student:
Galeazzi, Roberto (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Blanke, Mogens (Intern)
Examiner:
Santos, Ilmar (Intern)
Kinnaert, Michel (Ekstern)
Nijmeijer, Henk (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Achieving Channel QoS and Security with a Software Defined Radio

An increasing number of applications require a specific level of QoS on the communication channel and at the same time the fulfilment of some security demands. An example is VoIP that might require at least 100 kbps bandwidth, at most 200 msec delay, and encryption (and/or hiding) of the package stream. Furthermore for example at most 10% of data/packages can be allowed lost or vanished due to noise or DoS attack. In our project we are working on a software defined radio platform (GNU radio) for the reason that we want to look into how the flexibility of a software defined radio can help us in achieving specific QoS and security demands needed by typical applications. The setup is simple and consists of two computing devices connected to software defined radios. The devices are running applications that require package streams over the air. A third computing device connected to a third software defined radio is the adversary that can carry out any kind of attacks – especially it can carry out DoS attacks by generating noise.
Denial of Service Prevention for 5G

Project

Hearing aid Amplification at Soft Input Levels

Department of Electrical Engineering
Period: 01/07/2006 → 03/03/2010
Number of participants: 6
Phd Student:
Connor, Helen (Intern)
Supervisor:
Ludwigsen, Carls (Ekstern)
Main Supervisor:
Poulsen, Torben (Intern)
Examiner:
Buchholz, Jörg (Intern)
Holube, Inga (Ekstern)
Larsby, Hanna Birgitta (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Sporingsteknologiske Person og Operatør Services

Department of Electrical Engineering
Risø National Laboratory for Sustainable Energy
IT University of Copenhagen
Alexandra Institutet A/S
GfK Danmark A/S
BLIP Systems A/S
København Lufthavne A/S
Lyngsoe Systems A/S
Period: 01/07/2006 → 31/12/2009
Number of participants: 1
Acronym: SPOPOS
Project Manager, organisational:
Jakobsen, Kaj Bjarne (Intern)

Financial sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 6,598,800.00 Danish Kroner
Project

3D Synthetic Aperture Imaging and Implementation

Department of Electrical Engineering
Period: 01/05/2006 → 23/09/2009
Number of participants: 7
Phd Student:
Andresen, Henrik Stenby (Intern)
Supervisor:
Jensen, Henrik (Ekstern)
Nikolov, Svetoslav (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Wilhjelm, Jens E. (Intern)
Stepinski, Tadeusz (Ekstern)
Torp, Hans (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Synthetic Aperture Beamforming in Ultrasound using Moving Arrays.
Project: PhD

Advanced use of phasor measurement units in the Danish electric power system

Department of Electrical Engineering
Centre for Electric Technology
Energinet.dk
Period: 01/05/2006 → 31/12/2007
Number of participants: 5
Phasor, Measurement, Units
Acronym: PMU_ENDK
Project ID: 55402
Project participant:
Pedersen, Knud Ole Helgesen (Intern)
Andersen, Erik (Intern)
Østergaard, Jacob (Intern)
Project Manager, organisational:
Nielsen, Arne Hejde (Intern)
Strunge, Carsten (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 774,000.00 Danish Kroner
Project

Highly Compact Radar Circuits Utilizing LTCC Technology

Department of Electrical Engineering
Period: 01/05/2006 → 24/11/2010
Number of participants: 6
Phd Student:
Jensen, Thomas (Intern)
Supervisor:
Pedersen, Peder R. (Ekstern)
Main Supervisor:
Krozer, Viktor (Intern)
Examiner:
Kjærgaard, Claus (Ekstern)
Gevorgian, Spartak (Ekstern)
Jacob, Arne F. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD
Non-invasive in-vivo Spatial Pressure Measurement in Real Time

Department of Electrical Engineering
Number of participants: 5
Phd Student: Andersen, Klaus Scheldrup (Intern)
Main Supervisor: Jensen, Jørgen Arendt (Intern)
Examiner: Ferkinghøff-Borg, Jesper (Intern)
Hoff, Lars (Ekstern)
Jansson, Tomas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

Relations
Publications:
Non-invasive ambient pressure estimation using non-linear ultrasound contrast agents
Project: PhD

Millimeter-Wave Integrated Circuits for Systems in Package

Department of Electrical Engineering
Period: 01/02/2006 → 18/11/2009
Number of participants: 5
Phd Student: Jiang, Chenhui (Intern)
Supervisor: Johansen, Tom Keinicke (Intern)
Main Supervisor: Krozer, Viktor (Intern)
Examiner: Berger, Michael Stübert (Intern)
Keil, Ulrich Dieter Felix (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Electricity Demand As Frequency Controlled Reserve
This project studies the potentials for using frequency controlled demand as reserves in the Danish electricity system. The aim is to give practical recommendations for an efficient and safe use of demand as frequency controlled reserves. The basis for the recommendation will be analysis of potential and alternative designs.

Department of Electrical Engineering
Centre for Electric Technology
EA Energianalyse A/S
Period: 01/01/2006 → 31/12/2007
Number of participants: 3
Electric power system, Demand, Frequency control
Acronym: DFR
Project participant: Xu, Zhao (Intern)
Togeby, Mikael (Ekstern)
Project Manager, organisational:
Östergaard, Jacob (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 1,919,000.00 Danish Kroner
Project

Ultra-fast Tracking Power Converters for RF power Amplifiers
Department of Electrical Engineering
Period: 01/01/2006 → 24/03/2010
Number of participants: 6
Phd Student:
Høyerby, Mikkel Christian Kofod (Intern)
Supervisor:
Larsen, Anders (Ekstern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Johansen, Tom Keinicke (Intern)
Maksimovic, Dragan (Ekstern)
Wolf, Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Characterizing binaural processing of amplitude modulated sounds.
Department of Electrical Engineering
Number of participants: 4
Phd Student:
Thompson, Eric Robert (Intern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Akeroyd, Michael A. (Ekstern)
Kohrausch, Armin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Perceptual Consequences of Impaired Auditory Signal Processing in Complex Acoustical Environments
Department of Electrical Engineering
Period: 15/10/2005 → 24/06/2009
Number of participants: 6
Phd Student:
Strelcyk, Olaf (Intern)
Supervisor:
Naylor, Graham (Ekstern)
Main Supervisor:
Dau, Torsten (Intern)
Examiner:
Poulsen, Torben (Intern)
Krumbholz, Katrin (Ekstern)
Moore, Brian C.J (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

**Maintenance Free and Sustainable High-Level Control in Cement and Mining Industry**

Department of Electrical Engineering
Period: 01/10/2005 → 26/08/2009
Number of participants: 7
Phd Student:
Hansen, Ole Fink (Intern)
Supervisor:
Ravn, Ole (Intern)
Recke, Bodil (Intern)
Main Supervisor:
Andersen, Nils Axel (Intern)
Examiner:
Lind, Morten (Intern)
Andersen, Karsten Hvalkof (Intern)
Gustavsson, Rune (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Microwave and Millimeter-Wave Signal Power Generation**

Department of Electrical Engineering
Period: 01/10/2005 → 24/06/2009
Number of participants: 6
Phd Student:
Hadziabdic, Dzenan (Intern)
Supervisor:
Vidkjær, Jens (Intern)
Main Supervisor:
Krozer, Viktor (Intern)
Examiner:
Tafur Monroy, Idelfonso (Intern)
Rahkonen, Timo Erkki (Ekstern)
Zirath, Herbert (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Design of Microwave Camera for Breast Cancer Detection**

Department of Electrical Engineering
Period: 01/09/2005 → 23/12/2008
Number of participants: 6
Phd Student:
Zhurbenko, Vitaliy (Intern)
Supervisor:
Meincke, Peter (Intern)
Main Supervisor:
Krozer, Viktor (Intern)
Minimering af vibro-akustik i tilbagekobling (feedback) i høreapparater

Department of Electrical Engineering
Period: 01/07/2005 → 20/05/2009
Number of participants: 6
Phd Student:
Friis, Lars (Intern)
Supervisor:
Jacobsen, Finn (Intern)
Jensen, Lars Bækgaard (Ekstern)
Main Supervisor:
Ohlrich, Mogens (Intern)
Examiner:
Agerkvist, Finn T. (Intern)
Carcaterra, Antonio (Ekstern)

New Technology-Driven Approaches in the Design of Preamplifiers for Condenser Microphones

Department of Electrical Engineering
Period: 01/07/2005 → 19/08/2009
Number of participants: 8
Phd Student:
Haas-Christensen, Jelena (Intern)
Supervisor:
Andreani, Pietro (Intern)
Rombach, Pirmin (Intern)
Stenberg, Lars Jørn (Ekstern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Andersen, Michael A. E. (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Wisland, Dag T. (Ekstern)

Transiente Forhold i Elproduktionsanlæg - Påvirkning og Konsekvens

Department of Electrical Engineering
Period: 01/07/2005 → 03/03/2010
Number of participants: 7
Phd Student:
**Multi-Resolution Spectrotemporal Analysis of Complex Sounds in the Human Auditory System**

Department of Electrical Engineering  
Period: 01/05/2005 → 18/11/2009  
Number of participants: 6  
Phd Student:  
Piechowiak, Tobias (Intern)  
Supervisor:  
Ewert, Stephan (Intern)  
Main Supervisor:  
Dau, Torsten (Intern)  
Examiner:  
Poulsen, Torben (Intern)  
Par, Steven van de (Ekstern)  
Verhey, Jesko L. (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Ansat eksternt  
Project: PhD

**Assessment of speech intelligibility in background noise and reverberation**

Department of Electrical Engineering  
Period: 01/03/2005 → 21/12/2009  
Number of participants: 5  
Phd Student:  
Nielsen, Jens Bo (Intern)  
Main Supervisor:  
Dau, Torsten (Intern)  
Examiner:  
Poulsen, Torben (Intern)  
Hagerman, Björn (Ekstern)  
Laukli, Einar (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Brystkærfte screening ved brug af mikrobølger**

Department of Electrical Engineering
Period: 01/01/2005 → 24/06/2008  
Number of participants: 5  
Phd Student: Rubæk, Tonny (Intern)  
Main Supervisor: Meincke, Peter (Intern)  
Examiner: Hansen, Per Christian (Intern)  
Rappaport, Carey M. (Ekstern)  
Van den Berg, Peter M. (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD

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**Implementation of Synthetic Aperture Imaging**  
Department of Electrical Engineering  
Period: 01/01/2005 → 29/05/2008  
Number of participants: 7  
Phd Student: Kortbek, Jacob (Intern)  
Supervisor: Gammelmark, Kim (Intern)  
Jørgensen, Michael Ø. (Ekstern)  
Main Supervisor: Jensen, Jørgen Arendt (Intern)  
Examiner: Sams, Thomas (Intern)  
Hald, Jørgen (Ekstern)  
Holm, Sverre (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU

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**Relations**

Publications:  
Synthetic Aperture Sequential Beamforming and other Beamforming Techniques in Ultrasound Imaging  
Project: PhD

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**Synthetic Aperture Vector Flow Imaging**  
Department of Electrical Engineering  
Period: 01/01/2005 → 30/04/2008  
Number of participants: 5  
Phd Student: Oddershede, Niels (Intern)  
Main Supervisor: Jensen, Jørgen Arendt (Intern)  
Examiner: Sørensen, Helge Bjarup Dissing (Intern)  
Andersen, Jens Damgaard (Ekstern)  
Hoeks, Arnoldus P. G. (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering

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**Relations**
Publications:
Synthetic Aperture Vector Flow Imaging
Project: PhD

**Low Power Adaptive Beamforming**
Department of Electrical Engineering
Period: 15/12/2004 → 31/10/2006
Number of participants: 3
Phd Student:
Jensen, Mikael (Intern)
Supervisor:
Tuohy, Aidan (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Lidar for Wind Measurements**
Department of Electrical Engineering
Period: 01/11/2004 → 25/03/2008
Number of participants: 8
Phd Student:
Lindelöw, Per Jonas Petter (Intern)
Supervisor:
Christensen, Erik Lintz (Intern)
Feuchter, Thomas (Intern)
Peucheret, Christophe (Intern)
Main Supervisor:
Mohr, Johan Jacob (Intern)
Examiner:
Mann, Jakob (Ekstern)
Cariou, Jean-Pierre (Ekstern)
Svanberg, Sune Roland (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

**Antenna Diagnostics for Spherical Near-Field Antenna Measurements**
Department of Electrical Engineering
Period: 01/10/2004 → 29/01/2008
Number of participants: 6
Phd Student:
Cappellin, Cecilia (Intern)
Supervisor:
Frandsen, Aksel (Ekstern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Kristensson, Gerhard (Ekstern)
Castaner, Manuel Sierra (Ekstern)
Yaghjian, Arthur D. (Ekstern)
**High performance low cost digital controlled power conversion technology**

Department of Electrical Engineering  
**Period:** 01/10/2004 → 29/08/2008  
**Number of participants:** 8  
**PhD Student:**  
Jakobsen, Lars Tønnes (Intern)  
**Supervisor:**  
Niemann, Hans Henrik (Intern)  
Thomsen, Ole Cornelius (Intern)  
Tøttrup, Peter (Ekstern)  
**Main Supervisor:**  
Andersen, Michael A. E. (Intern)  
**Examiner:**  
Sparsø, Jens (Intern)  
Arefeen, Mohammed (Ekstern)  
Nelms, R. Mark (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**Signal Processing in the human auditory system: Auditory-evoked Brain Responses as a Correlate of Hearing Function**

Department of Electrical Engineering  
**Period:** 01/10/2004 → 23/12/2008  
**Number of participants:** 6  
**PhD Student:**  
Pigasse, Gilles (Intern)  
**Supervisor:**  
Harte, James (Intern)  
**Main Supervisor:**  
Dau, Torsten (Intern)  
**Examiner:**  
Poulsen, Torben (Intern)  
Lutman, Mark Edward (Ekstern)  
Stenfelt, Stefan (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: InnovationsPhD  
Project: PhD

**Power System Operation and Control for Integration of Large Scale of Wind Energy**

Department of Electrical Engineering  
**Period:** 01/09/2004 → 29/01/2008  
**Number of participants:** 7  
**PhD Student:**  
Lund, Torsten (Intern)  
**Supervisor:**  
Lund, Per (Intern)  
Serensen, Poul Ejnar (Intern)  
**Main Supervisor:**  

Methods for stability and Noise Analysis of Coupled Oscillating Systems

Department of Electrical Engineering
Period: 01/07/2004 → 24/06/2008
Number of participants: 6
Phd Student:
Djurhuus, Torsten (Intern)
Supervisor:
Vidkjær, Jens (Intern)
Main Supervisor:
Krozer, Viktor (Intern)
Examiner:
Mørk, Jesper (Intern)
Leuzzi, Giorgio (Ekstern)
Quéré, Raymond (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

Elektronisk Styrbare Antennesystemer til Satellitkommunikation

Department of Electrical Engineering
Period: 01/06/2004 → 29/10/2007
Number of participants: 6
Phd Student:
Larsen, Niels Vesterdal (Intern)
Supervisor:
Gothelf, Ulrich (Ekstern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Viskum, Hans-Henrik (Ekstern)
Kabacik, Pawel (Ekstern)
Østergaard, Erik Allan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret
Project: PhD

Meta-materialer i antenne-teknik til trådløs kommunikation

Department of Electrical Engineering
Period: 15/03/2004 → 03/09/2007
Number of participants: 5
Phd Student:
Arslanagic, Samel (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Mørk, Jesper (Intern)
Mosig, Juan R. (Ekstern)
Nosich, Alexander I. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Kritiske spændingsfordelinger i store vindmøllers tørtransformatorer under transiente påvirkninger

Department of Electrical Engineering
Period: 01/02/2004 → 03/09/2007
Number of participants: 8
Phd Student:
Pedersen, Kenneth (Intern)
Supervisor:
Henriksen, Mogens (Intern)
Jensen, Asger (Ekstern)
Koldby, Erik (Intern)
Rasmussen, Carsten (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Østergaard, Jacob (Intern)
Støvring-Hallsson, Søren (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Electrical-Domain Equalization Techniques for Optical Transmission Systems

Department of Electrical Engineering
Period: 01/01/2004 → 31/07/2006
Number of participants: 3
Phd Student:
Hansen, Kristian Adelbert (Intern)
Supervisor:
Lobel, Martin (Ekstern)
Main Supervisor:
Andreani, Pietro (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Acoustical Description of Perceptually Salient Features in Everyday Sounds

Department of Electrical Engineering
Period: 01/10/2003 → 30/04/2007
Number of participants: 6
Phd Student:
Kirkwood, Brent Christopher (Intern)
Supervisor:
Naylor, Graham (Ekstern)
Integrated Circuit Design of Switching Power Stages for Audio Power Amplification

Department of Electrical Engineering
Period: 01/08/2003 → 30/01/2007
Number of participants: 6
Phd Student: Nyboe, Flemming (Intern)
Supervisor: Risbo, Lars (Intern)
Main Supervisor: Andreani, Pietro (Intern)
Examiner: Andersen, Michael A. E. (Intern)
Berkhout, Marco (Ekstern)
Svensson, Lars (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Data Converters

Department of Electrical Engineering
Period: 01/07/2003 → 16/03/2007
Number of participants: 6
Phd Student: Wismar, Ulrik Sørensen (Intern)
Supervisor: Bruun, Erik (Intern)
Main Supervisor: Andreani, Pietro (Intern)
Examiner: Hansen, Ole (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Malcovsti, Piero (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Menneske-maskine samarbejde i distribuerede automatiseringssystemer

Department of Electrical Engineering
Period: 01/07/2003 → 30/03/2007
Number of participants: 7
Phd Student: Olsen, Mikkel Holm (Intern)
Data Convertes eith Adaptive Digital Error Correction

Department of Electrical Engineering
Period: 01/06/2003 → 30/01/2007
Number of participants: 4
Phd Student:
Vandi, Luca (Intern)
Main Supervisor:
Andreani, Pietro (Intern)
Examiner:
Bruun, Erik (Intern)
Samori, Carlo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Høreapparaters lydgengivelse ved kraftige lydniveauer,og betydningen af denne for brugerens taleforståelse og oplevelse af lyttekomfort.

Department of Electrical Engineering
Period: 01/05/2003 → 02/01/2007
Number of participants: 6
Phd Student:
Schmidt, Erik (Intern)
Supervisor:
Ludwigsen, Carls (Ekstern)
Main Supervisor:
Poulsen, Torben (Intern)
Examiner:
Arlinger, Stig (Ekstern)
Holube, Inga (Ekstern)
Neuman, Arlene C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Navigationssystemer til mobile robotter

Department of Electrical Engineering
Period: 15/03/2003 → 02/01/2007
Number of participants: 6
Phd Student:
Andersen, Jens Christian (Intern)
Supervisor:
Andersen, Nils Axel (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)
Christensen, Henrik Iskov (Ekstern)
Henriksen, Lars (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Elektriske Udladningers Interaktion med Vindmøllematerialer - Specielt i Relation til Lynbeskyttelse

Department of Electrical Engineering
Period: 01/03/2003 → 02/01/2007
Number of participants: 9
Phd Student:
Madsen, Søren Find (Intern)
Supervisor:
Bjært, Niels (Ekstern)
Henriksen, Mogens (Intern)
Jørgensen, Hans Jørgen (Ekstern)
Sørensen (fratrådt), Troels (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Nielsen, Arne Hejde (Intern)
Gockenbach, Ernst (Ekstern)
Sørensen, Freddy (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Fluxdynamik i Højtemperatur Superleder

Department of Electrical Engineering
Period: 01/01/2003 → 28/04/2006
Number of participants: 7
Phd Student:
Madsen, Søren Peder (Intern)
Supervisor:
Tønnesen, Ole (Intern)
Christiansen, Peter Leth (Intern)
Main Supervisor:
Pedersen, Niels Falsig (Intern)
Examiner:
Sørensen, Mads Peter (Intern)
Hedegård, Per (Ekstern)
Ustinov, Alexey V. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Intelligent Behandling af Sensoroutput
Department of Electrical Engineering
Period: 01/01/2003 → 31/05/2004
Number of participants: 3
Phd Student:
Arrøe, Skjalm Rosenkjær (Intern)
Supervisor:
Larsen, Rasmus (Intern)
Main Supervisor:
Andersen, Nils Axel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

SICAM - Single Conversion Stage AMplifier
Department of Electrical Engineering
Number of participants: 6
Phd Student:
Ljusev, Petar (Intern)
Supervisor:
Petersen, Lars Press (Intern)
Main Supervisor:
Andersen, Michael A. E. (Intern)
Examiner:
Wolf, Christian (Intern)
Maksimovic, Dragan (Ekstern)
Vanderkooy, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Estimation of Transverse Blood Flow using Ultrasound
Department of Electrical Engineering
Period: 01/11/2002 → 31/05/2006
Number of participants: 6
Phd Student:
Udesen, Jesper (Intern)
Supervisor:
Jørgensen, Michael Ø. (Ekstern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Wilhjelm, Jens E. (Intern)
Andersen, Jens Damgaard (Ekstern)
Torp, Hans (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
2-D blood vector velocity estimation using a phase shift estimator

**Elektromagnetisk Modellering af Jordradarantenner**

Department of Electrical Engineering  
Number of participants: 5  
PhD Student: Lenler-Eriksen, Hans-Rudolph (Intern)  
Main Supervisor: Meincke, Peter (Intern)  
Examiner: Hansen, Thorkild B. (Ekstern)  
Daniels, David J. (Ekstern)  
Eide, Egil Sverre (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Fejltolerant Regulering med Anvendelser indenfor Rumfart**

Department of Electrical Engineering  
Period: 01/09/2002 → 30/09/2003  
Number of participants: 3  
PhD Student: Ziegler, Bent Lindvig (Intern)  
Supervisor: Niemann, Hans Henrik (Intern)  
Main Supervisor: Blanke, Mogens (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

**Ultrasound flow imaging using coded signals**

Department of Electrical Engineering  
Period: 01/07/2002 → 23/12/2005  
Number of participants: 5  
PhD Student: Gran, Fredrik (Intern)  
Main Supervisor: Jensen, Jørgen Arendt (Intern)  
Examiner: Sørensen, Helge Bjarup Dissing (Intern)  
Stage, Bjame (Intern)  
Sörnmo, Leif (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD

**SAR til småfly**

Department of Electrical Engineering
Period: 01/04/2002 → 06/09/2006
Number of participants: 6
Phd Student: Kusk, Anders (Intern)
Supervisor: Christensen, Erik Lintz (Intern)
Main Supervisor: Dall, Jørgen (Intern)
Examiner: Mohr, Johan Jacob (Intern)
Gustavsson, Anders (Ekstern)
Madsen, Søren Nervang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-ønnet stipendie
Project: PhD

Akustisk Identifikation af Søminer
Department of Electrical Engineering
Period: 01/03/2002 → 30/03/2007
Number of participants: 7
Phd Student: Wendelboe, Gorm (Intern)
Supervisor: Damsgaard, Bjarne (Ekstern)
Jacobsen, Finn (Intern)
Main Supervisor: Sørensen, Helge Bjarup Dissing (Intern)
Examiner: Agerkvist, Finn T. (Intern)
Juhl, Peter Møller (Intern)
Lyons, Anthony P. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden sektorministeriel finans
Project: PhD

Optisk Identifikation af søminer
Department of Electrical Engineering
Period: 01/02/2002 → 29/08/2005
Number of participants: 7
Phd Student: Busck, Jens (Intern)
Supervisor: Caspersen, Mogens (Intern)
Heiselberg, Henning (Intern)
Main Supervisor: Sørensen, Helge Bjarup Dissing (Intern)
Examiner: Jakobsen, Kaj Bjarne (Intern)
Steinvall, Kurt Ove (Ekstern)
Wang, Gunnar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden sektorministeriel finans
Project: PhD
Havis i det Arktiske Ocean en sammenligning mellem satellit observationer og model beregninger

Department of Electrical Engineering
Period: 01/01/2002 → 25/11/2005
Number of participants: 6
Phd Student: Lübcke, Mikael (Intern)
Supervisor: Reeh, Niels (Intern)
Main Supervisor: Pedersen, Leif Toudal (Intern)
Examiner: Mohr, Johan Jacob (Intern)
Bøggild, Carl Egede (Ekstern)
Laxon, Seymour (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Investigation of System Protection Schemes for the Transmission Network in Eastern Denmark

Department of Electrical Engineering
Period: 01/01/2002 → 20/03/2006
Number of participants: 8
Phd Student: Rasmussen, Joana (Intern)
Supervisor: Havsager, Jan (Ekstern)
Jørgensen, Preben (Ekstern)
Rønne-Hansen, Jan (Intern)
Main Supervisor: Nielsen, Arne Hejde (Intern)
Examiner: Lind, Morten (Intern)
Holen, Arne T. (Ekstern)
Karlsson, Daniel H. W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

RF Front-end Architecture

Department of Electrical Engineering
Period: 01/01/2002 → 21/04/2005
Number of participants: 5
Phd Student: Wang, Xiaoyan (Intern)
Main Supervisor: Andreani, Pietro (Intern)
Examiner: Bruun, Erik (Intern)
Christensen, Kåre Tais (Intern)
Grasset, Jean-Charles (Ekstern)

Financing sources
Active Noise Cancellation Headset

Department of Electrical Engineering
Period: 01/09/2001 → 24/11/2008
Number of participants: 6
PhD Student:
Elmkjær, Torsten Haaber Leth (Intern)
Supervisor:
Sjöström, Svend Olof (Ekstern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Laugesen, Søren (Intern)
Jensen, Søren Holdt (Intern)
Rafaely, Boaz (Ekstern)

Coordinated Control of Different Components in the AC Network when Connecting Non-dispatchable Generation

Department of Electrical Engineering
Period: 01/09/2001 → 15/01/2007
Number of participants: 8
PhD Student:
Johnsen, Kim (Intern)
Supervisor:
Eliasson, Bo (Ekstern)
Falster, Peter (Intern)
Lindahl, Sture O.R. (Ekstern)
Main Supervisor:
Nielsen, Arne Hejde (Intern)
Examiner:
Pedersen, Knud Ole Helgesen (Intern)
Støvring-Hallsson, Søren (Ekstern)
Thiringer, Erik T. V. (Ekstern)

Design and Implementation of Algorithms for Improving Synthetic Aperture Ultrasound Images

Department of Electrical Engineering
Period: 01/09/2001 → 21/12/2004
Number of participants: 6
PhD Student:
Gammelmark, Kim (Intern)
Supervisor:
Dall, Jørgen (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)
Stage, Bjarne (Intern)
Steptinski, Tadeusz (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

**Relations**
Publications:
Improving the Image Quality of Synthetic Transmit Aperture Ultrasound Images - Achieving Real-Time In-Vivo Imaging
Project: PhD

**Designmetoder for high-speed, high-resolution digital imaging**
Department of Electrical Engineering
Period: 01/09/2001 → 16/05/2005
Number of participants: 6
Phd Student:
Allin, Thomas Højgaard (Intern)
Supervisor:
Neubert, Torsten (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Brauer, Peter (Intern)
Birger, Niss (Ekstern)
Mende, Stephen B. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Motion Compensation Techniques for Aerospace**
Department of Electrical Engineering
Period: 01/09/2001 → 29/08/2005
Number of participants: 5
Phd Student:
Denver, Troelz (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Brauer, Peter (Intern)
Birger, Niss (Ekstern)
Pickles, Andrew John (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

**Ikke-lineær Ultralyd Billedannelse**
Department of Electrical Engineering
Period: 01/08/2001 → 18/05/2006
Number of participants: 2
Phd Student:
Taylor, Louise Kold (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

ACT- Active Transducer
Department of Electrical Engineering
Period: 01/05/2001 → 12/02/2005
Number of participants: 5
Phd Student: Poulsen, Søren (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Hendricks, Elbert (Intern)
Frederiksen, Thomas Mansachs (Intern)
Veltman, André (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Frekvensdomænedetektion af ikke metalliske antipersonel miner
Department of Electrical Engineering
Period: 01/05/2001 → 29/08/2005
Number of participants: 7
Phd Student: Thaysen, Jesper (Intern)
Supervisor: Gram, Hans Erik (Intern)
Troelsen, Jens (Intern)
Main Supervisor: Jakobsen, Kaj Bjarne (Intern)
Examiner: Andersen, Jørgen Bach (Ekstern)
Bruun, Erik (Intern)
Vainikainen, Pertti (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Fejltolerante powersystemer
Department of Electrical Engineering
Period: 01/02/2001 → 27/07/2004
Number of participants: 5
Phd Student: Nesgaard, Carsten (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Niemann, Hans Henrik (Intern)
Nymand, Morten (Intern)
Weinberg, Simon Henry (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Low Power/Low Voltage Techniques for Analog CMOS Circuits**
Department of Electrical Engineering
Period: 01/01/2001 → 21/12/2004
Number of participants: 5
PhD Student:
Cassia, Marco (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Andreani, Pietro (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Larsen, Torben (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Avanceret polymer kabelisolation til HVDC**
Department of Electrical Engineering
Period: 01/12/2000 → …
Number of participants: 7
PhD Student:
Rasmussen, Claus Nygaard (Intern)
Supervisor:
Karthäuser, Joachim (Ekstern)
Henriksen, Mogens (Intern)
Main Supervisor:
Holbøll, Joachim (Intern)
Examiner:
Tønnesen, Ole (Intern)
Mikkelsen, Søren Damsgaard (Ekstern)
Montanari, Gian Carlo (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

**Compositional logic programming**
Logic programming is programming within certain fragments of logic. We advocate an operator form of logic which encourage compositional programming, and we examine theoretical and methodological aspects of the approach.

Department of Information Technology
Department of Electrical Engineering
Uppsala University
Period: 01/12/2000 → 01/01/9999
Number of participants: 2
Project participant:
Hamfelt, Andreas (Ekstern)
Project Manager, organisational:
Signal Processing in Humanitarian Demining
The aim is to investigate the possibilities for multisensor based system for detection and classification of burried landmines. The main focus is on signal and image processing techniques for improvement of Ground Penetrating Radar detection system

Department of Informatics and Mathematical Modeling
Biomedical Engineering
Department of Electrical Engineering

NDRF
Period: 01/11/2000 → 30/10/2003
Number of participants: 5
Project participant:
Jakobsen, Kaj Bjarne (Intern)
Karlsen, Brian (Intern)
Nymann, Ole (Ekstern)

Project Manager, organisational:
Hansen, Lars Kai (Intern)
Sørensen, Helge Bjarup Dissing (Intern)

Statistical signal processing in humanitarian demining systems
Department of Electrical Engineering
Number of participants: 2
Phd Student:
Karlsen, Brian (Intern)
Main Supervisor:
Sørensen, Helge Bjarup Dissing (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Benefit provide by improved High Frequency Audibility
Department of Electrical Engineering
Period: 01/10/2000 → 31/03/2004
Number of participants: 6
Phd Student:
Vestergaard, Martin David (Intern)
Supervisor:
Naylor, Graham (Ekstern)
Main Supervisor:
Poulsen, Torben (Intern)
Examiner:
Dau, Torsten (Intern)
Arlinger, Stig (Ekstern)
Gatehouse, Stuart (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt CAMP
Project: PhD
Adaptive Signal Processing
Department of Electrical Engineering
Number of participants: 6
Phd Student:
Lerchner, Alexander (Intern)
Supervisor:
Hertz, John (Ekstern)
Main Supervisor:
Bothe, Hans-Heinrich (Intern)
Examiner:
Bohr, Henrik (Intern)
Gerstner, Wulfram (Ekstern)
Lautrup, Benny (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

A model for the representation of speech signals in normal and impaired ears
Department of Electrical Engineering
Period: 01/08/2000 → 12/05/2004
Number of participants: 5
Phd Student:
Christiansen, Thomas Ulrich (Intern)
Main Supervisor:
Poulsen, Torben (Intern)
Examiner:
Henneberg, Kaj-Åge (Intern)
Christensen-Dalsgaard, Jakob (Intern)
Meddis, Raymond (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Task Oriented Display Design Based on Invariants and Physical Laws
Department of Electrical Engineering
Period: 01/06/2000 → 12/02/2005
Number of participants: 5
Phd Student:
Paulsen, Jette Lundtang (Intern)
Main Supervisor:
Lind, Morten (Intern)
Examiner:
Jørgensen, Sten Bay (Intern)
Andersen, Peter Begh (Intern)
Wieringa, Peter A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD
Effekteletroniske Styre- og omformersystemer til variabelt omløbstal vindmøllegenerator

Department of Electrical Engineering
Period: 01/04/2000 → 27/07/2004
Number of participants: 7
Phd Student:
Lindholm, Morten (Intern)
Supervisor:
Andersen, Kurt (Intern)
Pedersen, Jørgen Kaas (Intern)
Main Supervisor:
Rasmussen, Tonny Wederberg (Intern)
Examiner:
Undeland, Tore (Ekstern)
Jenkins, Nicholas (Ekstern)
Sørensen, Peter Løvstrøm (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Integral equation techniques for computational electromagnetics

Department of Electrical Engineering
Period: 01/04/2000 → 06/11/2003
Number of participants: 6
Phd Student:
Jørgensen, Erik (Intern)
Supervisor:
Meincke, Peter (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Hansen, Per Christian (Intern)
Aksun, M. Irsadi (Ekstern)
Kolundzija, Branko M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Digitalt system til SAR

Department of Electrical Engineering
Period: 01/03/2000 → 15/03/2004
Number of participants: 6
Phd Student:
Høeg, Flemming (Intern)
Supervisor:
Jørgensen, Jørn Hjelm (Intern)
Main Supervisor:
Christensen, Erik Lintz (Intern)
Examiner:
Skou, Niels (Intern)
Pedersen, Peder R. (Ekstern)
Østergaard, Erik Allan (Intern)

Financing sources
Source: Internal funding (public)
Power quality and stability issues of integration of large wind farms

Department of Electrical Engineering
Period: 01/03/2000 → 13/08/2003
Number of participants: 7
Phd Student: Rosas, Pedro Andrè Carvalho (Intern)
Supervisor: Bindner, Henrik W. (Intern)
Serensen, Poul Ejnar (Intern)
Main Supervisor: Nielsen, Arne Hejde (Intern)
Examiner: Lindahl, Sture O.R. (Ekstern)
Nielsen, John Eli (Intern)
Pedersen, Jørgen Kaas (Intern)

Financing sources
Source: Internal funding (public)

Energibesparende ensretter (ettrins konverter)

Department of Electrical Engineering
Period: 01/02/2000 → 12/01/2004
Number of participants: 5
Phd Student: Petersen, Lars Press (Intern)
Main Supervisor: Andersen, Michael A. E. (Intern)
Examiner: Wolf, Christian (Intern)
Kolar, Johann Walter (Ekstern)
Mohan, Ned (Ekstern)

Financing sources
Source: Internal funding (public)

Integreret bredbånds I/Q modulator/demodulator til SAR-system

Department of Electrical Engineering
Period: 01/02/2000 → 20/11/2003
Number of participants: 5
Phd Student: Johansen, Tom Keinicke (Intern)
Main Supervisor: Vidkjaer, Jens (Intern)
Examiner: Gaunholt, Hans (Intern)
Larsen, Torben (Ekstern)
Zirath, Herbert (Ekstern)

Financing sources
Source: Internal funding (public)
Dynamics and control of thrusters for ships and underwater vehicles
Dynamic effects were reported in the literature in recent literature but mathematical models of the axial flow phenomena only covered near-zero speed conditions. These models could not be used for conditions with current or for ships at voyage speed. A large signal model was developed. A nonlinear controller that provide improved control. The model and the new control concept explained phenomena with overshoot in propeller speed controls observed during many years and proposed a more accurate control system. The results are important for accurate maneuvering of autonomous underwater vehicles and robots.

Department of Automation
Department of Electrical Engineering
Norwegian University of Science and Technology
Period: 01/01/2000 → 01/01/9999
Number of participants: 3
Project participant:
Fossen, T. I. (Ekstern)
Lindegaard, P. (Ekstern)
Project Manager, organisational:
Blanke, Mogens (Intern)

Fault-tolerant control for complex systems
Concepts that enable systems to autonomously diagnose and react to faults have been under development since the 1990's. The concept, referred to as fault-tolerant control, utilise diagnosis with change detection to investigate whether faults have occurred in an automated system. If a fault has been detected, and a hypothesis about the nature of the fault has been confirmed, control system supervision can autonomously reconfigure the controller to handle the fault. One motivation fault-tolerant control is the safety aspects associated with loss of control when faults occur in automated systems. Another is the economic incentive that downtime of industrial processes is a major factor for total process yield. Fault-tolerant control was demonstrated to be able to improve availability and make control systems react sensibly for systems in different areas.

Department of Automation
Department of Electrical Engineering
Lund Institute of Technology
Eidgenössische Technische Hochschule
Universidad de Valencia
Aalborg University
Period: 01/01/2000 → 01/01/9999
Number of participants: 6
Project participant:
Åström, K. J. (Ekstern)
Schaufelberfer, W. (Ekstern)
Albertos, P. (Ekstern)
Zang, Z. (Ekstern)
Zamanabadi, R. (Ekstern)
Project Manager, organisational:
Blanke, Mogens (Intern)

Filtering of data from road profilographs
High-Speed profiling is a technology that began in 1960's. The current project addresses the calibration of high speed laser profilers by the aid of measurements from walking profilers. The main problem for walking profilers is a short observation length which gives particular problems with calibration in hilly regions. The project should give rise to better detrending methods providing stationary data for road roughness computations.

Department of Information Technology
Konvertering af danske vinddata til "Database on Wind Characteristics"

Formålet er at konvertere en række nye danske meteorologiske vinddata til "Database on Wind Characteristics" hvorved disse målinger bliver gjort generelt tilgængelig for en større kreds af brugere.

LIRNE.net

LIRNE.NET is a Strategic Collaboration between Faculty from Center for Tele-Information (CTI), Technical University of Denmark and Economics of Infrastructures, Delft University of Technology Netherlands Mission to facilitate telecom reform and information infrastructure development throughout the world - through research, training, policy and regulatory advice; to build human capital in the area as the foundation for the development, effective regulation and governance of new network economies. Activities Expert Analysis & Commentary on Current Issues External Training Initiatives (for Government, Industry and NGOs) Research Activities and Reports World Dialogue on Regulation for Network Economies.
Triclop - an artificial silicon retina
Objective of this project was the development and experimentation with a silicon retina, which is based on discrete electronic circuitry. The retina was placed on a mobile robot in order to detect moving objects in front of a stable background image. The functionality of the signal processing is derived from the biological example, though working with a much lower spatial resolution. The artificial retina is prepared to be used in cooperation with a sound source localization system, so that a multimodal localization system can be built-up.

Analysis of dynamic behaviour of electric power systems with large amount of wind power

Integrated circuits in medical ultrasound
Tomov, Borislav Gueorguiev (Intern)
Supervisor:
Bruun, Erik (Intern)
Sparsø, Jens (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Sørensen, Helge Bjarup Dissing (Intern)
Roth, Ole (Ekstern)
Öwall, Viktor (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Udvikling af CdZnTe detektorsystemer for rumforskning
Department of Electrical Engineering
Number of participants: 5
Phd Student:
Kuvvetli, Irfan (Intern)
Main Supervisor:
Korsbech, Uffe C C (Intern)
Examiner:
Thuesen, Gøsta (Intern)
Jensen, Mikael (Intern)
Lebrun, Francois (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

New Methods for Transducer Calibration
Department of Electrical Engineering
Period: 01/11/1999 → 27/06/2003
Number of participants: 6
Phd Student:
Barrera Figueroa, Salvador (Intern)
Supervisor:
Rasmussen, Knud (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Juhl, Peter Møller (Intern)
Roth, Ole (Ekstern)
Vorländer, Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

EUCAS 2001 Conference - Copenhagen
Department of Electric Power Engineering
Department of Physics
Department of Electrical Engineering
DIS Congress Service
Nordic Superconductor Technology
Period: 01/08/1999 → 01/11/2001
Number of participants: 13
Project participant:
Hald, Britta (Intern)
Herse, Erik (Intern)
Hvigeltoft, Georg (Intern)
Jensen, Kim Høj (Intern)
Larsen, Esben (Intern)
Leisner, Torben (Intern)
Pedersen, Niels Falsig (Intern)
Træholt, Chresten (Intern)
Däumling (fratrådt), Manfred (Intern)
Mygind, Jesper (Intern)
Jacobsen, Claus Schelde (Intern)
Renouf, Sophie (Ekstern)
Project Manager, organisational:
Tønnesen, Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 3,000,000.00 Danish Kroner
Project

Impleneterbare transpondere til nerve sensorer
Department of Electrical Engineering
Period: 01/06/1999 → 01/03/2004
Number of participants: 6
Phd Student:
Nielsen, Jannik Hammel (Intern)
Supervisor:
Lehmann, Torsten (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Andreani, Pietro (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Lande, Tor Sverre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Transient analyse af superledende kabler
Department of Electrical Engineering
Period: 01/06/1999 → 10/09/2002
Number of participants: 7
Phd Student:
Jensen, Kim Høj (Intern)
Nye kabelisolering til højeispændt jævnstrøm (HVDC)

Department of Electrical Engineering

Period: 01/04/1999 → ...

Number of participants: 7

PhD Student:

Hjerrild, Jesper (Intern)

Supervisor:

Henriksen, Mogens (Intern)

Karthäuser, Joachim (Ekstern)

Main Supervisor:

Holbol, Joachim (Intern)

Examiner:

Tønnesen, Ole (Intern)

Hegerberg, Rolf (Ekstern)

Sørensen, Freddy (Ekstern)

Financing sources

Source: Internal funding (public)

Name of research programme: Erhvervsforskerordningen

Project: PhD

Integration of AGS and CGS

This project is a first step towards a description of differences and similarities of the results from Airborne and Carborne Gamma-Ray Spectrometry to be used for mapping in case of a radioactive contamination.

Department of Automation

Period: 15/03/1999 → 30/08/1999

Number of participants: 3

Project participant:

Bargholz, Kim (Intern)

Aage, Helie Karina (Intern)

Project Manager, organisational:

Korsbech, Uffe C C (Intern)

Financing sources

Source: Unknown

Name of research programme: Ukendt

Amount: 120,000.00 Danish Kroner

Realtidssystemer til automatiserings- og styringsformål

Department of Electrical Engineering
Next Generation Synthetic Aperture Radar (SAR++)
This program aims at improving design methods and technology for complex sensor systems involving wide-bandwidth analog, digital, and antenna subsystems. Specifically the project will address synthetic aperture radar (SAR). The work will aim at achieving significant improvements in terms of performance, cost, and size to make SAR mapping more broadly used and also commercially viable in the future, while at the same time developing technical solutions of general relevance. Primary goals for this project are: 1) To develop design and implementation methods for very wide-band electronics for analog sensor systems 2) To develop effective and flexible design and implementation methods for complex high performance digital signal processing and control systems 3) To develop wide-band and multi-frequency antennas

Department of Electromagnetic Systems
Department of Photonics Engineering
Department of Electrical Engineering

Weibel Scientific A/S
Period: 01/02/1999 → 30/06/2003
Number of participants: 14
Project participant:
Christensen, Erik Lintz (Intern)
Jørgensen, Jørn Hjelm (Intern)
Johansen, Tom Keinicke (Intern)
Høeg, Flemming (Intern)
Skou, Niels (Intern)
Sørensen, Peter (Intern)
Andersen, Birte Kronbak (Intern)
Vidkjær, Jens (Intern)
Breten, Madalina (Intern)
Brændstrup, Bo (Intern)
Granholm, Johan (Intern)
Lindqvist, Gert Albert (Intern)
Søbjærg, Sten Schmidl (Intern)
Project Manager, organisational:
Madsen, Søren Nørvang (Intern)

Financing sources
Source: Unknown
Name of research programme: Uendt
Amount: 15,000,000.00 Danish Kroner
Project

Polarimetriske radiometre og anvendelse heraf
Department of Electrical Engineering
Period: 01/02/1999 → 14/05/2003
Number of participants: 4
Phd Student:
Søbjærg, Sten Schmidl (Intern)
Main Supervisor:
Udvikling af en general metode til højpræcisions interkalibrering af vektorinstrumenter

Department of Electrical Engineering
Period: 01/02/1999 → 18/09/2002
Number of participants: 7
Phd Student:
Jørgensen, Peter Siegbjørn (Intern)
Supervisor:
Brauer, Peter (Intern)
Risbo, Torben (Ekstern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Lühr, Hermann (Ekstern)
Birger, Niss (Ekstern)
Thuesen, Gøsta (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Fundamental fault detection
The area for this project is to develop a basic for the investigation of fault detection, fault identification and fault estimation. One of the main problems in fault detection, fault identification and fault estimation is that there does not exist a well defined fundament, where on the research can be based. As a consequency of this, it will in general be impossible to validate residual generators (components for fault detection/identification/estimation) with respect to e.g. optimality. The first part of the project deals with formulating a number of fundamental fault detection/identification/estimation problems and derive the solvability conditions for these problems. These problems describe the optimal/the best that can be obtained.

Department of Automation
Department of Electrical Engineering
Washington State University
Eindhoven University of Technology
Rutgers University
Period: 01/01/1999 → 31/12/2001
Number of participants: 4
Project participant:
Saberi, Ali (Ekstern)
Stoorvogel, Anton (Ekstern)
Peddapullaiah, Sannuti (Ekstern)
Project Manager, organisational:
Niemann, Hans Henrik (Intern)

GLIMS Regional Center for Greenland
The objectives of GLIMS (Global Land-Ice Measurement from Space) is to establish a global inventory of land ice, including surface topography, changes in extent, and surface velocity over a 5-year period, by using the ASTER
(Advanced Spaceborne Thermal Emission and Reflection Radiometer). ASTER is flown onboard the US earth observation satellite Terra launched in December 1999. GLIMS is expected to provide a substantial contribution to climate and environmental change research by enlightening the question of whether the Earth's glaciers and the Greenland and Antarctic ice sheets are currently in balance or are increasing or decreasing in volume. This question is still unanswered in spite of the fact that it is a clue to understanding the present and future global sea level change. The Regional GLIMS Center for Greenland at EMI will serve as centre for Greenland glacier change analysis, and planning of mission operations and data acquisition. The Center activities are partly funded by the Commission for Scientific Research in Greenland and the Danish Research Councils.

Department of Electromagnetic Systems

Department of Electrical Engineering

Geological Survey of Denmark and Greenland

Period: 01/01/1999 → 31/12/2002
Number of participants: 2
Project participant:
Kristensen, Steen Savstrup (Intern)
Project Manager, organisational:
Reeh, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,332,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 792,000.00 Danish Kroner

Hurtig signalbehandling med PFGA kredse for 3D-ultralydscanning

Department of Electrical Engineering

Period: 01/01/1999 → 01/10/2000
Number of participants: 2
PhD Student:
Pedersen, Henrik Møller (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

ONTOQUERY Ontology-based Querying

The purpose of the interdisciplinary project OntoQuery is to develop theories and methods for content-based information retrieval by devising a description language whose expressive power covers not only the purely linguistic analysis of texts, but also the description of a concept ontology and the analysis of queries. This part of the project is intended to serve as the basis of the construction of a prototype system for content-based retrieval of texts from (existing) text databases and knowledge bases. Since the query language will be Danish, the prototype system will have built-in knowledge of the morphology, grammatical functions, possible meanings, and sense relations of the relevant Danish words and phrases. This system functionality is obtained by devising an internal representation, viz. the above-mentioned ontology, which combines the descriptions of words with a coherent taxonomy of the concepts and terms of the domains selected. In this sense the system will be more intelligent and user friendly than search engines currently in use, which typically employ comparatively primitive search strategies based solely on the occurrence of string sequences, words, or combinations of words. The project is funded by the Danish Research Agency under the Information Technology Programme. See also www.ontoquery.dk

Department of Information Technology

Department of Electrical Engineering

University of Copenhagen

HHK
Development and Implementation of Interferometric SAR Processor, GSTP ph-1

In this project an interferometric SAR processing system is studied (phase 1) and will be implemented and delivered (phase 2) to the European Space Agency (ESA). Processing large amounts of synthetic aperture radar (SAR) data is no longer exceedingly difficult. Processing of individual strips of satellite SAR data, such as ERS-1/2, is routine many places. This also applies to the initial stages of the interferometric processing, including coarse baseline estimation, image-to-image registration and interpolation, and the formation of power differences and ratio images, interferograms, and correlation images. The steps following are, however, far from trivial or solved, even if significant improvements have been made through the last few years of work with SAR interferometry. These critical steps include phase unwrapping, the determination of the absolute phase, precise baseline determination, phase and correlation calibration, geophysical perturbations (most notably the atmosphere and temporal decorrelation), as well as the follow on processing, e.g. mosaicking. Despite the fact that many issues are still not completely resolved, InSAR data, in particular ERS-1/2 tandem mode data, are today being used in numerous geophysical studies, primarily scientific but also at times commercial, and the potential of interferometric SAR is today recognised widely. One example of a complex application of InSAR's potential is the simultaneous determination of elevations and 3-dimensional flow vectors as recently demonstrated at the Danish Center for Remote Sensing at EMI, [Mohr et al., 1998].

Department of Electromagnetic Systems

Department of Electrical Engineering

Period: 01/12/1998 → 30/04/2001
Number of participants: 2
Project participant:
Mohr, Johan Jacob (Intern)
Project Manager, organisational:
Madsen, Søren Nørvang (Intern)

Financing sources
Source: Unknown
Name of research programme: ukendt
Amount: 750,000.00 Danish Kroner

Distributed Multimedia

The project focuses on research issues central to the development and use of distributed multimedia. Task 2: the Information Society, convergence and electronic commerce explore the potentials and barriers in the information society based on convergence and with electronic commerce in a broad sense as its most important emerging economic activity.

Department of Telecommunication
Department of Electrical Engineering
Numerical Transducer Modelling
Department of Electrical Engineering
Period: 01/09/1998 → 13/03/2002
Number of participants: 5
Phd Student:
Cutanda Henriquez, Vicente (Intern)
Supervisor:
Gramtorp, Johan (Ekstern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Tarnow, Viggo (Intern)
Hamdi, Mohamed Ali (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Stabilitet og performance af neurale regulatorer
Department of Electrical Engineering
Period: 01/09/1998 → 18/03/2005
Number of participants: 5
Phd Student:
Luther, Jim Benjamin (Intern)
Main Supervisor:
Hendricks, Elbert (Intern)
Examiner:
Jantzen, Jan (Intern)
Pianese, Cesare (Ekstern)
Svarer, Claus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Styring og instrumentering af autonomt ubemandet luftfartøj
Department of Electrical Engineering
Period: 01/09/1998 → 28/05/2003
Number of participants: 6
Phd Student:
Nissen, Henrik Ditlev (Intern)
Supervisor:
Sørensen, Paul Haase (Intern)
Main Supervisor:
Jannerup, Ole Erik (Intern)
Examiner:
Hendricks, Elbert (Intern)
Berg, Joel (Ekstern)
Bindner, Henrik W. (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Three-dimensional real-time ultrasound imaging**
Department of Electrical Engineering
Period: 01/09/1998 → 14/03/2002
Number of participants: 5
Phd Student:
Nikolov, Svetoslav (Intern)
Main Supervisor:
Jensen, Jørgen Arendt (Intern)
Examiner:
Christensen, Erik Lintz (Intern)
Hald, Jørgen (Ekstern)
Stepinski, Tadeusz (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt

**Relations**
Publications:
Synthetic aperture tissue and flow ultrasound imaging
Project: PhD

**Pulse Edge Delay Error Correction**
Research in error correction for switch-mode audio power amplifiers with a digital input signal.

Department of Applied Electronics
Department of Electrical Engineering
Bang & Olufsen A/S
Period: 01/08/1998 → 31/07/1999
Number of participants: 3
Project participant:
Christensen, Frank Schwartz (Intern)
Nielsen, Karsten (Intern)
Project Manager, organisational:
Andersen, Michael A. E. (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner
Project

**Vertical Deflection in TV**
Ice thickness and ice-surface elevation in Greenland

Ice thickness data of Nioghalvfjerdsfjorden glacier, Northeast Greenland measured with the airborne EMI 60 MHz ice radar have been processed to produce preliminary ice-thicknesses along c. 3000 km flight-lines. A preliminary ice-thickness map of the c. 2000 km2 floating tongue and grounding zone of Nioghalvfjerdsfjorden glacier has been prepared. Laser-altimeter data for accurate surface profiling and differential GPS data for accurate positioning of the twin otter aircraft used for the radar measurements have been processed in collaboration with Kort og Matrikelstyrelsen (KMS).

Electromagnetic inverse scattering

Electromagnetic inverse scattering (EIS) is a technique that is used to obtain information about an object from the scattered electromagnetic field measured outside the object. This project develops new EIS techniques applicable to a wide range of areas such as medical imaging, landmine detection, remote sensing, radar target identification, resource exploration, and non-destructive testing.
Advanced Stellar Compass For the SAC-C satellite

The international Geophysics potential decade, has been declared beginning with the launch of the Ørsted satellite. To support the effort of precise mapping of the Geomagnetic field, NASA, the Argentine and the Danish government decided to include a simplified version of the Ørsted instrumentation platform in the Argentine SAC-C satellite. The Space Instrumentation Group was contracted to develop an improved version of the Ørsted Star Imager for this mission.

Department of Automation
National Space Institute
Institute for Product Development
Department of Electrical Engineering
TERMA Elektronik A/S
CONAE Argentina
DDC-I A/S
Danmarks Meteorologisk Institut
NASA Jet Propulsion Laboratory
University of Copenhagen
INVAP Argentina

Advanced Stellar Compass For the SAC-C satellite

The international Geophysics potential decade, has been declared beginning with the launch of the Ørsted satellite. To support the effort of precise mapping of the Geomagnetic field, NASA, the Argentine and the Danish government decided to include a simplified version of the Ørsted instrumentation platform in the Argentine SAC-C satellite. The Space Instrumentation Group was contracted to develop an improved version of the Ørsted Star Imager for this mission.

Department of Automation
National Space Institute
Institute for Product Development
Department of Electrical Engineering
TERMA Elektronik A/S
CONAE Argentina
DDC-I A/S
Danmarks Meteorologisk Institut
NASA Jet Propulsion Laboratory
University of Copenhagen
INVAP Argentina

Period: 05/03/1998 → 01/01/1999
Number of participants: 8
Project participant:
Betto, Maurizio (Intern)
Kilsgaard, Søren (Intern)
Korsbech, Uffe C C (Intern)
Guldager, Peter Buch (Intern)
Riis, Troels (Intern)
Thuesen, Gøsta (Intern)
Denver, Troelz (Intern)
Project Manager, organisational:
Jørgensen, John Leif (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,500,000.00 Danish Kroner
Project
Low power CMOS chipdesign
Department of Electrical Engineering
Period: 01/02/1998 → 11/12/2001
Number of participants: 7
Phd Student:
Christensen, Kåre Tais (Intern)
Supervisor:
Olesen, Ole (Intern)
Rebild, Dan (Ekstern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Gaunholt, Hans (Intern)
Johansen, Eivind (Ekstern)
Qiuting, Huang (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Gyldigheden om antagelsen om Gaussisk Turbulens
1) at undersøge om den sædvanlige antagelse om Gaussisk (normalfordelt) turbulens er opfyldt i almindelighed og mulige konsekvenser heraf på lastberegninger, som generelt vil være underestimeret som følge af den Gaussiske antagelse. Vi vil benytte en netop opbygget meget stor database bestående af hurtigt samplede vind tidsserier (til at belyse problemets omfang. 2) Afholde to workshops hvor man med udgangspunkt i resultaterne under 1) demonstrerer for danske fabrikanter og andre interesserede, hvad man kan bruge ovennævnte database til.

Department of Energy Engineering
Risø National Laboratory for Sustainable Energy
VESTAS Wind Systems A/S

On-board satellite autonomous orbit determination
Department of Electrical Engineering
Period: 01/01/1998 → 22/10/2001
Number of participants: 5
Phd Student:
Betto, Maurizio (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Korsbech, Uffe C C (Intern)
Birger, Niss (Ekstern)
Pickles, Andrew John (Ekstern)

Financing sources
rev. slutdato 15. august 98

Department of Electrical Engineering
Period: 01/01/1998 → 01/04/2000
Number of participants: 2
Phd Student:
Møller, Karen-Margrethe Juul (Intern)
Main Supervisor:
Madsen, Søren Nørvang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Robust control of non-linear systems

Department of Electrical Engineering
Period: 01/01/1998 → 30/08/2002
Number of participants: 6
Phd Student:
Vigild, Christian Winge (Intern)
Supervisor:
Sørenson, Spencer C (Intern)
Main Supervisor:
Hendricks, Elbert (Intern)
Examiner:
Jantzen, Jan (Intern)
Eriksson, Lars (Ekstern)
Henningsen, Svend (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

SEALION, SEa cie in the Antarctic Linked with OceaN-atmosphere forcing
The aim of the project is to assess and improve the performance of coupled global atmosphere-sea ice-ocean models (AOGCMs) in reproducing sea ice in the high southern latitudes. This will be achieved by (1) deriving datasets of sea ice concentration and motion using remote sensing techniques, (2) performing selected runs with a sophisticated high resolution dynamic-thermodynamic sea ice model, which will be optimized with the datasets derived in the project, and (3) analyzing the output of coupled global AOGCM runs.

Department of Electromagnetic Systems
Department of Electrical Engineering
Universität Kiel
University of Bremen
British Antarctic Survey
Hadley Centre for Climate Prediction and Research
German Climate Computing Center
Period: 01/01/1998 → 31/12/2000
Number of participants: 2
Project participant:
Saldo, Roberto (Intern)
Statistical Energy Analysis Thematic Network (SEANET)

High frequency vibration problems are very common in complex structures, where they constitute a major cause of interior and exterior noise. An approach called Statistical Energy Analysis (SEA) now has the capability to address such problems and to identify how the vibrations are distributed in the subsystems of complex structures, e.g., machinery, transportation vehicles and space structures. The objectives of establishing the thematic network SEANET are to bring together existing research efforts in the SEA field through active networking, and to overcome the barriers which exist today between the academic research on SEA and its application to industrial problems. This will also include the preparation for the transfer of knowledge from university to industry. This action will include realisation of a number of industrial validation cases by cooperative teams from research institutes and industry. The network consists of 12 university groups involved in major SEA research, 7 industrial end-users of different sectors (automobile, components, railways, ships, aeronautics and aerospace) and 9 small industries and industrial research centres. Contract begins 1 January 1999.

Department of Acoustic Technology
Department of Electrical Engineering
Leuven Measurements and Systems
Aerospatiale
Construcciones Aeronáuticas SA
Dornier Luftfahrt
Renault Recherche et Innovation
Centro Ricerche FIAT
Rieter Automotive France
Duewag
Defence Research Agency
Aeronautical Research Institute of Sweden
Centre Scientifique et Technique du Bâtiment
Instituto Nazionale Architettura Navale
Germanischer Lloyd
Brekke & Strand Akustikk
Paragon Ltd
Absorber-Engenharia Acustica
Institute of Sound and Vibration Research
Dresden University of Technology
Università degli Studi di Napoli Federico II
Università degli Studi di Firenze
Institut National des Sciences Appliquees de Lyon
Escole Centrale de Lyon
KTH - Royal Institute of Technology
Luleå University
Katholieke Universiteit
Heriot-Watt University
Trinity College Dublin

**Period:** 01/01/1998 → 31/12/2001
**Number of participants:** 1
**Project Manager, organisational:**
Ohlrich, Mogens (Intern)

**Financing sources**
**Source:** Unknown
**Name of research programme:** Ukendt
**Amount:** 135,000.00 Danish Kroner

**Styring af hurtige flexible robotter**
Department of Electrical Engineering
**Period:** 01/01/1998 → 29/08/2001
**Number of participants:** 6
**PhD Student:**
Nielsen, Henrik Skovsgaard (Intern)
**Supervisor:**
Ravn, Ole (Intern)
**Main Supervisor:**
Sørensen, Paul Haase (Intern)
**Examiner:**
Jannerup, Ole Erik (Intern)
Holm, Hans (Ekstern)
Siciliano, Bruno (Ekstern)

**Financing sources**
**Source:** Internal funding (public)
**Name of research programme:** DTU-lønnet stipendie
**Project:** PhD

**Udvikling af karakterisering af algoritmer til estimation af blodhastighed med ultralyd**
Department of Electrical Engineering
**Period:** 01/01/1998 → 04/09/2001
**Number of participants:** 5
**PhD Student:**
Schlaikjer, Malene (Intern)
**Main Supervisor:**
Jensen, Jørgen Arendt (Intern)
**Examiner:**
Wilhjelm, Jens E. (Intern)
Andersen, Jens Damgaard (Ekstern)
Torp, Hans (Ekstern)

**Financing sources**
**Source:** Internal funding (public)
**Name of research programme:** DTU-lønnet stipendie
**Project:** PhD

**Adaptive methods for transceivers**
Department of Electrical Engineering
**Period:** 01/12/1997 → 07/09/2001
**Number of participants:** 7
**PhD Student:**
Nielsen, Per Asbeck (Intern)
Supervisor:
Olesen, Ole (Intern)
Rebild, Dan (Ekstern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Vidkjær, Jens (Intern)
Rahkonen, Timo (Ekstern)
Nielsen, Peter Østergaard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Design Techniques for Submicron RF Power amplifiers

Department of Electrical Engineering
Period: 01/12/1997 → 15/11/2001
Number of participants: 6
Phd Student:
Fallesen, Carsten (Intern)
Supervisor:
Olesen, Ole (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Rahkonen, Timo (Ekstern)
Johansen, Eivind (Ekstern)
Vidkjær, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftalefinans
Project: PhD

Multi-frekvens, multi-polarisations antenner til telemålingsformål

Department of Electrical Engineering
Period: 01/12/1997 → 09/04/2001
Number of participants: 6
Phd Student:
Granholm, Johan (Intern)
Supervisor:
Dich, Mikael (Intern)
Woelders, Kim (Intern)
Main Supervisor:
Skou, Niels (Intern)
Examiner:
Maci, Stefano (Ekstern)
Vidkjær, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Fremstilling af digitale topografiske kort ved hjælp af syntetisk apertur radar
Topographic mapping by SAR

Topographic maps containing both thematic information about objects (e.g. forests, agricultural areas, roads, and buildings), and elevation information for the surface are used in numerous applications, for instance for registration and planning purposes in municipalities, counties, government agencies, and civil engineering companies. The availability of high-resolution Earth observation data from spaceborne and airborne sensors both today and in the future has focused the attention on the role for such sensors in speeding up and making more efficient the process of compiling and revising topographic maps. The advantages of the SAR sensors are for instance their all-weather mapping capabilities, and their complementarity compared to optical sensors. The ultimate objective of the research is to be able to perform quickly and efficiently compiling and updating of topographic maps using such data. The specific objectives are: To evaluate requirements of today for topographic mapping with a view to present and future remote sensing capabilities. To evaluate the potential of the polarimetric and interferometric SAR to detect the necessary object classes to be used for the thematic map content, and to evaluate the complementarity with traditional methods, as well as the accuracy of retrieval methods. To study the potential of SAR for change detection as a means of fast, frequent and cost-efficient updating of existing map information. The project was finalized in 2000, and a number of methods have been developed, e.g. for edge detection, segmentation, and change detection. Furthermore, the classification potential of the polarimetric SAR data has been evaluated. Results have been or will be published at conferences and in papers.

Department of Electromagnetic Systems

Department of Civil Engineering

National Survey and Cadastre

Period: 01/11/1997 → 31/12/2000

Number of participants: 10

Project participant:

Dall, Jørgen (Intern)
Madsen, Søren Nørvang (Intern)
Schou, Jesper (Intern)
Dierking, Wolfgang (Intern)
Jacobi, Ole (Intern)
Dueholm, Keld (Intern)
Frederiksen, Poul (Intern)
Jørgensen, Lars T. (Ekstern)
Knudsen, Per (Ekstern)

Project Manager, organisational:

Skriver, Henning (Intern)

Financial sources

Source: Unknown

Name of research programme: Ukendt

Amount: 0.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 132,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 3,000,000.00 Danish Kroner

Project

Autonom detektion, sporing og fastholdelse af objekter i field of view i et satellitbaseret kamerasystem

Department of Electrical Engineering
Number of participants: 3
Phd Student:
Riis, Troels (Intern)
Main Supervisor:
Jørgensen, John Leif (Intern)
Examiner:
Birger, Niss (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Biotelemetri systemer

Department of Electrical Engineering
Period: 01/09/1997 → 04/01/2002
Number of participants: 5
Phd Student:
Gudnason, Gunnar (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Hansen, Ole (Intern)
Jørgensen, Ivan Harald Holger (Intern)
Lande, Tor Sverre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Regulering af systemer med begrænsninger

Department of Electrical Engineering
Period: 01/09/1997 → 18/04/2001
Number of participants: 6
Phd Student:
Bak, Martin (Intern)
Supervisor:
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Jannerup, Ole Erik (Intern)
Rasmussen, Henrik (Ekstern)
Raymond, Hanus (Ekstern)

Financing sources
**High temperature superconductors for transmission of electric energy**

Department of Electrical Engineering  
Period: 01/06/1997 → 01/01/2001  
Number of participants: 2  
PhD Student:  
Olsen, Søren Krüger (Intern)  
Main Supervisor:  
Tønnesen, Ole (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-Su Stipendium, Eksperiment  
Project: PhD

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**Real-Time ‘Plant-Wide’ Diagnosis**

Department of Electrical Engineering  
Period: 01/05/1997 → 27/03/2000  
Number of participants: 3  
PhD Student:  
Petersen, Johannes (Intern)  
Main Supervisor:  
Lind, Morten (Intern)  
Examiner:  
Blanke, Mogens (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Erhvervsforskerordningen  
Project: PhD

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**Superconducting power cable termination**

Department of Electrical Engineering  
Period: 01/05/1997 → 08/11/2000  
Number of participants: 2  
PhD Student:  
Rasmussen, Carsten (Intern)  
Main Supervisor:  
Tønnesen, Ole (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsstip.-SU, Ekspr  
Project: PhD

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**Navigation**

Department of Electrical Engineering  
Period: 01/03/1997 → 04/12/2002  
Number of participants: 6  
PhD Student:  
Larsen, Mikael Bliksted (Intern)  
Supervisor:  
Lind, Morten (Intern)  
Main Supervisor:  
Andersen, Niels Axel (Intern)
SMEAR, Automatic Screening For Cervical Cancer
Almost all women in Denmark participate in vaginal cytological screening programmes, that is, frequent analyses by microscope of cells (smear) from the vagina. A major problem is that cyto-technicians may misinterpret or overlook ill cells when looking into the microscope. At present about 650,000 smears are examined annually. There are, however, almost 500 new cases of cervical cancer per year. The project objective is to develop an automated screening system, as an aid for the cyto-technicians, in order to increase the diagnostic certainty. The Dept. of Automation focuses on developing a robot that will feed a sample to a microscope, move it under the lens during the image processing phase, and take it away again for storage in a rack. Another task for the department is to develop algorithms that classify cells -- by means of, say, shape, colour, and size -- into the groups: OK and not OK. The latter group should be further divided into mild, moderate, and severe cancer (dysplasia). So far, three Master's projects have been completed (Voss, 1996; Post & gjerløv, 1998; Byriel, 1999).

Department of Automation
Department of Electrical Engineering
Herlev Amtssygehus
DIMAC A/S
Period: 01/02/1997 → 31/12/2000
Number of participants: 3
Project participant:
Det Ulfeldtske chifferbrev
For Danmarks Radio, TV-Fakta (Piet van Deurs), er brudt et 350 år gammelt chifferbrev, der er registreret i Rigsarkivet som "Privatarkiv 6473, Corlitz Ulfeldt 1606-1664, A.I.4 Chifferbrev". Projektet er gennemført i samarbejde med museumsinspektør Steffen Heiberg, Det Nationalhistoriske Museum på Frederiksborg, og lektor Knud Nissen, Matematiklærerforeningen. Finansieringen er en del af instituttets samlede bevilling.

Department of Electric Power Engineering
Department of Electrical Engineering
Matematiklærerforeningen
Natural History Museum of Denmark
Period: 01/01/1997 → 01/01/9999
Number of participants: 3
Project participant:
Nissen, Knud (Ekstern)
Heiberg, Steffen (Ekstern)
Project Manager, organisational:
Franksen, Ole Immanuel (Intern)

Graduate School in Microelectronics
The Graduate School in Microelectronics was started in 1997 and its aim was to enhance (quantitatively and qualitatively) the Ph.d.-education in the area of Microelektronics. The Graduate School was funded by the Danish Research Training Council (in Danish: Forskeruddannelsesrådet) with 1 M kr. per year. The graduate school has co-funded summer schools, visiting professors and Ph.d.-scholarships. In total 8 Ph.d.-projects has been funded jointly by the Graduate School, private companies and research projects. The projects are hosted by MIC, Ørsted*DTU and IMM and the companies involved are: B-K Medical, Dicon, GN ReSound, NOKIA, Oticon, Sensor Technology Center and SonionMEMS.

Department of Information Technology
Department of Informatics and Mathematical Modeling
Department of Electrical Engineering
Department of Micro- and Nanotechnology
Period: 01/01/1997 → 31/12/2001
Number of participants: 15
Project participant:
Paker, Ozgun (Intern)
Larsen, Ken (Intern)
Holten-Lund, Hans Erik (Intern)
Pedersen, Steen (Intern)
Madsen, Jan (Intern)
Jensen, Jørgen Arendt (Intern)
Tomov, Borislav Gueorguev (Intern)
Andreani, Pietro (Intern)
Wang, Xiaoyan (Intern)
Hansen, Ole (Intern)
Yalcinkaya, Arda Deniz (Intern)
Menon, Aric Kumaran (Intern)
Radar Interferometry of Aeolian Surfaces

Sand transport is an important effect in global climate studies, particularly in relation to desertification and dust generation, and is linked with topographic changes of aeolian surfaces. Radar interferometry has the capability to map topography and topographic changes of any terrain. As part of the project, ERS tandem data acquired over the Algodones Dunefield in California (USA) have been analysed. Four data pairs, each consisting of two images acquired on consecutive days, were available every 35 days in the period from January to June 1996. The topography of the test site was derived for each tandem pair with local height accuracies of the order 5-10 m. Significant large scale distortions due to atmospheric propagation anomalies were recognised. Differences between individual topographic maps showed no statistically significant topographic changes throughout the monitoring period. The radar brightness, topographic slopes, and interferometric decorrelation are useful measures of surface properties related to aeolian classes and aerodynamic roughness. (Related projects - see: www.dcrs.dtu.dk).

Department of Electromagnetic Systems
Department of Electrical Engineering
Aarhus University

Adaptive control of a cutting process.

This activity concerns development of a nonlinear adaptive controller for a cutting process. The objective is to control the feed rate such that it is optimized without exceeding the permitted maximum torque acting on the tool. Most control systems currently available are simple and follow conservative strategies. In the current project we pursue various nonlinear adaptive control strategies for high performance control of the process. The controllers are designed to perform well for arbitrary combinations of material, type of tool, tool wear, depth of cut, and tool speed. The project is carried out in collaboration with Division of Manufacturing Engineering, Luleå University of Technology. This division has at its disposal a machining center with modified control hardware which is used for practical experiments. A nonlinear adaptive controller has been designed and various tests and fine tunings have been carried out. Practical experiments have demonstrated a promising performance for cutting in aluminum. In the forthcoming year we will explore the performance of the controller for other tools and materials.

CICT
Department of Informatics and Mathematical Modeling
Department of Automation
Department of Electrical Engineering
Luleå University of Technology

Nørgård, Peter Magnus (Intern)
Ravn, Ole (Intern)
Bäckström, Mikael (Ekstern)

Project Manager, organisational:
Poulsen, Niels Kjølstad (Intern)

Project

Superledende strømbegrænsere

Department of Electrical Engineering
Period: 01/12/1996 → …
Number of participants: 3
Phd Student:
Nielsen, Jørgen Nygård (Intern)
Supervisor:
Jørgensen, Preben Nygård (Intern)
Main Supervisor:
Tønnesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Modular Supervisory Controller for Hybrid Power systems

Department of Electrical Engineering
Number of participants: 4
Phd Student:
Pereira, Alexandre De Lemos (Intern)
Main Supervisor:
Jannerup, Ole Erik (Intern)
Examiner:
Heningsen, Arne (Ekstern)
Lind, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Selvfinansierende (privatist)
Project: PhD

Airborne and groundbased gamma-ray

Department of Electrical Engineering
Period: 01/09/1996 → 19/11/2001
Number of participants: 5
Phd Student:
Bargholz, Kim (Intern)
Main Supervisor:
Korsbech, Uffe C C (Intern)
Examiner:
Jørgensen, John Leif (Intern)
Roed, Jørn (Intern)
Samuelsson, Christer (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Spatially extended sound equalisation in rooms
The motivation of this PhD project is the fact that sound reproduced in a normal listening room undergoes a spectral colouration, which is an undesirable effect. The objective of the work has been to study the extent to which sound can be reproduced without spatial fluctuations and spectral colouration in a region in a room as large as possible, over a frequency range as large as possible, and using as few loudspeakers as possible. The problem has been studied theoretically using computer simulations, both in the frequency domain approach and with a time domain approach. Experiments in a flat (two-dimensional) enclosure have also been carried out. One of the conclusions of the study is that it is a much better strategy to generate a plane travelling wave than to try to obtain the same response in amplitude and phase; the equalised region can be larger and the frequency range can be wider. For example it has been shown that a plane wave travelling in a certain direction can be generated in a room of 2.9x3.6x2.5 m at frequencies up to 320 Hz by using 32 loudspeakers. Supervisor: Finn Jacobsen

Department of Acoustic Technology
Department of Electrical Engineering
Period: 01/09/1996 → ...
Number of participants: 1
Project Manager, organisational:
Orozco, Arturo (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 210,000.00 Danish Kroner
Project
Spatially extended sound equalisation in rooms at low frequencies

Department of Electrical Engineering
Period: 01/09/1996 → 31/03/2000
Number of participants: 4
Phd Student:
Orozco, Arturo (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Gade, Anders Christian (Intern)
Hald, Jørgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Selvfinansierende (privatist)
Project: PhD

A Port Air Mass Flow Sensor
On the basis of work carried out earlier, a sensor is being developed to measure the air mass flow in the port of a spark ignition engine. This sensor is fast enough to resolve the details of the air flow to an engine during the intake process.

Department of Automation

Department of Electrical Engineering
Period: 01/08/1996 → ...
Number of participants: 1
Project Manager, organisational:
Hendricks, Elbert (Intern)

Scalar magnetometers.
Scalar magnetometers based on the principle of magnetic resonance are used for accurate measurements of the Earth’s magnetic field, e.g. from satellites. A new type of magnetometer is now being developed, with lower weight, lower power consumption and higher accuracy than existing magnetometers.

Department of Automation

Department of Electrical Engineering
Period: 01/08/1996 → 31/12/1999
Number of participants: 3
Project participant:
Ardenkjær-Larsen, Jan Henrik (Intern)
Project Manager, organisational:
Laursen, Ib (Intern)
Petersen, Jan Raagaard (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 295,000.00 Danish Kroner

Optical phase locked loops for phased array communication antennas
US Army project dealing with the design and construction of the world’s first packaged semiconductor laser optical phase locked loop (OPLL) for optical generation and transmission of microwave signals. The Technical University of Denmark contributes with system level studies, general OPLL studies, design and construction of microwave and control electronics, and detailed OPLL design and simulation.

Department of Electromagnetic Systems

Department of Electrical Engineering
Airborne gamma-ray surveys in Latvia
Selected areas of Latvia has been overflown for mapping of manmade and natural radioactivity, and for searching for lost radioactive sources. The results of the measurements are processed by new techniques developed at IAU.

Automation

Department of Electrical Engineering

Danish Emergency Management Agency

Period: 01/06/1996 → 31/10/1997
Number of participants: 4
Project participant:
Andersen, Frank (Intern)
Bargholz, Kim (Intern)
Hovgaard, Jens (Intern)
Project Manager, organisational:
Korsbech, Uffe C C (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 70,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 140,000.00 Danish Kroner

Klassifikation af afgrøder

Department of Electrical Engineering

Period: 01/05/1996 → 16/11/2001
Number of participants: 6
Phd Student:
Svendsen, Morten Thougaard (Intern)
Supervisor:
Dall, Jørgen (Intern)
Skriver, Henning (Intern)
Main Supervisor:
Madsen, Søren Nørvang (Intern)
Examiner:
Dierking, Wolfgang (Intern)
Krogager, Ernst (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Sektorministeriel Fin-SU
Project: PhD

Mobils system til tilstandsvurdeing af AC-højspændingskabler

Department of Electrical Engineering

Period: 01/05/1996 → …
Number of participants: 3
PhD Student: Villefrance, Rasmus (Intern)
Main Supervisor: Henriksen, Mogens (Intern)
Examiner: Sørensen, John Aasted (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

AC-anvendelser af højtemperatursuperledere
Department of Electrical Engineering
Period: 01/03/1996 → 15/08/1998
Number of participants: 3
PhD Student: Pinholt, Henriette Understrup (Intern)
Supervisor: Vase, Per (Ekstern)
Main Supervisor: Tønnesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Korrelations radiometri:
Department of Electrical Engineering
Period: 01/03/1996 → ...
Number of participants: 3
PhD Student: Laursen, Brian (Intern)
Main Supervisor: Skou, Niels (Intern)
Examiner: Christensen, Erik Lintz (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Kandidatstipendium ansat på DT
Project: PhD

Ph.d. project, Henriette Understrup: AC applications for high temperature superconductors
The project is an industrial ph.d. education supported by the Danish Academy of Technical Sciences. The partners in the project are: Industry: Dr. Per Vase, NKT Research Center, University: Prof. Ole Tønnesen, Department of Electrical Power Engineering, Technical University of Denmark and 3. part: Dr. Henrik Jeltoft Jensen Department of Mathematics, Imperial College London. The scientific goal of the project is to establish a thorough understanding of the loss mechanisms in superconducting BSCCO2223 silver tapes and cable configurations made of these tapes. The loss models are verified experimentally. Reliable measurement methods for measuring AC losses are developed.

Department of Electrical Power Engineering
Department of Electrical Engineering
NKT Research & Innovation A/S
Imperial College London
Period: 01/03/1996 → 01/09/1998
Number of participants: 4
Project participant:
Power Quality (PQ) Modelling

Investigation of coupled transmission-line structures, especially medium voltage power-lines (cables with up to 7 conductors). The purpose of the investigation is to try to find a mathematical model (or models) which can be used to predict how signals (not 50Hz) of different kinds propagate on the power-lines. The final goal is to be able to predict how noise of any kind propagates on a power grid. The work also forms the basis for choosing the kind of signal (modulation) to be used on the power grid for communication purposes. The work which shall continue in the form of a Ph.D project has until now resulted in an overview of different methods that can be used to investigate transfer functions and time domain responses on coupled transmission-line structures. A very simple method presented by Arne Brejning Dalby can in most cases be used with fine accuracy instead of the more rigorous (exact) methods, which in many cases in practice are difficult to implement. The work until now, which was paid by the power companies of Zealand, Denmark, is reported in the "PQ-Modelling report", which can be obtained from IAE. Two papers have been presented at conferences in France and Germany. The work which is part of a larger project where "NESA", a Danish power-company, the Technical University in Lund, Sweden and "Sydkraft" a Swedish power-company also have participated, continues with support from the companies.

Department of Applied Electronics
Department of Electric Power Engineering
Department of Electrical Engineering

NESA A/S
Lund Institute of Technology
Period: 01/03/1996 → 31/12/1997
Number of participants: 3
Project participant:
Andersen, Hans-Kurt (Intern)
Bang, Jørn Winge (Intern)
Project Manager, organisational:
Dalby, Arne Brejning (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 560,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 500,000.00 Danish Kroner

Udformning af procesdisplays

Department of Electrical Engineering
Period: 01/03/1996 → ...
Number of participants: 6
Phd Student:
Petersen, Chr. Rud (Intern)
Supervisor:
Nicolaisen, Bent (Ekstern)
Main Supervisor:
Lind, Morten (Intern)
Active control of noise radiation from vibrating structures
The purpose of this PhD study has been to investigate the use of active noise control to reduce unwanted sound radiation from vibrating panels such as the ones forming the fuselage of an aeroplane, the housing of a large machine etc. The principle of active noise control is to reduce unwanted noise from a primary sound source by adding 'anti noise' with secondary sources, resulting in destructive interference and reduced overall noise. This particular study has focused on ways to control and alter the vibrations of a panel by active means in order to reduce the overall sound radiation from the panel. Secondary vibration sources act directly on the panel to introduce a secondary vibration field in the panel. The work has concentrated on optimal robust feedback control. In 1999 all the time has been spent on writing the thesis "Active control of noise radiation from vibrating structures". Supervisor: Finn Jacobsen Co-supervisor: Mogens Ohlrich

Department of Acoustic Technology

Department of Electrical Engineering
Period: 01/02/1996 → 30/04/1999
Number of participants: 1
Project Manager, organisational:
Mørkholt, Jakob (Intern)

Financing sources
Source: Unknown
Name of research programme: DTU-Su Stipendium, Eksperiment
Amount: 380,000.00 Danish Kroner
Project

Aktiv kontrol af udstået stød fra vibrerende strukturer

Department of Electrical Engineering
Period: 01/02/1996 → 17/11/1999
Number of participants: 3
Phd Student:
Mørkholt, Jakob (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

ALARM, Soft Protection in Power Plants
Modern power plants generate more alarm events than operators can cope with. The alarms occur in situations where there is no automatic procedure that resolves the situation and it is left to the operator to take action. Our objective is to automate the alarm treatment as far as possible. Hopefully a number of alarms can be disabled by means of rules of action based on fuzzy logic. At least some decision support can be given based on the signal flows in the system such that operators can see the consequences of alternative actions. The project contains three main elements: 1) to gather existing power plant models and implement them in SIMULINK, 2) to build a total model of a power plant and find the related signal flow graph, and 3) to close certain loops by means of fuzzy controllers. In summary, alarm handling is a soft area that we try to approach from a firm foundation, that is, models and graph theory. The project is a Danish Research Council project (Reg.nr. 28813). See also http://www.iau.dtu.dk/~mb/power.html The project ended prematurely in 1998.

Department of Automation
Distribueret styring af autonome systemer

Department of Electrical Engineering
Period: 01/02/1996 → 25/06/1999
Number of participants: 5
Phd Student:
Lildballe (fratrådt), Jacob (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Perram-John, William (Ekstern)
Sørensen, Paul Haase (Intern)
Sørensen, Allan Theill (Ekstern)

Financial sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Fuzzt alarmbehandling på kraftværker

Department of Electrical Engineering
Period: 01/02/1996 → 01/10/1998
Number of participants: 2
Phd Student:
Bahar (fratrådt), Mehrdad (Intern)
Main Supervisor:
Jantzen, Jan (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Modellering af mikroølgesignaturer for havis

Department of Electrical Engineering
Period: 01/02/1996 → 19/09/2001
Number of participants: 6
Phd Student:
Thomsen, Bjørn Bavnehøj (Intern)
Supervisor:
Pedersen, Leif Toudal (Intern)
Main Supervisor:
Examination of statistical methods for analysis of gamma-ray spectra
Existing methods for examination of airborne gamma-ray spectra with the aim of detecting minor amounts of manmade radioactivity in the environment are evaluated and compared to promising new methods.

A control method for test of the attenuation of ear-plugs for musicians
Custom-moulded earplug for musicians and audience are used more and more. The plugs are relatively expensive compared with ordinary hearing protectors, because they are made from an impression of the individual user's ear-canal and outer ear. A simple method is needed to test the attenuation of the plug for the individual user. Therefore a comparison has been made between measurements carried out in accordance with the standard hearing protector method (ISO 4869-1, Hearing threshold determinations with one-third octave noise in a special diffuse field) and the simpler sound field audiometry method (ISO 8253-2). Almost every audiological clinic in Denmark uses the latter method, and therefore test facilities for a simple control test are available. The experimental work is finished, and the results are presented in the report (in Danish): 'Måling af høreværnsdæmpning via fritfeltsaudiometri,' Teknisk Audiologisk Laboratorium, Sdr. Boulevard 29, DK-5000 Odense C. The project has been carried out in collaboration with Bjørn Knud Andersen, Technical Audiological Laboratory, Odense.

Characterization and utilization of plant fibres for new, environmentally friendly products
The project is aimed at the basic understanding of wood- and plant fibre properties with a view to the better utilisation of natural fibres for industrial products. The two major tasks of the BKM involvement are 1) the study of cell wall structure with respect to sorption of water and 2) the study of the effects of hygrothermal treatment of wood- and plant fibres.
Detection of landmines for humanitarian demining - a feasibility study

More than 100 million anti-personel landmines are spread during wars all over the world. In the afterwar period these landmines constitute a major obstacle for rebuilding the society and the present methods for finding the mines are very slow, very dangerous and very unreliable. This project has been concerned about studying high-tech methods for the detection of landmines and in particular the very small plastic types without any metal. The project was lead by Center for Advanced Technology and IAE contributed to the system definition and specification, infrared detection and detection by ground penetration radar systems. As a major result IAE demonstrated that the smallest non-metallic plastic mines can be detected by a stepped frequency ground penetrating radar.

Engineering problem solving and use of knowledge

In the project engineers' initial comprehension and modelling of problems is investigated and their use of theoretical and practical knowledge is identified. The idea is to simulate practical open ended problem situations and present them on a CD-rom. A first version dealing with an industrial production plant is under construction. Under controlled conditions, engineers with different theoretical and practical backgrounds are exposed to the presentation and asked first to identify and describe relevant problems and then to propose methods for solving the problems.
PIPESCAN
The purpose of the project is to develop control and supervision system for the Danish autonomous underwater vehicle MARTIN. The objective of the control and supervision system is to ensure reliable and safe mission performance in inspection of pipelines and seacables. The control and supervision tasks are shared between an operator and the computer system onboard the vehicle.

Department of Automation
Risø National Laboratory for Sustainable Energy
Department of Electrical Engineering
Maridan Aps
Period: 01/01/1996 → 31/12/1998
Number of participants: 3
Project participant:
Larsen, Mikael Bliksted (Intern)
Andersen, Nils Axel (Intern)
Project Manager, organisational:
Lind, Morten (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 726,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 538,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner

Optimal Reguleringsteknisk Sensorudnyttelse
Department of Electrical Engineering
Period: 01/10/1995 → 03/02/1999
Number of participants: 4
Phd Student:
Larsen, Thomas Dall (Intern)
Main Supervisor:
Andersen, Nils Axel (Intern)
Examiner:
Christensen, Henrik Iskov (Ekstern)
Sørensen, Paul Haase (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
HIGHWAY
Optical Time Division Multiplexing (OTDM) will be a possibility to upgrade optical transmission system capacity beyond electronic capabilities. Hence, in order to use this technology in trunklines with multiple nodes, methods for all-optical demultiplexing and add-and-drop multiplexing must be investigated. The scope of this project is to derive crucial parameters limiting the transmission capacity and to develop optical components enabling the upgrade of existing transmission systems to 40 Gbit/s and above.

Department of Electromagnetic Systems
Department of Electrical Engineering
Alcatel SEL
France Telecom
Phillips - PML
Heinrich-Hertz Institute
Deutsche Telekom AG
Eidgenössische Technische Hochschule
BT Laboratories
University of Bristol
Number of participants: 17
Project participant:
Clasen, Anders (Intern)
Buxens Azcoaga, Alvaro Juan (Intern)
Veith, Gustav (Ekstern)
Lefevre, Rene (Ekstern)
Bouchoule, Sophie (Ekstern)
Houany, Jean (Ekstern)
Hoffmann, Detlef (Ekstern)
Sartorius, Bernd (Ekstern)
Burkhard, Herbert (Ekstern)
Hansmann, Stefan (Ekstern)
Melchior, Hans (Ekstern)
Nesset, Derek (Ekstern)
Kelly, Tony (Ekstern)
Deitrich, Ian H. (Ekstern)
Penty, Richard V. (Ekstern)
Project Manager, organisational:
Poulsen, Henrik Nørskov (Intern)
Lach, Eugen (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 3,000,000.00 Danish Kroner

Phased array WDM
It is very likely that integrated components will obtain a breakthrough in connection with WDM (Wavelength Division Multiplex) systems, and by participating in METON we have designed a number of components, the most complicated being the Phased Array unit. Splitting the signal from one waveguide into a large number of waveguides and combining these again, it is possible to create a filter with a number of pass/stop bands. We have used two different numerical methods for analyzing this component, and obtained a very good agreement with results measured on devices manufactured at MIC. Especially the Far Field Perturbation Method is very suitable for optimization of such a component.

Department of Electromagnetic Systems
WDM Networks and Transmission

This topic is concentrated on contributions to the ACTS-project METON in co-operation with CBT 3 and MIC. The overall purpose of the METON project is to develop an optical WDM-based transport layer to support an ATM/SDH network in providing, cost-effectively, a significant number of subscribers with a multi-service network as well as demonstrating the results in a WDM network based on the Stockholm Gigabit Network. MIC, CBT 3 and CBT 4 have developed a WDM and an Add/Drop multiplexer based on silica-on-silicon technology. The main contribution from CBT 4 has been to develop a WDM transmission simulation program and necessary models for optical components (e.g. nonlinear fiber, optical filters) in order to evaluate the transmission characteristics. The program is called STONE (Simulation Tool for Optical Networks). Within the area of CW transmitters for WDM networks the stability of fiber DFB lasers has been investigated in co-operation with CBT 3 and MIC (Mikroelektronik Centret). The influence of Stimulated Raman Scattering (SRS) on WDM transmission has been included in an optical network simulator at British Telecom Laboratories as a part of an industrial Ph.D. program. With increases in transmission speed as well as in network complexity, the optical phase characteristics of components used in optical communication systems might turn out to be a critical parameter. In order to evaluate the importance of the phase it is essential to be able to measure its wavelength dependence accurately. A phase-shift set-up has been built and the dispersion properties of components such as filters, add-drop multiplexers, arrayed waveguide gratings multiplexers, etc., have been characterised successfully. The measured phase characteristics will be related to observed systems impairments through numerical simulation as well as transmission experiments. Publications: P1449, P1451, P1456 and P1459. The project has been moved to COM by Dec. 31, 1998.

Electromagnetic Systems

Department of Electrical Engineering
Ericsson Telecom AB
Tele Danmark
Herbert Venghaus

Technical University of Denmark
Period: 01/09/1995 → 31/12/1998
Number of participants: 9
Project participant:
Pedersen, Rune Johan Skullerud (Intern)
Rasmussen, Christian Jørgen (Intern)
Kjeldsen, Peter Møller (Intern)
Jørgensen, Bo Foged (Intern)
Peucheret, Christophe (Intern)
Johansson, Sonny (Ekstern)
Nielsen, Steen Krogh (Ekstern)
Kristensen, Martin (Ekstern)

Project Manager, organisational:
Jeppesen, Palle (Intern)

**Financing sources**

Source: Unknown
Name of research programme: **Ukendt**
Amount: **1,000,000.00** Danish Kroner
Source: Unknown
Name of research programme: **Ukendt**
Amount: **2,000,000.00** Danish Kroner

**DK-Superconductors in the Electric Power Sector**
The goal of the project is to investigate the potential use of high temperature superconductors in the electric power sector. The technological possibilities of using superconductors in power cables for transmission and distribution will be examined experimentally based on a 30 m long prototype power cable by year 2000. The cable under design and construction is made with a room temperature dielectric design i.e. the electrical insulation is placed outside the cryostat. In connection with the design of the cable experimental work is being carried out at ELTEK to dimension the former, arrangement of the superconducting tapes, AC losses, critical current, cryostat, electrical insulation, superconducting cable end terminations and closed cycle cooling system. The goal is to construct a 10 m long cable model and test it in 1998 and a 3 phase 30 m cable model by year 2000.

Department of Electric Power Engineering
Department of Management Engineering
Department of Electrical Engineering
NKT Research & Innovation A/S
NKT Cables A/S
Forskningscenter Risø
NESA A/S
Københavns Belysningsvæsen

Period: **01/05/1995 → 01/05/2002**
Number of participants: **11**

Project participant:
Pinholt, Henriette Understrup (Intern)
Holm (fratrådt), Jesper (Intern)
Andersen, Erik (Intern)
Larsen, Jørgen (Intern)
Olsen (Fratrådt), Ole Dirch (Intern)
Christensen, Jørn Erik Berriil (Intern)
Däumling (fratrådt), Manfred (Intern)
Holbøll, Joachim (Intern)
Kyhle, Anders (Intern)
Nielsen, Jørgen Nygård (Intern)

Project Manager, organisational:
Tønnesen, Ole (Intern)

**Financing sources**

Source: Unknown
**Home Automation**

This project is part of ETHOS - a project under the EU-Esprit programme. Several Danish manufacturers and utilities are involved, and the Danish part of the project is managed by DEFU. The aim of the project is to provide an inter-connection of available electronic devices in private homes using the open EHS (European Home Systems) standard and protocols for in-home communication and to establish two way communication links between customers and utilities for value added services and energy management. In Denmark a range of applications are evaluated such as multi-utility meter reading (electricity, district heating, natural gas heating and water), load and comfort control, control/alarms in gas installations and display of consumption information and DSM advice via a PC interface. In 1996 a lab set-up has been established to demonstrate the basic functions of the system. ELTEK has contributed through 2 master’s projects, in which specific EHS-applications were programmed. In spring 1997 a test house was fully equipped with EHS-units for metering electricity, heat and water and for light control. A few months later similar systems were installed in 5 more dwellings. Two master’s projects - with 4 students participating - have been completed in 1997. In 1998 further installations have been made in around 100 houses. A conclusion of the experiment has not yet been drawn due to problems with a new EHS-unit, which communicates data via a PSTN-line. An alternative way of communicating has been demonstrated in a master's project where the Internet is used as communication media. Other student projects have looked into data base techniques and an Explore like user interface has been build to visualise units on the EHS-bus.

**Department of Electric Power Engineering**

DEFU a.m.b.a.

Period: 01/02/1995 → 01/01/9999

Number of participants: 2

Project participant:

Kofod, Casper (Ekstern)

Project Manager, organisational:

Pedersen, Knud Ole Helgesen (Intern)
Analyse af satellitantenner med ekstrem nøjagtighed

Department of Electrical Engineering
Period: 01/01/1995 → 27/03/1998
Number of participants: 4
Phd Student:
Lumholt, Michael (Intern)
Main Supervisor:
Breinbjerg, Olav (Intern)
Examiner:
Andersen, Jørgen Bach (Ekstern)
Maci, Stefano (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Danske bidrag til kryptografiens historie
I til knytning til et igangværende samarbejde med Matematiklærerforeningen omkring udførelsen af midtvejsprojekter i systemlære med det formål at frembringe interactive undervisningsværktøjer til brug i gymnasiets matematikundervisning i det nye emne kryptografi, gennemføres der et egentlig teknologi-historisk forskningsprojekt for at fremskaffe egnet kildemateriale med særlig tilknytning til Danmark. En historisk bearbejdning af dette kildemateriale er til sin tid planlagt at indgå i en undervisningspakke sammen med de nævnte ebd-værktøjer, der vil blive formidlet til gymnasielærerne af Matematiklærerforeningen. Projektet har i øvrigt nær tilknytning til den matematisk-historiske forskning ved andre danske universiteter og herunder især det såkaldte "Julius Petersen-projekt", hvor man samarbejder med Odense Universitet. Finansieret som del af instituttets samlede bevilling.

Department of Electric Power Engineering

Matematiklærerforeningen
Period: 01/01/1995 → …
Number of participants: 2
Project participant:
Nissen, Knud (Ekstern)
Project Manager, organisational:
Franksen, Ole Immanuel (Intern)

ERUDIT, European Network in Uncertainty Techniques Developments for Use in Information Technology
ERUDIT is an open network concerning modelling with uncertainty and fuzzy logic. Its objective is to establish a communication network for researchers, students and practitioners. Our contribution is to co-chair the training and education committee. A service centre in Aachen, Germany, holds the network together. ERUDIT uses Internet, World Wide Web, and a newsletter to disseminate information. There are eight committees other than the human resources committee, and the network comprises 235 nodes consisting of 60% universities and 40% industrial nodes. The network is an ESPRIT Network Of Excellence (contract no 8193). See also http://www.mitgmbh.de/erudit/ The project has been extended into a second phase, ERUDIT 2.

Department of Automation

Imperial College of Science, Technology and Medicine

ELITE Foundation
Period: 01/01/1995 → 31/03/2000
Number of participants: 3
Project participant:
Mamdani, E.H. (Ekstern)
Zimmermann, H.-J. (Ekstern)
Project Manager, organisational:
Jantzen, Jan (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 70,000.00 Danish Kroner

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**Feltlinierettede strømme i jordens magnetosfære**
Department of Electrical Engineering
Period: 01/01/1995 → 01/07/1998
Number of participants: 3
Phd Student:
Gjerløv, Jesper Wittendorff (Intern)
Main Supervisor:
Korsbech, Uffe C C (Intern)
Examiner:
Høeg, Per (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

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**Locating earth fault in distribution network with Petersen coil**
In electric distribution network with Petersen coil, the single phase earth fault current is very small, for which reason it is difficult to locate. A method for locating these faults has been developed and testet in DEFU's 10 kV laboratory in Odense. A prototype is under test in the 10 kV network in Randers.

Department of Electric Power Engineering
Department of Electrical Engineering
DEFU a.m.b.a.
Period: 01/01/1995 → 01/01/9999
Number of participants: 2
Project Manager, organisational:
Nielsen, Arne Hejde (Intern)
Jørgensen, Hans Jørgen (Ekstern)

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**Robust og optimal regulering af samplede systemer**
Department of Electrical Engineering
Period: 01/01/1995 → 21/02/1999
Number of participants: 4
Phd Student:
Rank, Mike Lind (Intern)
Supervisor:
Parkum, Jens Ejner (Ekstern)
Stoustrup, Jakob (Intern)
Main Supervisor:
Niemann, Hans Henrik (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Okklusionseffekters betydning for lydkvalitet og fysisk komfort

Department of Electrical Engineering
Number of participants: 2
Phd Student: Spurs, Tonie Maj (Intern)
Main Supervisor: Poulsen, Torben (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Radar Remote Sensing of Soil Moisture

Department of Electrical Engineering
Number of participants: 3
Phd Student: JIANKANG, JI (Intern)
Main Supervisor: Skriver, Henning (Intern)
Examiner: Madsen, Søren Nørvang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden International Finan-SU
Project: PhD

Analoge signalbehandlingsmetoder til anvendelse i forbindelse med intelligente transducerer

Department of Electrical Engineering
Period: 01/11/1994 → 08/03/1999
Number of participants: 3
Phd Student: Steensgaard-Madsen, Jesper (Intern)
Main Supervisor: Bruun, Erik (Intern)
Examiner: Nielsen, Peter Østergaard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Videnintegration i intelligente kontrolsystemer

Department of Electrical Engineering
Number of participants: 4
Phd Student: Henriksen, Lars (Intern)
Main Supervisor: Andersen, Nils Axel (Intern)
Examiner: Sørensen, Paul Haase (Intern)
Velund, Aage (Ekstern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Wide bandwidth control of the air-fuel ratio of spark ignition engines**
Department of Electrical Engineering
Period: 01/08/1994 → 25/05/2000
Number of participants: 5
Phd Student:
Chevalier, Alain Marie Roger (Intern)
Supervisor:
Sorenson, Spencer C (Intern)
Main Supervisor:
Hendricks, Elbert (Intern)
Examiner:
Jannerup, Ole Erik (Intern)
Rasmussen, Henrik (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**EMAC campaigns**
EMISAR has participated in the European Multi-sensor Airborne Campaign (EMAC) organised and financed by the European Space Agency (ESA). In June 1994 and in March, May, and July 1995 EMISAR collected fully polarimetric L- and C- band data from the NOPEX site at Uppsala, Sweden and from three ice and snow sites in Norway and Finland. Additionally, on each campaign the Danish calibration site at Foulum was mapped in order to allow calibration verification. The processing of the EMAC’95 data was completed in 1996. By then more than 50 GB of focused and calibrated data had been delivered to ESA for dissemination to Principal Investigators in Europe. An analysis of the internal and external calibration data has proved that the EMISAR stability justifies using just a single external calibration per mission. In April 1997 the EMAC-94/95 Final Results Meeting was held, and the proceedings from this meeting are expected early 1998. (Related projects - see: www.dcrs.dtu.dk).

Department of Electromagnetic Systems
Department of Electrical Engineering
University of Manchester
NORUT Information Technology
Aalto University
Vrije Universiteit Amsterdam
European Space Agency
Remote Sensing Applications Consultants
Number of participants: 14
Project participant:
Grinder-Pedersen, Jan (Intern)
Dall, Jørgen (Intern)
Kristensen, Steen Savstrup (Intern)
Madsen, Søren Nørvang (Intern)
Rezai, Mac (Intern)
Sørensen, Peter (Intern)
Woelders, Kim (Intern)
Theakstone, Wilf (Ekstern)
Guneriussen, Tore (Ekstern)
Hallikainen, Martti (Ekstern)
van de Griend, Adriaan (Ekstern)
Attema, Evert (Ekstern)
Project Manager, organisational:
Christensen, Erik Lintz (Intern)
Wooding, Mike (Ekstern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,600,000.00 Danish Kroner
Project

SESDIP, Structural Evaluation of Synthesis of Distributed Industrial Processes
SESDIP concerns analysis and design of control systems, and the objective is to develop tools and methodologies for complex industrial processes. SESDIP focuses on structure, that is methodologies that exploit causal relations underlying the models. Our contribution to the project is qualitative analyses based on structure rather than numbers by means of directed graphs (digraphs). Models on matrix form (state space equations) can be analysed structurally with respect to controllability, observability, decomposability, disturbance rejection, input/output decoupling, pole assignability, and decentralized control. The graph approach is relatively new, but there are other research groups around the world. The Danish contribution is towards programming and applications rather than original theory. The project is under the EU programme Esprit Basic Research (contract no 8924).

Department of Automation
Department of Electrical Engineering
City University London
Aalto University
Ecole Centrale de Nantes
University of Patras
Intrasoft
Laboratoire d'Automatique de Grenoble
Period: 23/06/1994 → 22/06/1996
Number of participants: 8
Project participant:
Bahar (fratrådt), Mehrdad (Intern)
Karcanias, Nicos (Ekstern)
Koivo, Heikki (Ekstern)
Malabre, Michel (Ekstern)
Groumpos, Peter (Ekstern)
Mantzari, P. (Ekstern)
Dion, Jean-Michel (Ekstern)
Project Manager, organisational:
Jantzen, Jan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 700,000.00 Danish Kroner
Project

Optically Active Materials in Fibers and Silica-on-Silicon Integrated Photonics Circuits
The MUP2 frame program "Optically Active Materials in Fibers and Silica-on-Silicon Integrated Photonics Circuits" aims to develop photonics components for local networks and high speed optical communication systems. This requires development of new, optically active and non-linear materials. In particular, the program has initiated activities within the following areas: - Development of processes for erbium doping PECVD grown silica films - development of erbium doped silica planar waveguides with gain - development of erbium doped loss-less functional devices - development of high-concentration erbium doped fibers for fiber lasers - development of erbium doped polarisation maintaining fiber - development of low-concentration distributed erbium doped fiber for distributed optical amplifiers - development of fiber lasers for high-speed systems - development of techniques for fiber termination of integrated photonic devices -
development of models for high-concentration erbium doped waveguides - development of models for erbium doped fiber lasers

Electromagnetic Systems
Department of Electrical Engineering
Department of Micro- and Nanotechnology
IONAS A/S
Lucent Technologies Denmark A/S
Period: 15/06/1994 → 30/06/1998
Number of participants: 1
Project Manager, organisational:
Bjarklev, Anders Overgaard (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,351,000.00 Danish Kroner
Project

Layout generation - herunder placement og routing - af analoge og mixed signal ASIC's.

Department of Electrical Engineering
Period: 01/05/1994 → 01/01/1998
Number of participants: 3
PhD Student:
Bloch, Rene (Intern)
Main Supervisor:
Olesen, Ole (Intern)
Examiner:
Bruun, Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Dynamic control of robotic manipulators - mechatronics approach
This project is a cooperation between the polish University of Mining and Metallurgy, the french university INSA-Lyon and the Technical University of Denmark. The project is supported by the Commission of the European Communities under the COPERNICUS project and DG 13. The main aim of the project was to improve current design methodologies of robotic manipulators using the mechatronic approach. The most promising areas of the research are the following: - sensor modelling, - mechatronics approach to design of actuators, - application of compliant devices attached to the robot, - methodologies for development of advanced control algorithms. The basic tasks of this Copernicus project are listed below: - Modelling of the components of robotic manipulators - Development of control strategies for robotic manipulators - Implementation and experimental validation of the mechatronic design methodology. More information on http://www.iau.dtu.dk/research/autonom/cop93.html

Department of Automation
Department of Electrical Engineering
Period: 01/04/1994 → 31/03/1996
Number of participants: 4
Project participant:
Szymkat, Maciej (Ekstern)
Uhl, Tadeuz (Ekstern)
Betemps, Maurice (Ekstern)
Project Manager, organisational:
Ravn, Ole (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 1,928,724.00 Danish Kroner

Luftbåren Gamma-Strålingsspektrometri Airborne Gamma-Ray Spectrometry

Department of Electrical Engineering
Period: 01/04/1994 → 25/03/1998
Number of participants: 4
Phd Student:
Hovgaard, Jens (Intern)
Main Supervisor:
Korsbech, Uffe C C (Intern)
Examiner:
Roed, Jørn (Intern)
Trumpy, Georg (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Sektorministeriel Fin-SU
Project: PhD

Object Based Large Scale Reuse in Industrial Systems Design

Department of Electrical Engineering
Period: 01/03/1994 → 09/09/1997
Number of participants: 3
Phd Student:
Sørensen, Michael (Intern)
Main Supervisor:
Lind, Morten (Intern)
Examiner:
Jannerup, Ole Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftale-Finan-SU
Project: PhD

Danish Center for Remote Sensing (DCRS)
The Danish Center for Remote Sensing (DCRS, see "www.drcs.dtu.dk") is one of the centres of the Danish National Research Foundation (Danmarks Grundforskningsfond). It is located at the Department of Electromagnetic Systems (EMI), the Technical University of Denmark. The centre conducts research relating to instruments for remote sensing and their application to Earth observation and Earth Science. The objective of DCRS is to integrate technological R&d in the areas of remote sensing sensors, data processing, interpretation, and visualisation, with earth science studies. dcrs is continuing the sensor r&d activities at emi, however, with focus on advancing observational techniques of importance for earth observations and science. dcrs is conducting science experiments and data collection campaigns to provide original experimental data for the research of dcrs scientists and dcrs partners. the research at dcrs includes electromagnetics and geophysics modelling. the centres technological research covers subjects within microwave techniques (measurement techniques and development of subsystems for radar and radiometers), microwave sensors (the principles of modern coherent radar, radiometry, system design, technology, and applications), and signal- and data processing methods (including the digital signal processing that transfers the raw microwave sensor data into focused and calibrated imagery, as well as the data- and image processing needed for information extraction, information presentation, data fusion, and archiving). the centres earth science research is pursued in collaboration with associated scientists focused on the application of sar data in: glacier dynamics; Microwave Sea Ice Signatures; Geologic Mapping; Sand Dune Dynamics; and Plant and Soil Mapping.

Department of Electromagnetic Systems
Department of Electrical Engineering
Period: 01/02/1994 → 31/01/1999
Number of participants: 27
Project participant:
Christensen, Erik Lintz (Intern)
Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 50,100,000.00 Danish Kroner
Project

Fejlanalyse af proceskontrolsystemer
Department of Electrical Engineering
Period: 01/02/1994 → 27/05/1997
Number of participants: 4
Phd Student:
Jalashgar, Atoosa (Intern)
Main Supervisor:
Lind, Morten (Intern)
Examiner:
Jørgensen, Sten Bay (Intern)
Larsson, Jan E. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Handlingsstruktur i robot og proceskontrolsystemer
Department of Electrical Engineering
Period: 01/02/1994 → 23/01/1998
Number of participants: 4
Phd Student:
Sediment Transport and Dune Dynamics (ERS-1/2 PI study)

Wind erosion is a major source of soil degradation in arid and semiarid areas. Dust and sand storms eroding agricultural areas are of major economic importance globally, and desertification is a main issue of global change studies. An allocation of 80 ERS scenes is obtained, through a third Announcement of Opportunity (AO3) for the exploitation of ERS data from ESA. In this study ERS InSAR techniques will be tested in four semi-arid areas (Israel/Nizzana, USA/Salton Sea, Egypt/Western Gulf of Suez, and Burkina Faso/Oudalan Province). In previous ERS studies interferometric phase images was used to derive Digital Elevation Models which were then investigated with respect to change. In this study we shall also use correlation images in an attempt to estimate the components of the sediment budget and changes of the vegetation cover. We will relate the results to other possible techniques, in-situ or other remote sensors.

Department of Electromagnetic Systems
Department of Electrical Engineering
Aarhus University
Period: 01/02/1994 → 01/06/1999
Number of participants: 4
Project participant:
Møller, Karen-Margrethe Juul (Intern)
Mohr, Johan Jacob (Intern)
Rasmussen, K. R. (Ekstern)
Project Manager, organisational:
Madsen, Søren Nørvang (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

Vegetation and soil

Vegetation and soil parameters are important for studies using global circulation models. The parameters are essential in estimating and modelling e.g. surface energy balance, evapotranspiration, desertification, deforestation, and carbon dioxide circulation, and on a local scale on yield prediction and agricultural subsidiary enforcement. Vegetation and soil parameters such as soil moisture, vegetation type, structural characteristics for the vegetation (height, foliage, density), and vegetation biomass may be estimated from microwave remote sensing. The research aims at: 1) improving the techniques to determine vegetation type from SAR images, especially agricultural crops, but also with a view to natural vegetation, such as trees and heath; and 2) studying and evaluating algorithms for retrieval of vegetation and soil parameters, such as soil moisture, and vegetation height and biomass. The application of SAR to monitor agricultural crops, biomass and soil moisture is being studied in collaboration with Research Center Foulum (RCF). The farmland at RCF has been mapped each year from 1994 to 1998 from March to July with both L- and C-band polarimetric SAR. During the growing season and particularly at the time of data acquisition, a series of in-situ measurements was performed of soil and vegetation parameters. This information is used to interpret and model the backscatter characteristics of the soil and vegetation and forms the basis for studying methods for parameters retrieval. The main results of this project are new results in the understanding of scattering mechanisms for backscattering from agricultural crops, new methods for the classification of crops, and thorough evaluation of the classification potential of polarimetric SAR. Results have been or will be published at conferences and in papers.

Department of Electromagnetic Systems
Geological mapping in Greenland

Radar sensors, which are sensitive to the morphological and electrical characteristics of the Earth's surface, are often applied in geological investigations. In a project carried out in collaboration with the Danish Lithosphere Center, L- and C-band SAR polarimetry data and C-band across-track-interferometry (XTI) data were analyzed. The data were acquired by EMISAR in 1994 and 1995 over a test site on the East coast of Greenland. The objective of the project was to investigate the utilization of SAR in geological mapping of rugged, glacially moulded terrain. The project included the generation of an elevation map by means of XTI, an assessment of the potential to map individual lava bands and dikes using SAR images, and an analysis focusing on the use of polarimetric SAR in the classification of different rock and surface types. It was found that an elevation map of the test site can be generated with sufficient spatial resolution and height accuracy. The identification of dikes and lava bands depends on their orientation relative to the radar look direction and the incidence angle of the radar beam on the ground. Polarimetric SAR data alone are not well suited for classification of rock and surface types in the test area because of the complex surface characteristics due to weathering and mass transport. It was also checked whether satellite SAR data (ERS tandem data) can be used to generate an elevation map of the test site, but phase unwrapping proved extremely difficult in this rugged terrain. (Related projects - see: www.dcrs.dtu.dk)
Robust Human Machine Interaction 'ROHMI'
The main objective of project is to facilitate mobility between various laboratories of the ROHMI network. The following two major research themes are covered by the netork activities: Integrated system design and cognitive modelling.

Department of Automation
Department of Electrical Engineering
European Institute of Cognitive Science and Engineering
University of Bonn
Delft University of Technology
Human Reliability Associates
Institut of Systems Engineering and Informatics
University of Kassel
University of Reading
Université de Valenciennes
University of Strathclyde

Period: 01/01/1994 → 31/12/1996
Number of participants: 3
Project participant:
Passen, Rene Marius Maria Van (Intern)
Poulsen, Helle (Intern)
Project Manager, organisational:
Lind, Morten (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 4,200,000.00 Danish Kroner

Dynamic performance of HVDC lines
An industrial Ph. D. project concerning the dynamic behaviour of two or more HVDC lines connected through the HVAC network.

Department of Electric Power Engineering
Department of Electrical Engineering
NESA A/S

Technical University of Denmark
Period: 01/12/1993 → 31/01/1997
Number of participants: 2
Project participant:
Jensen, Marianne Bruntt (Intern)
Project Manager, organisational:
Renne-Hansen, Jan (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 80,000.00 Danish Kroner

SAR - Interferometri.
Akutiske finite element beregninger i tidsdomænet

Department of Electrical Engineering
Period: 01/08/1993 → 23/04/1997
Number of participants: 4
PhD Student:
Jensen, Morten Skaarup (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Barker, Vincent A. (Intern)
Hald, Jørgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

MIRAS

Development of an L-band (1.4 GHz) radio camera has been carried out under an ESA contract with MATRA as the prime contractor. Eleven antenna elements (with a similar number of radiometers) are placed on a Y-formed structure with an arm length of approximately 60 cm. The instrument can be flown on a C-130 aircraft and used for measurement of soil moisture. Also ground based experiments are possible. Under this project, work with optimal algorithms for signal processing of data measured with a Ku-band SAIR demonstrations model (see separate section) has been carried out. The signal processing, comprising work with irregularly sampled spatial frequencies which are interpolated, inverse Fourier transformed, and coordinate transformed, results in the spatial distribution of the brightness temperature. Additional work has been carried out on calibration, which must rely on methods different from those applied for conventional radiometers. (Related projects - see: www.dcrs.dtu.dk).

Department of Electromagnetic Systems
Department of Electrical Engineering

MATRA
Period: 01/07/1993 → 01/07/1999
Number of participants: 3
Project participant:
Laursen, Brian (Intern)
Søbjærg, Sten Schmidl (Intern)
Project Manager, organisational:
Skou, Niels (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 705,000.00 Danish Kroner
Principper og metoder for analog signalbehandling af transducersignaler.

Department of Electrical Engineering
Period: 01/07/1993 → 28/05/1997
Number of participants: 4
Phd Student: Jørgensen, Ivan Harald Holger (Intern)
Main Supervisor: Bruun, Erik (Intern)
Examiner: Helwigh, Hans Eggert (Ekstern)
Nielsen, Lars Drud (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

VLSI kredsløb til analog signalbehandling i forbindelse med intelligente transducer.

Department of Electrical Engineering
Period: 01/07/1993 → 09/09/1997
Number of participants: 5
Phd Student: Fürst, Claus Erdmann (Intern)
Main Supervisor: Bruun, Erik (Intern)
Examiner: Hansen, Ole (Intern)
Helwigh, Hans Eggert (Ekstern)
Nielsen, Peter Østergaard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Dosimetri af beta- og lavenergetisk foton-stråling.

Department of Electrical Engineering
Period: 01/03/1993 → 04/09/1996
Number of participants: 3
Phd Student: Borg, Jette (Intern)
Main Supervisor: Korsbech, Uffe C C (Intern)
Examiner: Trumpy, Georg (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Avancerede metoder i adaptiv regulering

Department of Electrical Engineering
Period: 01/02/1993 → 20/09/1996
Number of participants: 6
Phd Student:
Nørgård, Peter Magnus (Intern)
Supervisor:
Hansen, Lars Kai (Intern)
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Jantzen, Jan (Intern)
Wagner, Christian Hedager (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Designmetoder og teknikker for højhastigs VLSI-kredse
Department of Electrical Engineering
Period: 01/02/1993 → 14/01/1997
Number of participants: 4
Phd Student:
Midtgaard, Jacob (Intern)
Supervisor:
Sparsø, Jens (Intern)
Svensson, Christer (Ekstern)
Main Supervisor:
Olesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Mechatronic approach in design and modelling of robotic manipulators
Department of Electrical Engineering
Period: 01/02/1993 → 04/09/1996
Number of participants: 5
Phd Student:
Baungaard, Jens Rane (Intern)
Supervisor:
Poulsen, Niels Kjølstad (Intern)
Main Supervisor:
Ravn, Ole (Intern)
Examiner:
Abildgaard, Ole (Ekstern)
Jannerup, Ole Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Superledende mikrobølgekredsløb
Department of Electrical Engineering
Period: 01/12/1992 → 31/03/1995
Number of participants: 4
Phd Student:
Hagensen, Morten (Ekstern)
Supervisor:
Mygind, Jesper (Intern)
Vidkjær, Jens (Intern)
Main Supervisor:
Knudsen, Bent (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådene via projektbe
Project: PhD

IMCIA Intelligent Motion Control & Intelligent Actuators.
The IMCIA Research Programme is organised under the Danish Informatic Research Programme (PIFT). The focus is on research and development of methodologies for design and intelligent actuators and intelligent control of motion control of machines, in particular on hydraulic actuator systems for machines and robots.

Department of Control and Engineering Design
Automation
Department of Electrical Engineering
Department of Mechanical Engineering
Aalborg University
Danfoss A/S
Magnemag A/S
Period: 29/10/1992 → 31/12/1997
Number of participants: 9
Project participant:
Andersen, Torben Ole (Intern)
Hansen, Poul Erik (Intern)
Zhang, Muzhi (Intern)
Voigt, Kristian (Intern)
Christensen, Jacob Vejby (Intern)
Andersen, Nils Axel (Intern)
Ravn, Ole (Intern)
Holm, Hans (Ekstern)
Project Manager, organisational:
Conrad, Finn (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 3,721,000.00 Danish Kroner
Project

Modelanvendelse i integreret design af transportsystemer
Department of Electrical Engineering
Number of participants: 3
Phd Student:
Andersen, Gert Lysgaard (Intern)
Main Supervisor:
Lind, Morten (Intern)
Examiner:
Holm, Hans (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Mean value metoden

Department of Electrical Engineering
Period: 01/09/1992 → 17/08/1995
Number of participants: 3
Phd Student:
Hugin, Claus Thomas (Intern)
Main Supervisor:
Ohlrich, Mogens (Intern)
Examiner:
Ødegaard, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Grafgrammatiker og grafiske editorer til modelbygning

Department of Electrical Engineering
Period: 01/08/1992 → 09/05/1996
Number of participants: 2
Phd Student:
Duschek, Jacob (Intern)
Main Supervisor:
Lind, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Syntese af parallelle systemmarktækturer til robotstyringsformål

Department of Electrical Engineering
Period: 01/08/1992 → 21/03/1997
Number of participants: 3
Phd Student:
Hald, Bjarne (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Olesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Huses beskyttende virkning ved luftforurningsuheld

Department of Electrical Engineering
Period: 01/04/1992 → 10/04/1995
Number of participants: 2
Phd Student:
Fogh, Christian Lange (Intern)
Main Supervisor:
Korsbech, Uffe C C (Intern)

Financing sources
Realtidskontrol af ikke-lineære systemer
Department of Electrical Engineering
Period: 01/04/1992 → 25/08/1995
Number of participants: 5
Phd Student:
Vesterholm, Thomas (Ekstern)
Supervisor:
Hendricks, Elbert (Intern)
Houbak, Niels (Intern)
Sorenson, Spencer C (Intern)
Main Supervisor:
Ravn, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Specifikation, syntese og verifikation af komplekse ASIC's eksemplificeret inden for det synkron digitale hieraki
Department of Electrical Engineering
Period: 01/03/1992 → …
Number of participants: 3
Phd Student:
Lindqvist, Lars (Intern)
Supervisor:
Madsen, Jan (Intern)
Main Supervisor:
Olesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Opbygning af et digitalt objektorienteret robotsystem som tilladerr integration af eksterne sencorer
Department of Electrical Engineering
Period: 01/02/1992 → 02/08/1995
Number of participants: 3
Phd Student:
Poulsen, Bjarne (Intern)
Main Supervisor:
Jannerup, Ole Erik (Intern)
Examiner:
Rasmussen, Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning u/skema-SU
Project: PhD

Principper og metoder til current mode analog signalbehandling
Department of Electrical Engineering
Period: 01/02/1992 → 02/01/1996
Number of participants: 3
PhD Student:
Kaulberg, Thomas (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Helwigh, Hans Eggert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

**Samtidig tids- og frekvensanalyse**
Department of Electrical Engineering
Period: 01/02/1992 → 02/08/1995
Number of participants: 3
PhD Student:
Agerkvist, Finn T. (Intern)
Main Supervisor:
Jacobsen, Finn (Intern)
Examiner:
Eiberling, Claus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

**Acoustics and geometries of concert halls**
This investigation attempts to reveal general relationships between room geometry and the acoustic properties in concert halls through statistical analysis of the data available in our existing data base. The examined objective acoustic parameters for audience are EDT, ts, L EF, C, G, G(\(r\)) (Rate of Spatial Decay [dB/10 m]), and for musicians, EDT P (EDT measured on the podium) and ST1. The acoustic parameters are averaged over frequency and position before the analyses. This year correlation analysis, principal component analysis and multible linear regression analysis have been carried out in order to see if these methods were able to reveal further information on the interaction between room geometry and acoustic properties. Besides, new geometrical parameters were included in the analyses; some were taken from newer literature and some were developed within the project. Also, two general and flexible room models were made in the simulation program ODEON, one rectangular model and one fanshaped model, in which single geometrical parameters were varied in an attempt to verify the regression models. For the acoustic parameters the correlation analysis showed that often many of the geometrical parameters had a good correlation with the acoustic parameters or with the difference between the parameter and its expected value according to diffuse field theory. Furthermore, the principal component analysis revealed complicated interactions among the geometrical parameters. From the simulations in ODEON it was generally found that the altered geometrical parameter showed the same effect on a current acoustic parameters as found from the regression models. The similarity between the ODEON calculations and the regression models was more distinct for acoustic parameters not related to reverberation time (ie parameters for which no value can be predicted via diffuse field theory).

Department of Acoustic Technology

Department of Electrical Engineering
Period: 01/01/1992 → ...
Number of participants: 2
Project participant:
Weitze, Christoffer Andreas (Intern)
Project Manager, organisational:
Gade, Anders Christian (Intern)

**Danish Primary Laboratory on Acoustics**
The Danish Primary Laboratory on Acoustics, DPLA, was established in 1991 by the Ministry of Industry. The laboratory is based on a cooperation agreement between the Department of Acoustic Technology, DTU, and the company Brüel & Kjær.
A/S. The Danish Primary Laboratory on Acoustics is accredited by the Danish Accreditation Body for Testing Laboratories, DANAK, to carry out primary calibration of microphones and accelerometers. The development of new software for free-field reciprocity calibration of microphones was nearly finished by the end of 1997. The measurement system makes it possible to carry out automated calibrations in a wide frequency range (from 630 Hz to 100 kHz) and for measurement distances in the range from 200 to 800 mm between the microphones, variable in steps of 0.1 mm. An automatic measurement system has been developed for the calibration of pistonphones. DANAK has appointed the Danish Primary Laboratory on Acoustics to organise an intercomparison on the calibration of pistonphones and sound calibrators among accredited laboratories under the auspices of EA, European cooperation for Accreditation. The intercomparison was conducted in 1998/1999 and the final report issued in December 1999.

Department of Acoustic Technology

Department of Electrical Engineering

Brüel & Kjær A/S
Period: 01/01/1992 → …
Number of participants: 2
Project participant:
Olsen, Erling Sandermann (Intern)
Project Manager, organisational:
Rasmussen, Knud (Intern)
Project:

Design af analogeinterface-chip

Department of Electrical Engineering
Period: 01/01/1992 → 25/09/1995
Number of participants: 2
Phd Student:
Ølgaard, Christian (Intern)
Main Supervisor:
Olesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

VLSI implementering af neurale netværk

Department of Electrical Engineering
Period: 01/10/1991 → 21/03/1995
Number of participants: 2
Phd Student:
Lansner, John (Intern)
Main Supervisor:
Bruun, Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Program-stipendium
Project: PhD

Neurale netværk i VLSI teknologi

Department of Electrical Engineering
Period: 01/09/1991 → 09/01/1995
Number of participants: 3
Phd Student:
Lehmann, Torsten (Intern)
Main Supervisor:
Bruun, Erik (Intern)
Examiner:
Skelboe, Stig (Ekstern)
Selecting hearing aid amplification for different listening conditions

Department of Electrical Engineering
Number of participants: 2
Phd Student: Keidser, Gitte (Intern)
Main Supervisor: Poulsen, Torben (Intern)

Optical Current sensor for high voltage applications

Department of Electrical Engineering
Period: 01/01/1991 → ...
Number of participants: 2
Phd Student: Petersen, Anders E. (Intern)
Main Supervisor: Tønnesen, Ole (Intern)

Undersøgelse af sammenhæng mellem elfiltres rensningsgrad og agglomeringegenskaber af forskellige typer flyveaske

Department of Electrical Engineering
Period: 01/01/1991 → 29/10/1993
Number of participants: 5
Phd Student: Kildesø, Jan (Intern)
Supervisor: Bhatia, Vinay K. (Ekstern)
Lind, Leif (Ekstern)
Main Supervisor:
**Design of Analogue Integrated Circuits for Very Low Frequency Signal Processing**

Department of Electrical Engineering  
Period: 01/09/1990 → 01/01/1994  
Number of participants: 2  
Phd Student: Shah, Peter Jivan (Intern)  
Main Supervisor: Bruun, Erik (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ATV- Gammel ordning  
Project: PhD

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**Formel syntese udfra høj-niveau syntese**

Department of Electrical Engineering  
Period: 01/09/1990 → 21/03/1995  
Number of participants: 3  
Phd Student: Bojsen, Per (Intern)  
Supervisor: Madsen, Jan (Intern)  
Main Supervisor: Olesen, Ole (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Gammel ordning u/skema-SU  
Project: PhD

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**Planlægning i procesanlæg**

Department of Electrical Engineering  
Period: 01/08/1990 → 02/08/1995  
Number of participants: 2  
Phd Student: Larsen, Morten Nordby (Intern)  
Main Supervisor: Lind, Morten (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Gammel ordning u/skema-SU  
Project: PhD

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**Datamaskinarkitektur og teknologi til implementering af højhastigheds digitale signalbehandlingssystemer**

Department of Electrical Engineering  
Period: 01/09/1989 → 02/08/1995  
Number of participants: 3  
Phd Student:
Jørgensen, Jørn Hjelm (Intern)
Main Supervisor: Christensen, Erik Lintz (Intern)
Examiner: Roth, Ole (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Designmetodologi for højhastighedskredsløb
Department of Electrical Engineering
Period: 01/09/1989 → 01/07/1996
Number of participants: 3
Phd Student: Jensen, Ole Perch (Intern)
Supervisor: Stassen, Flemming (Intern)
Main Supervisor: Olesen, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Formulering af generiske MFM-modeller for skibssystemer med henblik på brug i diagnosesystemer
Department of Electrical Engineering
Period: 01/09/1989 → 04/10/1993
Number of participants: 2
Phd Student: Jørgensen, Steffen Stevnhoved (Intern)
Main Supervisor: Lind, Morten (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Graphical Control Environment (GRACE)
Department of Electrical Engineering
Period: 01/02/1989 → 15/06/1994
Number of participants: 3
Phd Student: Osman, Ashraf (Intern)
Main Supervisor: Lind, Morten (Intern)
Examiner: Andersen, Peter Bøgh (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD
Adaptive Control

In practice this implies that an adaptive controller is a controller with adjustable parameters, which is tuned on-line according to some mechanism in order to cope with time-variations in process dynamics and changes in the environment. This can be approached in different ways, but at IAU we focus primarily on the so-called indirect self-tuning regulators. A "pragmatic" approach to adaptive control is taken. We do not spend much time on stability proofs, but our research is primarily governed by implementation issues. We are continuously working on developing a set of software tools to facilitate practical implementation of adaptive controllers. Furthermore we are always interested in trying out adaptive methods on "real world" systems. This is also reflected in the DTU course "50360 Adaptive Control", taught by the department. The IRCST tool was originally implemented in an adaptive control context, but it has since then developed way beyond that. Today the tool contains an adaptive controller "template" and a "library" of building blocks for use in adaptive control. The library contains a number of utilities for control design, filtering, recursive estimation, and utilization of physical insight. A feature is the close connection to MATLAB. Matlab is an integrated part of the tool: filters, matrices, vectors, parameters, etc. are initialized in MATLAB and then send to the Real-time program. The results are then returned to MATLAB either during or after a run.

Department of Automation

CICT

Department of Informatics and Mathematical Modeling

Department of Electrical Engineering

Period: 01/01/1983 → 01/01/1993
Number of participants: 2
Project participant:
Nørgård, Peter Magnus (Intern)
Project Manager, organisational:
Ravn, Ole (Intern)

**Positron annihilation**
Studies of defects in solid materials by use of the positron lifetime method. Present projects: 1) Investigation of dislocation formation in copper and aluminium under tensile stress. 2) Studies of defect contents in meteoric glasses found in Africa and Australia.

Department of Automation
Department of Electrical Engineering
Research Establishment Risø
Royal Veterinary and Agricultural University

Period: 01/01/1972 → 31/12/1999
Number of participants: 3

Project participant:
Eldrup, Morten (Ekstern)
Koch, Christian (Ekstern)

Project Manager, organisational:
Trumpy, Georg (Intern)

**Activities:**

**Topic Chair of IEEE PEAC 2018**
Period: 2018
Zhe Zhang (Organizer)
Department of Electrical Engineering
Electronics

**Related event**

**Topic Chair of IEEE PEAC 2018**
04/11/2018 → 07/11/2018
Activity: Attending an event › Participating in or organising a conference

**Member of Technical Program Committee in the 2nd IEEE International Power Electronics and Application Conference and Exposition (PEAC 2018)**
Period: 4 Nov 2018 → 7 Nov 2018
Zhe Zhang (Organizer)
Department of Electrical Engineering
Electronics

**Description**
Member of Technical Program Committee in the 2nd IEEE International Power Electronics and Application Conference and Exposition (PEAC 2018)
Degree of recognition: International

**Related event**

**Member of Technical Program Committee in the 2nd IEEE International Power Electronics and Application Conference and Exposition (PEAC 2018)**
04/11/2018 → 07/11/2018
Activity: Attending an event › Participating in or organising a conference

**Automation and Control (Organisational unit)**
Period: 15 Sep 2018 → 15 Oct 2018
Mogens Blanke (Chairman)
Department of Electrical Engineering
Automation and Control

Description
International Evaluation of NTNU Education Program in Engineering Cybernetics
Degree of recognition: International

Related organisation
Automation and Control (Organisational unit)
Blanke, M. (Chairman)
15 Sep 2018 → 15 Oct 2018
Activity: Membership › Membership in review committee

Impact of the skull model on simulated TFUS beam profiles
Period: 17 Jul 2018 → 21 Jul 2018
Cristina Pasquinelli (Speaker)
Hazael Montanaro (Other)
Esra Neufeld (Other)
Hyunjoo Jenny Lee (Other)
Axel Thielscher (Other)
Department of Electrical Engineering
Center for Magnetic Resonance
Documents:
EMBC18_2973_MS-1
Links:
https://embc.embs.org/2018/

Related event
40th International Conference of the IEEE Engineering in Medicine and Biology Society
17/07/2018 → 21/07/2018
Honolulu, United States
Activity: Talks and presentations › Conference presentations

DTU CEE Summer School 2018: Modern Optimization in Energy Systems
Period: 25 Jun 2018 → 29 Jun 2018
Jalal Kazempour (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Description
DTU CEE Summer School 2018: Modern Optimization in Energy Systems

Related event
DTU CEE Summer School 2018: Modern Optimization in Energy Systems
25/06/2018 → 29/06/2018
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Judge of DTU Green Challenge 2018
Period: 22 Jun 2018
Zhe Zhang (Panel member)
Description
Judge of DTU Green Challenge 2018
Degree of recognition: National

Related event
Judge of DTU Green Challenge 2018
22/06/2018 → 22/06/2018
Activity: Attending an event › Participating in or organising a conference

Pitfalls in Acoustic Transducer Modeling for Focused Ultrasound (FUS)
Period: 16 May 2018 → 19 May 2018
Cristina Pasquinelli (Other)
Hazael Montanaro (Other)
Esra Neufeld (Other)
Redi Poni (Speaker)
Niels Kuster (Other)
Axel Thielscher (Other)

Department of Electrical Engineering
Center for Magnetic Resonance
Documents:
ESHO18_abstract_submission
Links:
https://www.esho2018.eu/

Related event
32nd Annual Meeting of the European Society for Hyperthermic Oncology
16/05/2018 → 19/05/2018
Activity: Talks and presentations › Conference presentations

Investigation of fallacies in focused ultrasound transducer acoustic modeling
Period: 14 May 2018 → 17 May 2018
Hazael Montanaro (Speaker)
Cristina Pasquinelli (Other)
Esra Neufeld (Other)
Hyunjoo Jenny Lee (Other)
Lars G. Hanson (Other)
Axel Thielscher (Other)
Niels Kuster (Guest lecturer)

Department of Electrical Engineering
Center for Magnetic Resonance
Documents:
ISTU18_submission
Links:
http://www.istu.org/

Related event
The 18th International Symposium for Therapeutic Ultrasound
14/05/2018 → 17/05/2018
Nashville, United States
Activity: Talks and presentations › Conference presentations
Best Paper Award at International Conference on Intelligent Green Building and Smart Grid 2018
Period: Apr 2018
Zhe Zhang (Participant)
Department of Electrical Engineering

Description
Best Paper Award at International Conference on Intelligent Green Building and Smart Grid 2018

Related event
Best Paper Award at International Conference on Intelligent Green Building and Smart Grid 2018
23/04/2018 → 27/04/2018
Activity: Attending an event › Participating in or organising a conference

Custom Integrated Circuits for Portable Ultrasound Systems
Period: 26 Apr 2018
Pere Llimos Muntal (Invited speaker)
Department of Electrical Engineering

Links:
https://www.ntnu.edu/cius

Related external organisation
Centre for Innovative Ultrasound Solutions (CIUS)
Norwegian University of Science and Technology (NTNU), 7491, Trondheim, Norway
Activity: Talks and presentations › Conference presentations

Custom Integrated Circuits Design for Portable Ultrasound Scanners
Period: 25 Apr 2018
Pere Llimos Muntal (Invited speaker)
Department of Electrical Engineering

Links:
https://www.ntnu.edu/cius

Related external organisation
Centre for Innovative Ultrasound Solutions (CIUS)
Norwegian University of Science and Technology (NTNU), 7491, Trondheim, Norway
Activity: Talks and presentations › Conference presentations

Synchronous Condenser Allocation for Improving System Short Circuit Ratio
Period: 24 Apr 2018
Jundi Jia (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related event
5th International Conference on Electric Power and Energy Conversion Systems
23/04/2018 → 25/04/2018
Kitakyushu, Japan
Activity: Talks and presentations › Conference presentations

4th EU-Japan Workshop on Neurorobotics
Period: 18 Apr 2018
Silvia Tolu (Participant)
Department of Electrical Engineering
Automation and Control
Centre for Playware

Description
Title of the talk: Using robots for understanding the cerebellar role in sensorimotor control

Related event
4th EU-Japan Workshop on Neurorobotics
18/04/2018 → 20/04/2018
Tokyo, Japan
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Mechanical Systems and Signal Processing (Journal)
Period: 5 Apr 2018 → 2 May 2018
Oliver Ackermann Lylloff (Reviewer)
Acoustic Technology
Department of Wind Energy
Aerodynamic design
Degree of recognition: International

Related journal
Mechanical Systems and Signal Processing
0888-3270
BFI (2018): BFI-level 2, Scopus rating (2017): CiteScore 5.05 SJR 1.805 SNIP 2.874, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts

IEEE Transactions on Sustainable Energy (Journal)
Period: Mar 2018 → …
Jundi Jia (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related journal
IEEE Transactions on Sustainable Energy
1949-3029
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts

The 14th International Conference on Developments in Power System Protection (DPSP 2018)
Period: 12 Mar 2018 → 15 Mar 2018
Jundi Jia (Participant)
Noise Quantification with Beamforming Deconvolution: Effects of Regularization and Boundary Conditions
Period: 6 Mar 2018
Oliver Ackermann Lylloff (Speaker)
Acoustic Technology
Department of Wind Energy
Aerodynamic design
Degree of recognition: International

IEEE Transactions on Industrial Electronics (Journal)
Period: 1 Mar 2018 → 1 Mar 2019
Zhe Zhang (Editor)
Department of Electrical Engineering
Electronics

Description
Guest Editor on TIE Special Section on "High & Very High Frequency Power Supplies for Industrial Applications"
Degree of recognition: International

Exaggerated temporal processing deficits as animals age after synaptopathic noise
Period: 13 Feb 2018
Gerard Encina-Llamas (Panel member)
Department of Electrical Engineering
Hearing Systems

Description
Background
Normal aging results in a progressive loss of synapses between inner hair cells and auditory nerve fibers. An early overexposure to sound exacerbates this loss, even when thresholds recover. The functional consequences of this synaptopathy are poorly understood, though it is thought to affect suprathreshold coding of sound, especially in challenging listening conditions like the presence of background noise. Here, population level auditory brainstem responses (ABRs) and envelope following responses (EFRs) were used to study suprathreshold temporal processing with
Methods
ABRs and EFRs were obtained from an age-graded series of CBA/CaJ mice with or without a single exposure to a known synaptopathic noise that does not cause permanent hearing threshold elevations. ABRs were obtained to tone pips at various sound levels and frequencies. EFR stimuli were sinusoidally amplitude modulated (sAM) tones. Stimuli were centred on synaptopathic or non-synaptopathic cochlear regions. The modulation frequency, depth, sound levels and signal-to-noise ratio of the sAM stimuli were systematically varied to test temporal processing with degraded envelope cues. DPOAE thresholds and growth functions provided information about outer hair cell (OHC) functional integrity, and immunostained cochlear whole-mounts were used to quantify hair cells and synapses.

Results
ABR wave 1 and EFRs measured from early neural sources both show progressive loss of amplitudes with age. Prior exposure to TTS-producing noise exaggerated these ongoing declines: As animals aged after noise, amplitude declines for both metrics exceeded those of age-matched controls in frequency regions of largest noise-induced synaptopathy. Pre-neural responses (DPOAEs, EFRs from pre-neural sources) were minimally affected until advanced age, when hair cell losses occur. Synaptopathic animals also showed a reduced dynamic range of encoding AM depth and noise masking in EFRs. These changes were present even though ABR and DPOAE thresholds and DPOAE amplitudes were similar to age-matched controls. Together, these changes are consistent with decreased temporal processing, exaggerated in the previously noise-exposed ears.

Conclusions
Age-related cochlear synaptopathy is accompanied by deficits in temporal processing at the earliest neural generators, resulting in a decrease in the dynamic range of encoding degraded envelope cues. These deficits are accelerated, but not fundamentally altered by an early over-exposure to noise. These results suggest that even a single exposure to synaptopathic noise can result in increased deficits in temporal processing throughout the lifespan.

Funding
DoD W81XWH-15-1-0103 (SGK)
Degree of recognition: International

Related event
41st MidWinter Meeting of the Association for Research in Otolaryngology
09/02/2018 → 14/02/2018
San Diego, United States
Activity: Talks and presentations › Conference presentations

A mouse model of the auditory nerve to study cochlear synaptopathy
Period: 10 Feb 2018
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems
Description
Background
Cochlear synaptopathy, the loss of auditory nerve (AN) fiber synapses after a temporary threshold shift, has been demonstrated in several non-human mammals. By far, the mouse is the most used and best characterized species in connection with cochlear synaptopathy. Studies in human listeners are, however, inconclusive. The impossibility to directly assess the status of the AN in humans is a major challenge. Hence, similar studies carried out in humans and mice are of great interest. Previously, we proposed the use of envelope following responses (EFR) as a tool to investigate synaptopathy both in mice and humans. We reported similar patterns in synaptopathic mice and humans, which could be explained by a humanized model of the AN with simulated synaptopathy. In this study, the original animal version of the AN model developed using cat data was evaluated and modified to account for the EFRs recorded in mice.

Methods
The cat version of the AN model by Zilany et al. (2009, 2014) was used to simulate EFR level-growth functions using sinusoidally amplitude modulated tones with strong (m=85%) and shallow (m=25%) modulation depths in noise-exposed and control mice. The stimuli used in the mice recordings were adapted to the cat AN model by transposing them to the cat's relative cochlear place. A mouse model was proposed by modifying the middle-ear response, the AN tuning, and the sensitive frequency range of the model.

Results
The cat AN model could account for the overall effect of synaptopathy on the recorded EFRs in noise-exposed mice.
However, the shape of the recorded EFR level-growth functions both in the noise-exposed and the control mice did not fully agree with the simulated EFRs using the cat model. The mouse model also showed deviations from the data.

Conclusions
The analysis of the simulated results suggested that the inaccuracy of the model outcome may be caused by the differences in AN tuning between the model (cat) and the data (mouse). In addition, at supra-threshold levels, the total EFR is dominated by the off-frequency contributions (i.e., neuronal activity away from the characteristic place of the stimulus), which are limited in the high frequencies of the cat AN model. The proposed modifications of the model showed improvements which were not sufficient to entirely account for the data.

Funding
This work was supported by CHeSS at the Technical University of Denmark.

Degree of recognition: International

Related event
41st MidWinter Meeting of the Association for Research in Otolaryngology
09/02/2018 → 14/02/2018
San Diego, United States
Activity: Talks and presentations › Conference presentations

41st MidWinter Meeting of the Association for Research in Otolaryngology
Period: 9 Feb 2018 → 14 Feb 2018
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Poster presentation at the 41st MidWinter Meeting of the Association for Research in Otolaryngology
Degree of recognition: International
Links:
http://www.aro.org/

Related event
41st MidWinter Meeting of the Association for Research in Otolaryngology
09/02/2018 → 14/02/2018
San Diego, United States
Activity: Attending an event › Participating in or organising a conference

Special 3-week PhD/MSc level course at DTU on "Large-scale optimization problems in energy systems: Applications of decomposition techniques"
Period: 2 Jan 2018 → 22 Jan 2018
Jalal Kazempour (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Related organisation
Special 3-week PhD/MSc level course at DTU on "Large-scale optimization problems in energy systems: Applications of decomposition techniques"
Kazempour, J. (Lecturer)
2 Jan 2018 → 22 Jan 2018
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

A correlation metric in the envelope power spectrum domain for speech intelligibility prediction
Period: 2017
Helia Relano Iborra (Guest lecturer)
A powerful tool to investigate speech perception is the use of speech intelligibility prediction models. Recently, a model was presented, termed correlation-based speech-based envelope power spectrum model (sEPSMcorr), that uses a correlation-based back end at the output of an audio-frequency and modulation-frequency selective auditory preprocessing (Relaño-Iborra et al., 2016). The use of the correlation back-end extended the predictive power of earlier versions of the sEPSM framework (e.g. Jørgensen et al. 2013) towards conditions of non-linear signal processing, such as phase jitter and ideal binary mask processing. Moreover, the model was shown to account for conditions with fluctuating interferers, unlike other correlation-based models.

Here, the back end of the sEPSMcorr was combined with a more realistic auditory pre-processing front end adopted from the computational auditory signal processing and perception model (CASP; Jepsen et al., 2008). The preprocessing contains outer- and middle-ear filtering and a non-linear auditory filterbank (DRNL, López-Poveda and Meddis, 2001), followed by inner hair-cell transduction, adaptation and a modulation filterbank.

The predictions were compared to measured data in conditions of additive masking noise, phase jitter distortions, reverberation and noise-reduction algorithms. The effects of the back end as well as the different preprocessing stages on the predicted results were analyzed. The modelling framework could be useful for the design and evaluation of, e.g. speech transmission algorithms or hearing-instrument algorithms.

Documents:
spin_helia_final_v2

Related event

9th Speech in Noise Workshop
05/01/2017 → 06/01/2017
Oldenburg, Germany
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

A correlation metric in the envelope power spectrum domain for speech intelligibility prediction
Period: 2017
Helia Relano Iborra (Guest lecturer)
Department of Electrical Engineering
Hearing Systems

Description
A speech intelligibility model, named sEPSMcorr, is presented, which uses a modulation-frequency selective processing based on the (multi-resolution) speech-based envelope power spectrum model (mr-sEPSM; Jørgensen et al. 2013) in combination with a cross-correlation based back end inspired by the short-time objective intelligibility measure (STOI; Taal et al., 2011). The model can accurately predict data obtained with normal-hearing (NH) listeners for a broad range of listening conditions, including effects of stationary and fluctuating additive interferers as well as effects of non-linear distortions, such as spectral subtraction, phase jitter and ideal binary mask (IBM) processing. The model has a larger predictive power than both the original mr-sEPSM (which fails in the phase-jitter and IBM conditions) and STOI (which fails to predict the influence of fluctuating interferers).

However, the sEPSMcorr preprocessing does not provide a flexible framework to predict individual speech intelligibility data from hearing impaired listeners. Thus, the back end of the sEPSMcorr was combined with a more realistic auditory pre-processing front end adopted from the computational auditory signal processing and perception model (CASP; Jepsen et al., 2008). The preprocessing contains outer- and middle-ear filtering and a non-linear auditory filterbank (DRNL, López-Poveda and Meddis, 2001), followed by inner hair-cell transduction, adaptation and a modulation filterbank.

The predictions of the sEPSM-based and the CASP-based models were compared with respect to measured data (NH) in conditions of additive masking noise, phase jitter distortions, reverberation and noise-reduction algorithms. The effects of the back end as well as the different preprocessing stages on the predicted results were analyzed. The resulting modelling framework could be useful for the design and evaluation of, e.g. speech transmission algorithms or hearing-instrument algorithms.

Documents:
ARCHES_poster_final3

Related event

ARCHES/ICANHEAR 2016: Audiological Research Cores in Europe (ARCHES) meeting and Improved Communication through Applied Hearing Research (ICanHear) conference
Zurich, Switzerland
Chimera states - mythological monsters from math arise in the real world
Period: 2017
Erik Andreas Martens (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Electrical Engineering

Description
Invited topical lecture
Degree of recognition: International

Related event
ICMS Complexity Science Winter School 2017
13/02/2017 → 17/02/2017
Eindhoven, Netherlands

Extending a computational model of auditory processing towards speech intelligibility prediction
Period: 2017
Helia Relano Iborra (Guest lecturer)
Department of Electrical Engineering
Hearing Systems

Description
A speech intelligibility model is presented, based on the computational auditory signal processing and perception model (CASP; Jepsen et al., 2008). CASP has previously been shown to successfully predict psychoacoustic data of normal hearing (NH) listeners obtained in conditions of, e.g., spectral masking, amplitude-modulation detection, and forward masking (Jepsen et al., 2008). Furthermore, CASP can be tuned to model data from individual hearing-impaired listeners in different behavioral experiments (Jepsen and Dau, 2011). In this study, the CASP model is investigated as a predictor of intelligibility for Danish sentences for NH listeners.

Here, predictions of speech intelligibility obtained with the speech-based CASP implementation are presented and compared to speech intelligibility data measured in conditions of additive noise, phase jitter, spectral subtraction, ideal binary mask processing and reverberation.

Related event
International Symposium on Auditory and Audiological Research
23/08/2017 → 25/08/2017
Nyborg, Denmark

ISMRM study group on Detection and Correction of Motion in MRI and MRS (External organisation)
Period: 2017 → 2018
Lars G. Hanson (Chairman)
Department of Electrical Engineering
Center for Magnetic Resonance
Center for Hyperpolarization in Magnetic Resonance

Description
Chairman, ISMRM study group on Detection and Correction of Motion in MRI and MRS
Degree of recognition: International
Related external organisation

ISM RM study group on Detection and Correction of Motion in MRI and MRS
Activity: Membership › Membership of research networks or expert groups

Perceptual consequences of noise-induced neural degeneration in humans
Period: 2017 → 2019
Gerard Encina-Llamas (Supervisor)
Bastian Epp (Main supervisor)
Department of Electrical Engineering
Hearing Systems

Description
Research suggests that synaptic and neuronal damage precedes the hair cell damage that causes increased pure-tone thresholds. The neural synapses and fibres sensitive to this type of noise-induced damage are responsible for the coding of mid- to high-intensity stimuli and seem to play a crucial role for our ability to perceive sound stimuli in background noise.

Signs of a disorder impairing only supra-threshold processing without affecting pure-tone thresholds have been documented in humans before and is recently referred to as the "hidden hearing loss". The main symptoms related to these are difficulties with speech perception in noise and presence of tinnitus despite normal pure-tone thresholds.

This project is aimed at investigating noise-induced neural degeneration in human listeners with normal pure-tone sensitivity and clarify the relation between people with a history of working in noise exposure and supra-threshold auditory impairments. It will be investigated if a history of noise exposure can be linked to the diagnosis of hidden hearing loss. Objective electrophysiological measures will be applied to investigate auditory neural firing activity. Behavioral psychoacoustic experiments will be implemented to investigate supra-threshold processing deficits. A second goal of this project is to explore the potential contribution of noise-induced neural degeneration in populations with a diagnosed high-frequency hearing loss and explore potential alternative amplification strategies for this group.

Activity: Examinations and supervision › Supervisor activities

Proceedings of the International Symposium on Auditory and Audiological Research (Journal)
Period: 2017 → …
Sébastien Santurette (Editor)
Torsten Dau (Editor)
Department of Electrical Engineering
Hearing Systems

Description
Proceedings of ISAAR: International Symposium on Auditory and Audiological Research
Degree of recognition: International
Links:
https://proceedings.isaar.eu

Related journal

Proceedings of the International Symposium on Auditory and Audiological Research
Local database
Activity: Research › Series editor

Scientific Committee of the European Congress of Medical Physics 2018 (External organisation)
Period: 2017 → 2018
Lars G. Hanson (Member)
Department of Electrical Engineering
Center for Magnetic Resonance
Center for Hyperpolarization in Magnetic Resonance
Degree of recognition: International

Related external organisation
Scientific Committee of the European Congress of Medical Physics 2018
Activity: Membership › Membership of research networks or expert groups

KTH - Royal Institute of Technology (External organisation)
Period: 18 Dec 2017
Mattia Marinelli (Chairman)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
PhD defence of Mikel Armendariz, KTH, Stockholm, Sweden.
PhD thesis: Cost-effective Communication and Control Architectures for Active Low Voltage Grids
Degree of recognition: International
Documents:
Thesis with papers

Related external organisation
KTH - Royal Institute of Technology
Drottning Kristinas Väg 51, SE-10044, Stockholm, Sweden
Activity: Membership › Membership in review committee

Smart campus data and analysis sustain 2017
Period: 6 Dec 2017
Ole Schultz (Lecturer)
Department of Electrical Engineering
Center for Bachelor of Engineering Studies
Afdeelingen for Informatik

Description
Big Data platform for Analytics and energy monitoring
Degree of recognition: International
Documents:
Smart campus data and analysis sustain 2017

Related event
DTU Sustain 2017
06/12/2017 → 06/12/2017
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Member of the Technical Committee (TC) of 2018 IEEE International Future Energy Challenge (IFEC)
Period: 28 Nov 2017 → 19 Jul 2018
Zhe Zhang (Organizer)
Department of Electrical Engineering
Electronics

Description
Member of the Technical Committee (TC) of 2018 IEEE International Future Energy Challenge (IFEC)
Degree of recognition: International

Related event
Member of the Technical Committee (TC) of 2018 IEEE International Future Energy Challenge (IFEC)
28/11/2017 → 21/07/2018
Activity: Attending an event › Participating in or organising a conference
The Poul la Cour Tunnel: A new aerodynamic and aeroacoustic wind tunnel dedicated to wind energy

Period: 28 Nov 2017 → 30 Nov 2017

Christian Bak (Other)
Andreas Fischer (Other)
Robert Flemming Mikkelsen (Other)
Anders Smærup Olsen (Other)
Mac Gaunaa (Other)
Efren Fernandez Grande (Other)
Witold Robert Skrzypinski (Other)

Department of Wind Energy
Aerodynamic design
Fluid Mechanics

Description
Poster

Degree of recognition: International

Related event

WindEurope 2017
28/11/2017 → 30/11/2017
Amsterdam, Netherlands
Activity: Talks and presentations › Conference presentations

International Symposion on Future I&C for Nuclear Power Plants
Period: 26 Nov 2017 → 29 Nov 2017
Denis Kirchhübel (Speaker)

Department of Electrical Engineering
Automation and Control

Degree of recognition: International

Related external organisation

IAEA
Activity: Talks and presentations › Conference presentations

External examiner on PhD defense by PhD student Farideh Javidi Niromand
Period: 20 Nov 2017
Michael A. E. Andersen (External examiner)

Department of Electrical Engineering
Activity: Examinations and supervision › External examination

University of California, San Diego
Period: 20 Nov 2017 → 15 Mar 2018
Ha Thi Nguyen (Visiting researcher)

Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Visiting Scholar at Center for Energy Research (CER), University of California, San Diego, CA, USA
Activity: Visiting an external institution › Visiting another research institution

**Principles and Applications of Dissolution Dynamic Nuclear Polarization**
Period: 13 Nov 2017 → 17 Nov 2017
Vitaliy Zhurbenko (Participant)

Department of Electrical Engineering
Center for Magnetic Resonance
Center for Hyperpolarization in Magnetic Resonance

**Description**
PhD level training school
Degree of recognition: International

Links:
http://www.conferencemanager.dk/dDNP-training-school/

**Related event**
**Principles and Applications of Dissolution Dynamic Nuclear Polarization**
13/11/2017 → 17/11/2017
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**University of New South Wales**
Period: 13 Nov 2017 → 10 Feb 2018
Theis Bo Rasmussen (Visiting researcher)

Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Description**
External research stay at the School of Electrical Engineering and Telecommunications under the supervision of Professor Joe Dong.
Activity: Visiting an external institution › Visiting another research institution

**Responsible Conduct of Research**
Period: 1 Nov 2017
Vitaliy Zhurbenko (Participant)

Department of Electrical Engineering
Electromagnetic Systems
Degree of recognition: Local

**Related event**
**Responsible Conduct of Research**
01/11/2017 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**IEEE Transactions on Sustainable Energy (Journal)**
Period: Oct 2017 → …
Theis Bo Rasmussen (Reviewer)

Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems
Related journal

IEEE Transactions on Sustainable Energy
1949-3029
Central database
Activity: Research › Peer review of manuscripts

International Journal of Distributed Sensor Networks (Journal)
Period: Oct 2017 → ...
Theis Bo Rasmussen (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related journal

International Journal of Distributed Sensor Networks
1550-1329
Scopus rating (2017): CiteScore 1.34 SJR 0.255 SNIP 0.745, Web of Science (2018): Indexed yes Indexed in DOAJ
Central database
Activity: Research › Peer review of manuscripts

Evaluation of respiratory motion correction in PET/CT using a 3D printed phantom
Period: 22 Oct 2017
Josefine Holm Vilsbøll (Speaker)
Hasler S. W. Hasler (Guest lecturer)
L. D. L. Duchstein (Guest lecturer)
Jens E. Wilhjelm (Guest lecturer)
M. N. Lonsdale (Guest lecturer)
Department of Electrical Engineering
Biomedical Engineering
Degree of recognition: International

Related event

EANM'17: 30th Annual Congress of the European Association of Nuclear Medicine
21/10/2017 → 25/10/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations

Enhancing the role of EVs as grid proactive DER - The Danish experience
Period: 12 Oct 2017
Mattia Marinelli (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
Workshop organized at North China Electric Power University (NCEPU), Beijing on 12-10-2017
title:
Enhance the Role of EVs and Make It an Integral of Smart Grids
speakers:
Associate Prof. Mattia Marinelli (DTU)
Associate Prof. Zechun Hun (Tsinghua University)
Prof. Chunlin Guo (NCEPU)
Enhancing the role of EVs - Mattia Oct 2017

Related external organisation

North China Electric Power University
China
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Investigation of echogenic surface enhancements for improved needle visualization in ultrasonography: A PRISMA systematic review
Period: 11 Oct 2017
Caroline Harder Hovgesen (Speaker)
Jens E. Wilhjelm (Guest lecturer)
Peter Vilmann (Guest lecturer)
Evangelos Kalaitzakis (Guest lecturer)
Department of Electrical Engineering
Biomedical Engineering
Degree of recognition: National

Related event

DMTS Annual meeting
10/10/2017 → 12/10/2017
Vingsted, Denmark
Activity: Talks and presentations › Conference presentations

Piezoelectric transformers: Control
Period: 5 Oct 2017
Tiberiu-Gabriel Zsurzsan (Guest lecturer)
Department of Electrical Engineering
Electronics
Degree of recognition: International
Documents:
Gabriel ZSURZSAN - ICAT2017

Related event

70th ICAT International Smart Actuator Symposium
03/10/2017 → 04/10/2017
State College, United States
Activity: Talks and presentations › Conference presentations

An extended test battery for characterizing hearing deficits
Period: 29 Sep 2017
Raul Sanchez Lopez (Speaker)
Federica Bianchi (Other)
Michal Fereczkowski (Other)
Sébastien Santurette (Other)
Torsten Dau (Other)
Department of Electrical Engineering
Hearing Systems

Related event

Dansk Teknisk Audiologisk Selskab årsmøde 2017
**Searching for Plausible N-k Contingencies Endangering Voltage Stability**

**Period:** 27 Sep 2017

Johannes Tilman Gabriel Weckesser (Guest lecturer)

Department of Electrical Engineering

Center for Electric Power and Energy

**Electric Power Systems**

**Description**

Presentation of a novel search algorithm using time-domain simulations to identify plausible N-k contingencies endangering voltage stability. Starting from an initial list of disturbances, progressively more severe contingencies are investigated. After simulation of a N-k contingency, the simulation results are assessed. If the system response is unstable, a plausible harmful contingency sequence has been found. Otherwise, components affected by the contingencies are considered as candidate next event leading to N-(k+1) contingencies. This implicitly takes into account hidden failures of component protections. The performance of the proposed search algorithm is compared to a brute-force algorithm and demonstrated on the IEEE Nordic test system.

**Degree of recognition:** International

**Documents:**

ISGT - N-k search algorithm

**Related event**

**2017 IEEE PES Innovative Smart Grid Technologies Conference Europe**

26/09/2017 → 29/09/2017

Torino, Italy

Activity: Talks and presentations › Conference presentations

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**National Renewable Energy Laboratory**

**Period:** 25 Sep 2017 → 31 Jan 2018

Jundi Jia (Visiting researcher)

Department of Electrical Engineering

Center for Electric Power and Energy

**Electric Power Systems**

**Description**

Academic guest at the National Wind Technology Center (NWTC) under the supervisor of Eduard Muljadi and Vahan Gevorgian

Activity: Visiting an external institution › Visiting another research institution

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**Miniature converters**

**Period:** 20 Sep 2017

Michael A. E. Andersen (Invited speaker)

Department of Electrical Engineering

**Electronics**

**Degree of recognition:** National

**Links:**

https://hightechsummit.dk/

**Related event**

**High Tech Summit**

20/09/2017 → 21/09/2017

Kongne Lyngby, Denmark

Activity: Talks and presentations › Conference presentations
JASA Express Letters (Journal)
Period: 10 Sep 2017
Oliver Ackermann Lylloff (Reviewer)
Acoustic Technology
Department of Wind Energy
Aerodynamic design
Degree of recognition: International

Related journal
JASA Express Letters
1529-7853
Central database
Activity: Research › Peer review of manuscripts

Federated Conference on Computer Science and Information Systems
Period: 3 Sep 2017 → 6 Sep 2017
Theis Bo Rasmussen (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Oral presentation of conference paper

Related event
Federated Conference on Computer Science and Information Systems
04/09/2017 → 07/09/2017
Prague, Czech Republic
Activity: Attending an event › Participating in or organising a conference

Organizer of the Special Session "Components and protection of residential nano-grids with multiple power sources" in the IEEE International Conference on Intelligent Green Building and Smart Grid (IBSG 2018)
Period: 1 Sep 2017 → 25 Apr 2018
Zhe Zhang (Organizer)
Department of Electrical Engineering
Electronics
Degree of recognition: International

Related event
Organizer of the Special Session "Components and protection of residential nano-grids with multiple power sources" in the IEEE International Conference on Intelligent Green Building and Smart Grid (IBSG 2018)
01/09/2017 → 25/04/2018
Activity: Attending an event › Participating in or organising a conference

University of Salamanca
Period: 1 Sep 2017 → 31 Dec 2017
Helia Relano Iborra (Visiting researcher)
Department of Electrical Engineering
Hearing Systems
Description
4 months research stay at the Auditory Computation & Psychoacoustics group of the Institute of Neurosciences of the University of Salamanca with Professor Enrique A. Lopez-Poveda
Activity: Visiting an external institution › Visiting another research institution

Trends in Hearing (Journal)
Period: Aug 2017
Helia Relano Iborra (Reviewer)
Department of Electrical Engineering
Hearing Systems
Related journal
Trends In Hearing
2331-2165
Scopus rating (2017): CiteScore 1.95, Web of Science (2018): Indexed yes
Indexed in DOAJ
Activity: Research › Peer review of manuscripts

Data-Driven Security-Constrained OPF
Period: 30 Aug 2017
Florian Thams (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems
Description
Presentation of the accepted paper.
Degree of recognition: International
Related event
10th Bulk Power Systems Dynamics and Control Symposium
27/08/2017 → 01/09/2017
Espinho, Portugal
Activity: Talks and presentations › Conference presentations

International Symposium on Auditory and Audiological Research
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems
Description
Oral presentation at the International Symposium on Auditory and Audiological Research
Degree of recognition: International
Related event
International Symposium on Auditory and Audiological Research
23/08/2017 → 25/08/2017
Nyborg, Denmark
Activity: Attending an event › Participating in or organising a conference

Auditory profiling through computational data analysis
Period: 19 Aug 2017
Raul Sanchez Lopez (Other)
Federica Bianchi (Other)
Michal Fereczkowski (Other)
Sébastien Santurette (Other)
Torsten Dau (Other)
Department of Electrical Engineering
Hearing Systems

Description
Nowadays, the pure-tone audiogram is the main tool used to characterize the degree of hearing loss and to fit hearing aids. However, the perceptual consequences of a hearing loss are typically associated not only with a loss of sensitivity, but also with a loss of clarity (distortion loss) that is not captured by the audiogram. Detailed characterization of hearing deficits can be complex and it has to be simplified in order to efficiently investigate the specific compensation needs of individual listeners. The aim of this study is to characterize individual hearing deficits by means of a test battery that allows to capture the diverse aspects of hearing loss, considering not only the loss of sensitivity but also supra-threshold distortions.

It was hypothesized that any listeners' hearing can be characterized along two dimensions: distortion type I and distortion type II. While distortion type I can be linked to factors affecting audibility, distortion type II is considered as a non-audibility-related distortion, or clarity loss. To evaluate our hypothesis, the data from two studies was re-analyzed using a data-driven approach. Both studies carried out an extensive battery of psychoacoustic tests on potential hearing-aid users. The new analysis was based on an archetypal analysis and uses unsupervised learning to identify extreme patterns in the data which provide the basis for different auditory profiles. Subsequently, a decision tree was obtained that enables a simple classification of the listeners into one of the profiles.

This novel approach provided evidence for the existence of four different "auditory profiles" in the data. The most significant predictors for the profile identification were related to temporal processing, peripheral compression, and speech perception. The current approach is promising for identifying the most relevant tests for auditory profiling and considering new fitting strategies based on the individual's deficits.

Related event
19/08/2017 → 19/08/2017
Stockholm, Sweden
Activity: Talks and presentations › Conference presentations

Electrophysiological correlate of masking release using a high-density EEG system.
Period: 7 Aug 2017 → 10 Sep 2017
Gerard Encina-Llamas (Supervisor)
Bastian Epp (Main supervisor)
Department of Electrical Engineering
Hearing Systems

Description
A fundamental processing principle of the auditory system of many mammals is to analyze sounds in separate frequency channels. This frequency specific processing allows to detect narrow-band signals in the presence of broadband maskers. As a conceptual model, a neurally coded "internal signal-to-noise ratio (I-SNR)" has been suggested which reflects the energy of the signal to be detected relative to the energy of the masker. This I-SNR is then related to the minimum required energy of the signal in order to be detected, i.e. the detection threshold. Perceptually, the detection threshold can be varied by inclusion of beneficial signal properties (cues) like comodulation or interaural disparities, leading to a a reduced detection threshold, i.e. a release from masking. In the light of the I-SNR, a masking release is then equivalent to an improvement of the I-SNR due to the presence of the cues in the signal. It is largely unknown how masked signals are represented in the neural system. Such an objective metric would however be beneficial for, among others, clinical applications to evaluate supra-threshold hearing in non-responding listeners. A few studies exist, trying to link long-latency auditory evoked potentials (LAEPs) with the threshold of a masked signal, finding a correlation between the P2 peak of the LAEP and the level of the signal above masked threshold. These studies focused on single channels to evaluate the LAEP which potentially obscures the information about the contribution of different nuclei to the masking release in the presence of multiple cues. Hence, recordings with a high-density EEG might help to provide spatially high sampled data to obtain information about the underlying processing stages. The present project will integrate a 144-channel EEG system (g.Tec) into the existing lab infrastructure of the Hearing systems group. The system will be evaluated with replication and extension of a previous study about the presence of masking release in LAEPs (Egger et al., in prep). Project outcomes The goal of the present project is twofold: a) implementation of a 144-channel EEG system into a measurement routine for LAEPs within the existing infrastructure and b) recording and processing of LAEPs recorded in response to stimuli known to evoke a masking release in multiple channels using available and custom software implemented in MATLAB. The developed system and software will be documented in written form. The developed code will be developed using GIT and
published in an online repository (BitBucket), available for the Hearing Systems group at DTU.
Activity: Examinations and supervision › Supervisor activities

**Tutoial at ITEC Asia-Pacific 2017: “Advanced bidirectional dc-dc converters with emerging wide-bandgap semiconductor devices”**
Period: 7 Aug 2017
Zhe Zhang (Invited speaker)
Department of Electrical Engineering
Electronics
Degree of recognition: International

**Related event**

07/08/2017 → 07/08/2017
Activity: Talks and presentations › Conference presentations

**Invited speech at Zhejiang University: New research progress in power electronics with wide bandgap devices**
Period: 2 Aug 2017
Zhe Zhang (Invited speaker)
Department of Electrical Engineering
Electronics

**Description**
Invited speech at Zhejiang University
Degree of recognition: International

**Related external organisation**

Zhejiang University
China
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**A Scalable Neuro-inspired Robot Controller Integrating a Machine Learning Algorithm and a Spiking Cerebellar-Like Network**
Period: 28 Jul 2017
Silvia Tolu (Speaker)
Henrik Hautop Lund (Other)
Department of Electrical Engineering
Automation and Control
Centre for Playware
Centre for Playware

**Description**
Conference on Biomimetic and Biohybrid Systems
Living Machines 2017
Degree of recognition: International

**Related event**

Living Machines 2017
25/07/2017 → 28/07/2017
Stanford, United States
Activity: Talks and presentations › Conference presentations
Quantifying Biochemical Activities in Living Cells with $^{13}$C dDNP NMR
Period: 24 Jul 2017
Mathilde Hauge Lerche (Invited speaker)
Magnus Karlsson (Other)
Jan Henrik Ardenkjær-Larsen (Other)
Pernille Rose Jensen (Other)
Andrea Capozzi (Other)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents:
ismar2017_Mathilde_Hauge_Lerche

Related event
International Society of Magnetic Resonance
23/08/2017 → 28/08/2017
Quebec City, Canada
Activity: Talks and presentations › Conference presentations

Functional modelling in the operation of a cyber physical energy system
Period: 19 Jul 2017
Theis Bo Rasmussen (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Oral presentation at panel session in International practices in smart grid for smart city

Related event
2017 IEEE PES General Meeting
16/07/2017 → 20/07/2017
Chicago, United States
Activity: Talks and presentations › Conference presentations

Protection System Performance in Weak AC Grids through HIL Tests
Period: 19 Jul 2017
Jundi Jia (Panel member)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related event
2017 IEEE PES General Meeting
16/07/2017 → 20/07/2017
Chicago, United States
Activity: Talks and presentations › Conference presentations

Conference on Implantable Auditory Prosthesis
Period: 16 Jul 2017 → 21 Jul 2017
Andreu Paredes Gallardo (Participant)
A narrow line UV-induced non-persistent radical in view of generating highly polarized transportable glucose solid samples

Period: 2 Jul 2017 → 6 Jul 2017
Andrea Capozzi (Guest lecturer)
Alessandro Coi (Panel member)
S Patel (Panel member)
Olivier Ouari (Panel member)
Magnus Karlsson (Guest lecturer)
Mathilde Hauge Lerche (Guest lecturer)
Arnaud Comment (Panel member)
Jan Henrik Ardenkjær-Larsen (Panel member)

Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents:
 Euromar-2017_abstract-Capozzi_HP-glucose

Related event

EUROMAR 2017
02/07/2017 → 06/07/2017
Warsaw, Poland
Activity: Talks and presentations › Conference presentations

Low RF-field strength cross polarization combined with photo-induced non-persistent radicals for clinically applicable dDNP

Period: 2 Jul 2017 → 6 Jul 2017
Joachim Møllesæe Vinther (Speaker)
Andrea Capozzi (Speaker)
Mohammed Albannay (Speaker)
Jan Henrik Ardenkjær-Larsen (Speaker)

Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents:
 poster_jmv_v2

Related event

EUROMAR 2017
02/07/2017 → 06/07/2017
Warsaw, Poland
Activity: Talks and presentations › Conference presentations

**Poster Presentation**
Period: 2 Jul 2017 → 6 Jul 2017
Ronja Maja Malinowski (Speaker)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents:
EUROMAR2017RonjaMalinowski

**Related event**
EUROMAR 2017
02/07/2017 → 06/07/2017
Warsaw, Poland
Activity: Talks and presentations › Conference presentations

**Preparation of Radical-Free Hyperpolarized Water using Photo-induced non-persistent Radicals on a "SpinLab-like" dissolution-DNP Polarize**
Period: 2 Jul 2017 → 6 Jul 2017
Andrea Capozzi (Speaker)
Alessandro Coi (Panel member)
Magnus Karlsson (Panel member)
Mathilde Hauge Lerche (Guest lecturer)
Jan Henrik Ardenkjær-Larsen (Guest lecturer)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents:
Euromar-2017_abstract-Capozzi_HP-water

**Related event**
EUROMAR 2017
02/07/2017 → 06/07/2017
Warsaw, Poland
Activity: Talks and presentations › Conference presentations

**Department of Mechanical Engineering (Organisational unit)**
Period: 1 Jul 2017 → 26 Sep 2017
Mogens Blanke (Chairman)
Department of Electrical Engineering
Automation and Control
Description
Chairman for PhD evaluation Committee for Jonas Lauridsen
Degree of recognition: National

**Related organisation**
Department of Mechanical Engineering (Organisational unit)
Blanke, M. (Chairman)
High Current Full Scale Testing as Fundamental Element to Ensure Wind Turbine Reliability
Period: 29 Jun 2017
Stephan Vogel (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Equipment Technologies

Description
Testing of lightning protection measures on wind turbine components provides fundamental improvements to wind turbine reliability. Full-scale testing of blades and nacelles is regarded as the most exhaustive mean to evaluate lightning performance, identify weak-points, and improve the lightning protection design. The continuous increase of dimensions of the test objects also increases the effective stray inductance, leading to a practical challenge of injecting the full lightning current into the test object, as is defined in in IEC 61400-24 Ed.1.0 Wind turbines – Part 24: Lightning protection. This circumstance led to the formation of the project "Enhanced Lightning effect Testing (ELITE)" under which was designed, constructed and prototype tested a novel extendable high-current crowbar impulse generator.

In this work, the concept of the generator is introduced, the components are described and performance is evaluated for single modules. The extendibility of the generator is achieved by modularity of 12 individual high-current impulse generators cuboids, each equipped with an intrinsic capacitor bank, spark-gap, and a crowbar consisting of 45 series-connected rectifier diodes. Each module has a charging voltage of up to ±100 kV and a discharge current of 125 kA and can be used as an independent unit. By series and parallel connections of the modules, the capabilities of the resulting generator can be modified and tuned to the specific test item. During testing, the modules are arranged around the device under test which effectively minimizes the stray inductance of the circuit.

The audience will be introduced to the principles of high current full scale testing according to IEC 61400-24 and special focus will be placed on the limitations due to the increased size of full-scale test objects. Furthermore, test results from a prototype high current impulse are used to verify the principles of lightning current injection to test samples.

Degree of recognition: International

Related external organisation
European Academy of Wind Energy
Küpkersweg 70, 26129, Oldenburg, Germany
Activity: Talks and presentations › Conference presentations

The speech-based envelope power spectrum model (sEPSM) family: Development, achievements, and current challenges
Period: 29 Jun 2017
Helia Relano Iborra (Guest lecturer)
Department of Electrical Engineering
Hearing Systems

Description
Intelligibility models provide insights regarding the effects of target speech characteristics, transmission channels and/or auditory processing on the speech perception performance of listeners. In 2011, Jørgensen and Dau proposed the speech-based envelope power spectrum model [sEPSM, Jørgensen and Dau (2011). J. Acoust. Soc. Am. 130(3), 1475-1487]. It uses the signal-to-noise ratio in the modulation domain (SNRenv) as a decision metric and was shown to accurately predict the intelligibility of processed noisy speech. The sEPSM concept has since been applied in various subsequent models, which have extended the predictive power of the original model to a broad range of conditions. This
contribution presents the most recent developments within the sEPSM “family.” (i) A binaural extension, the B-sEPSM [Chabot-Leclerc et al. (2016). J. Acoust. Soc. Am. 140(1), 192-205] which combines better-ear and binaural unmasking processes and accounts for a large variety of spatial phenomena in speech perception; (ii) a correlation-based version [Relaño-Iborra et al. (2016). J. Acoust. Soc. Am. 140(4), 2670-2679] which extends the predictions of the early model to non-linear distortions, such as phase jitter and binary mask-processing; and (iii) a recent physiologically inspired extension, which allows to functionally account for effects of individual hearing impairment on speech perception.

Degree of recognition: International

Links:
http://dx.doi.org/10.1121/1.4989047

Related event

173rd Meeting of the Acoustical Society of America and the 8th Forum Acusticum
25/06/2017 → 29/06/2017
Boston, United States
Activity: Talks and presentations › Conference presentations

Test possibilities in the Pou l la Cour Tunnel
Period: 26 Jun 2017
Christian Bak (Speaker)
Andreas Fischer (Other)
Robert Flemming Mikkelsen (Other)
Anders Smærup Olsen (Other)
Mac Gaunaa (Other)
Efren Fernandez Grande (Other)
Department of Wind Energy
Aerodynamic design
Fluid Mechanics
Department of Electrical Engineering
Acoustic Technology

Description
Oral presentation
Degree of recognition: International

Related event

Wind Energy Science Conference 2017
26/06/2017 → 29/06/2017
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Disturbance Attenuation of DC Voltage Droop Control Structures in a Multi-Terminal HVDC- Grid
Period: 20 Jun 2017
Florian Thams (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Presentation of the accepted paper
Degree of recognition: International

Related event

18/06/2017 → 22/06/2017
Manchester, United Kingdom
Activity: Talks and presentations › Conference presentations

12th IEEE Power and Energy Society PowerTech Conference
Period: 18 Jun 2017 → 22 Jun 2017
Theis Bo Rasmussen (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Oral presentation of conference paper

Related event
18/06/2017 → 22/06/2017
Manchester, United Kingdom
Activity: Attending an event › Participating in or organising a conference

DTU Summer School 2017: Modern Challenges in Power System Operation and Electricity Markets: An Optimization Perspective
Period: 12 Jun 2017 → 16 Jun 2017
Jalal Kazempour (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Degree of recognition: International

Related event
DTU Summer School 2017: Modern Challenges in Power System Operation and Electricity Markets: An Optimization Perspective
12/06/2017 → 16/06/2017
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Dynamics Days Europe 2017
Period: 5 Jun 2017
Erik Andreas Martens (Speaker)
Department of Applied Mathematics and Computer Science
Dynamical Systems
Department of Electrical Engineering

Description
Organization of minisymposium "Complex patterns on networks"
Degree of recognition: International

Related event
Dynamics Days Europe 2017
05/06/2017 → …
Szeged, Hungary
Activity: Talks and presentations › Conference presentations

Studenterinvolvering via ressourcemaessig effektiv peer review i et obligatorisk kursus i fysikken i medicinsk billeddannelse
Position Dependence of Fractional Derivative Models for Loudspeaker Voice Coils with Lossy Inductance

Period: 20 May 2017
Alexander Weider King (Speaker)
Department of Electrical Engineering
Acoustic Technology

Description
Commonly used models of moving-coil loudspeaker voice coils, which include effects from eddy current losses, are either inaccurate or contain an abundance of parameters and are difficult to extend to the nonlinear domain. On the contrary, fractional derivative models accurately describe the frequency and position dependence of the lossy inductance, with meaningful connections to the underlying physics, while keeping the number of parameters low. These fractional derivatives are also compatible with state-space polynomial methods of modeling nonlinear behavior. It is shown that the fractional order derivative approaches a value of 1, corresponding to an ideal inductance, when the voice coil is completely outside the magnetic system. Finally, the developed model reveals details about the effect of conductive voice coil formers.

Degree of recognition: International

Related event

142nd International Audio Engineering Society (AES) Convention
20/05/2017 → 23/05/2017
Berlin, Germany
Activity: Talks and presentations › Conference presentations

Danish Sound Day Research Talent Pitch Battle

Period: 18 May 2017
Alexander Weider King (Speaker)
Department of Electrical Engineering
Acoustic Technology

Degree of recognition: National

Related event

Danish Sound Day 2017
18/05/2017 → …
Struer, Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Mary had a little Lamb: Scanner-recorded speech during MRI without gradient-induced sound
Period: 26 Apr 2017
Jan Ole Pedersen (Speaker)
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents: ISMRM17sound(1)

Related event
ISMRM 25th Annual Meeting & Exhibition
22/04/2017 → 27/04/2017
Honolulu, United States
Activity: Talks and presentations › Conference presentations

Encoding of Inductively Measured k-Space Trajectories in MR Raw Data
Period: 25 Apr 2017
Jan Ole Pedersen (Speaker)
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International
Documents: abstract_001

Related event
ISMRM 25th Annual Meeting & Exhibition
22/04/2017 → 27/04/2017
Honolulu, United States
Activity: Talks and presentations › Conference presentations

ISMRM 25th Annual Meeting & Exhibition
Period: 22 Apr 2017 → 27 Apr 2017
Jan Ole Pedersen (Speaker)
Department of Electrical Engineering
Center for Magnetic Resonance
Degree of recognition: International

Related event
ISMRM 25th Annual Meeting & Exhibition
22/04/2017 → 27/04/2017
Honolulu, United States
Activity: Talks and presentations › Conference presentations

52nd International Universities' Power Engineering Conference (Event)
Period: 11 Apr 2017 → 11 Apr 2024
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
UPEC (University Power Engineering Conference) Steering Committee participation
Degree of recognition: International
Links:
Related event

**52nd International Universities' Power Engineering Conference**
28/08/2017 → 31/08/2017
Heraklion, Greece
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

SINTEF (External organisation)
Period: 7 Apr 2017 → 31 Dec 2024
Mattia Marinelli (Chairman)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

**Description**
Scientific committee member of the CINELDI - Centre for intelligent electricity distribution @ SINTEF, Trondheim, Norway
Degree of recognition: International
Links:
https://www.sintef.no/prosjekter/cineldi/ (Centre for intelligent electricity distribution)

Related external organisation

SINTEF
Norway
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

IET Renewable Power Generation (Journal)
Period: Mar 2017 → …
Theis Bo Rasmussen (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Description**
Reviewer

Related journal

IET Renewable Power Generation
1752-1416
Central database
Activity: Research › Peer review of manuscripts

High Frequency Planar Magnetics for Power Conversion
Period: 27 Mar 2017
Ziwei Ouyang (Speaker)
William Gerard Hurley (Speaker)
Department of Electrical Engineering
Electronics

**Description**
Degree of recognition: International
Documents:
APEC_2017 Presentation
Related event

27/03/2017 → …
Tampa, United States
Activity: Talks and presentations › Conference presentations

APEC2017 Professional Education Seminar: Bidirectional DC-DC Converters: Fundamentals and Advances
Period: 25 Mar 2017
Zhe Zhang (Speaker)
Department of Electrical Engineering
Electronics

Description
Professional Education Seminar at the 2017 IEEE Applied Power Electronics Conference and Exposition (APEC 2017), Tampa, FL, USA

Related event

the 2017 IEEE Applied Power Electronics Conference and Exposition (APEC 2017)
26/03/2017 → 30/03/2017
Tampa, United States
Activity: Talks and presentations › Conference presentations

Dartmouth College (External organisation)
Period: 22 Mar 2017
Michael A. E. Andersen (Participant)
Department of Electrical Engineering
Electronics

Description
Tenure Track Review Evaluation (Associate Professor with tenure)

Related external organisation

Dartmouth College
United States
Activity: Membership › Membership in review committee

Bloch simulation and MR fundamentals visualized
Period: 11 Mar 2017
Lars G. Hanson (Speaker)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance

Description
Invited talk
Degree of recognition: International
Documents:
MMCE2017_visualization
Links:
http://drcmr.dk/MR (Related content)

Related event

Magnetic Moments in Central Europe 2017
Listening to music with a cochlear implant: Limitations and possible solutions
Period: 8 Mar 2017
Jeremy Marozeau (Invited speaker)
Sébastien Santurette (Invited speaker)
Department of Electrical Engineering
Hearing Systems

Description
Although the cochlear implant can restore the perception of speech in quiet environments remarkably well, CI users are still facing many challenges in order to perceive music. In this talk, we describe how musical dimensions (pitch, tempo, timbre,...) are affected by the sound processor and a few solutions that could be used to improve the enjoyment of music by CI users.

Links:
http://cfh.dk/6.-nordiske.html

Related event
Nordiske Konference - Høreise, kognition, kommunikation
18/03/2015 → …
Fredericia, Denmark
Activity: Talks and presentations › Conference presentations

Nordiske Konference - Høreise, kognition, kommunikation
Period: 8 Mar 2017
Wiebke Lamping (Participant)
Steffen Spangmose Pedersen (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Listening to music with a cochlear implant: Limitations and possible solutions

Although the cochlear implant can restore the perception of speech in quiet environments remarkably well, CI users are still facing many challenges in order to perceive music. In this talk, we describe how musical dimensions (pitch, tempo, timbre,...) are affected by the sound processor and a few solutions that could be used to improve the enjoyment of music by CI users.

Links:
http://cfh.dk/6.-nordiske.html

Related event
Nordiske Konference - Høreise, kognition, kommunikation
18/03/2015 → …
Fredericia, Denmark
Activity: Attending an event › Participating in or organising a conference

Period: 1 Mar 2017 → …
Jacob Østergaard (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Degree of recognition: International

Related journal
Lyd - trådløs kommunikation i intelligent brugertilpasset design

Period: 1 Mar 2017 → 26 Apr 2017
Kaj Bjarne Jakobsen (Participant)

Department of Electrical Engineering
Electromagnetic Systems

**Description**

Lyd - trådløs kommunikation i intelligent brugertilpasset design

At være til gavn for samfundet er et af DTU’s mål og motto, og det virker højaktuelt, når det handler om teknologiudviklingen indenfor feltet trådløs kommunikation og moderne høreforskning. Ikke mindst set i lyset af at hver 6. person anslås at have et høretab i Danmark (og 37 mio. i Europa). Det er jo en størrelse som er til at forholde sig til.

Trådløs kommunikation og antenneudvikling og –specialisering indgår som vigtige elementer i moderne høreapparater og på DTU Elektro arbejdes der tæt med de danske høreapparativirksomheder, som står for ca. 30 % af alle høreapparater i verden. Her kan man tale om high-end teknologier som tjener et reelt og nyttigt formål.


Kom og oplev udstillingen som spænder bredt; fra teoretiske illustrationer af hvad trådløs kommunikation kan i dag, fraktal antenner, smart phones teknologiers bidrag til høreapparater, m.m.

Interview person.
Degree of recognition: International

Links:
http://www.elektro.dtu.dk/Kalender/Arrangement?id=5651b779-d32b-41cd-838f-308ab6a7b7d5

Related event

Lyd - trådløs kommunikation i intelligent brugertilpasset design
01/03/2017 → 26/04/2017
Kgs. Lyngby, Denmark
Activity: Other

Hidden hearing loss with envelope following responses (EFRs): The off-frequency problem

Period: 11 Feb 2017
Gerard Encina-Llamas (Speaker)

Department of Electrical Engineering
Hearing Systems

**Description**

Background

The ability to communicate in challenging situations with high levels of background noise is a fascinating property of the healthy auditory system. Despite normal sensitivity to pure-tones, many listeners complain about having difficulties in such situations. Recent animal studies have shown that noise over-exposure that produces temporary threshold shifts can cause the loss of auditory nerve (AN) fiber synapses. This neuronal degeneration has been termed "hidden hearing loss" or, more accurately, "synaptopathy", since it is not reflected in the traditional pure-tone threshold. The envelope following response (EFR) has been proposed as a potential objective method to assess synaptopathy in humans. In this study, an AN computational model was used to investigate the effects of off-frequency contributions (i.e. away from the characteristic place of the stimulus) and the differential loss of different AN fiber types on EFR level-growth functions. The extent to which background noise can mask these off-frequency contributions was also examined.
Methods
EFRs were measured using a 64-channel EEG system with active electrodes. EFR level-growth functions were recorded in adults for SAM tones with a carrier frequency of 2 kHz. Modulations depths of 25% and 85% were tested at sound pressure levels (SPL) of 40 to 90 dB. Subjects were either normally hearing (NH) or mildly hearing impaired (HI) at frequencies above 2 kHz. A humanized AN model (Zilany et al., 2014) was used to simulate the EFR level-growth functions at the tested modulation depths and levels for several degrees of synaptopathy.

Results
The AN model can account for the general trends obtained from human EFR level-growth functions. The simulations reveal that on- vs off-frequency EFR level-growth functions show completely different shapes. Off-frequency contributions have a large impact in the overall EFR magnitudes. The total EFR responses are strongly dominated by the high-SR fibers, especially at lower intensities. Background noise minimize the effects of off-frequency contributions on the overall EFR.

Conclusions
Off-frequency contributions of high-SR fibers dominate the total model EFR responses, suggesting that the loss of low- and medium-SR fibers has only little impact on measured EFRs. However, the impact of off-frequency high-SR fibers is reduced in broadband noise, placing greater emphasis on low- and medium-SR fiber responses.

Funding
This work was supported by CHeSS at the Technical University of Denmark. This work has been done in collaboration with CompNet at Boston University and the Massachusetts Eye and Ear Infirmary, thanks to an ACN Erasmus Mundus scholarship.

Related event
40th MidWinter Meeting of the Association for Research in Otolaryngology
11/02/2017 → 15/02/2017
Baltimore, United States
Activity: Talks and presentations › Conference presentations

Temporal processing deficits due to noise-induced synaptopathy studied using envelope following responses
Period: 11 Feb 2017
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems
Description
Temporal processing deficits due to noise-induced synaptopathy studied using envelope following responses
Authors:
Aravindakshan Parthasarathy - Post-Doc, Eaton-Peabody Labs, Mass. Eye and Ear; Department of Otolaryngology, Harvard Medical School (Role: First Author;Presenting Author)
Gerard Encina-Llamas - PhD Student, Technical University of Denmark (Role: Co-Author)
Barbara Shinn-Cunningham - Professor, Boston University (Role: Co-Author)
Sharon G. Kujawa - Associate Professor, Harvard Medical School and Massachusetts Eye and Ear Infirmary (Role: Co-Author)

Introduction
Sound overexposure can result in a loss of synapses between inner hair cells (IHC) and the auditory nerve (AN) fibers. Although not manifested as changes in hearing thresholds, this synaptopathy may affect encoding of temporally complex stimuli, especially in conditions of background noise. Here, population envelope following responses (EFRs) were used to study suprathreshold temporal processing in a rodent model of synaptopathy. By also recreating these responses in a computational model of AN response, contributions of different spontaneous-rate (SR) fiber groups and the influence of off-frequency neurons to encoding suprathreshold sounds were explored.

Methods
EFRs were obtained from CBA/CaJ mice reared in quiet or after single exposure to a known synaptopathic noise that does not cause permanent hearing threshold elevations. EFR stimuli were tones, sinusoidally amplitude modulated (sAM) at 1024Hz that stimulated either synaptopathic or non-synaptopathic cochlear regions. First, tones were presented in quiet with modulation depths of 25% and 85% and sound levels from 20 to 80dBSPL. In the second experiment, fully modulated sAM tones were presented at a suprathreshold sound level, in varying levels of noise. ABR and DPOAE growth functions
also were recorded, and immunostained cochlear whole-mounts were used to quantify hair cells and synapses. Results were compared to model-simulated EFRs with varying degrees of noise-induced synaptopathy. Contributions of off-channel, higher frequency neurons to the EFRs, as well as contributions of low, medium and high SR fibers were explored.

Results
Animals with noise-induced synaptopathy showed reduced EFR and ABR amplitudes, even though ABR and DPOAE thresholds and DPOAE amplitudes were recovered. These synaptopathic animals also showed a decreased dynamic range of noise masking in EFRs, relative to controls. The computational model recreated these responses. Off-frequency contributions of high-SR fibers dominated the modelled EFR amplitudes in quiet; however, these contributions were minimized at supra-threshold levels in the presence of noise masking.

Conclusions
Noise-induced synaptopathy causes deficits in temporal processing, as reflected in the EFR. Modelled results can account for the general trends obtained from the EFRs. Specifically, off-frequency contributions of high-SR fibers dominated the total modelled EFR in quiet. However, high-SR fiber contributions were reduced in broadband noise, consistent with a greater role for low- and medium-SR neurons in the temporal processing of sound signals in noise.

Funding provided by DoD W81XWH-15-1-0103 (SGK); CHeSS, Technical University of Denmark and ACN Erasmus Mundus scholarship (GEL).

Related event
40th MidWinter Meeting of the Association for Research in Otolaryngology
11/02/2017 → 15/02/2017
Baltimore, United States
Activity: Talks and presentations › Conference presentations

Applied Acoustics (Journal)
Period: 10 Feb 2017
Oliver Ackermann Lylloff (Reviewer)
Acoustic Technology
Department of Wind Energy
Aerodynamic design
Degree of recognition: International

Related journal
Applied Acoustics
0003-682X
Central database
Activity: Research › Peer review of manuscripts

Linköping University (External organisation)
Period: 1 Feb 2017 → 8 Mar 2017
Mogens Blanke (Member)
Department of Electrical Engineering
Automation and Control
Description
Member of evaluation committee, Dr. Ing. degree Jonas Linder, Linköping University, Sweden
Degree of recognition: International

Related external organisation
Linköping University
Sweden
Activity: Membership › Membership in review committee
Cochlear
Period: 23 Jan 2017 → 13 May 2017
Thomas Bentsen (Visiting researcher)
Department of Electrical Engineering
Hearing Systems

Description
Visiting Cochlear House, Melbourne during my external research stay
Degree of recognition: International
Activity: Visiting an external institution › Visiting another research institution

ETH Zurich
Period: 15 Jan 2017 → 31 May 2017
Florian Thams (Visiting researcher)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Academic Guest at the Power System Laboratory (PSL) working with Professor Hug.
Degree of recognition: International
Activity: Visiting an external institution › Visiting another research institution

International Transactions on Electrical Energy System (Journal)
Period: 1 Jan 2017 → …
Jalal Kazempour (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Description
Member of Editorial Board

Related journal
International Transactions on Electrical Energy System
2050-7038
Scopus rating (2017): CiteScore 1.63, Web of Science (2018): Indexed yes
Central database
Activity: Research › Journal editor

Journal of Modern Power Systems and Clean Energy (Journal)
Period: 1 Jan 2017
Guangya Yang (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems
Degree of recognition: International

Related journal
Journal of Modern Power Systems and Clean Energy
2196-5625
Dansk Standard (External organisation)
Period: 2016 → …
Guangya Yang (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Description**
Committee S-508: System aspects of electrical energy supply

**Related external organisation**
Dansk Standard
Denmark
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

International Electrotechnology Commission (IEC), Technical Committee 8/Working Group 7 (External organisation)
Period: 2016 → …
Guangya Yang (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Description**
Project: IEC/TS 62898-3-1, Microgrids - Technical Requirements - Protection requirements in microgrids
Degree of recognition: International

**Related external organisation**
International Electrotechnology Commission (IEC), Technical Committee 8/Working Group 7
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

National Science Centre (NCN) (External organisation)
Period: 2016
Vitaliy Zhurbenko (Member)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Electromagnetic Systems

**Description**
Poland
Degree of recognition: International

**Related external organisation**
National Science Centre (NCN)
Activity: Membership › Membership in review committee

Vice-Chair, ISMRM study group on Detection & Correction of Motion in MRI & MRS (External organisation)
Period: 2016 → 2017
Lars G. Hanson (Participant)
Copenhagen Center for Health Technology
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance

Description
Research Network of the International Society for Magnetic Resonance in Medicine
Degree of recognition: International

Related external organisation
Vice-Chair, ISMRM study group on Detection & Correction of Motion in MRI & MRS
Activity: Membership › Membership of research networks or expert groups

Power and Energy Research – a Danish Perspective
Period: 13 Dec 2016
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
CEE presentation at Chalmers

Related event
Power system workshop at CHALMERS
13/12/2016 → 13/12/2016
Göteborg, Sweden
Activity: Talks and presentations › Conference presentations

Control of voltage source converters during faults
Period: Nov 2016 → Mar 2017
Jundi Jia (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Special course supervision
Activity: Examinations and supervision › Supervisor activities

Power system protection principles and application
Period: Nov 2016 → Jan 2017
Jundi Jia (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Special course supervision
Activity: Examinations and supervision › Supervisor activities

External examiner on PhD defense by PhD student Mark Caris
Period: 30 Nov 2016
Michael A. E. Andersen (External examiner)
ARCHES/ICANHEAR 2016

Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Poster contribution

Participation in the combined ARCHES/ICANHEAR conferences

Related event

ARCHES/ICANHEAR 2016: Audiological Research Cores in Europe (ARCHES) meeting and Improved Communication through Applied Hearing Research (ICanHear) conference
Zurich, Switzerland
Activity: Attending an event › Participating in or organising a conference

13th European Workshop on Advanced Control and Diagnosis

Period: 19 Nov 2016
Denis Kirchhübel (Speaker)
Department of Electrical Engineering
Automation and Control

Description
Presentation on "Representing Operational Modes for Situation Awareness"

Workshop participation at ACD2016

Related event

13th European Workshop on Advanced Control and Diagnosis
17/11/2016 → 19/11/2016
Lille, France
Activity: Talks and presentations › Conference presentations

CST Workshop Series 2016

Period: 14 Nov 2016
Vitaliy Zhurbenko (Organizer)
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance
Electromagnetic Systems

Description
Local coordination of the workshop.

Computer simulation activities at EMS, DTU

Related event

CST Workshop Series 2016
Investigation of grid-connected voltage source converter performance under unbalanced faults
Period: 28 Oct 2016
Jundi Jia (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related event
2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference
25/10/2016 → 28/10/2016
Xi’an, China
Activity: Talks and presentations › Conference presentations

2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference
Bahtiyar Can Karatas (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Related event
2016 IEEE PES Asia-Pacific Power and Energy Engineering Conference
25/10/2016 → 28/10/2016
Xi’an, China
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Professorship evaluation (External organisation)
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Member of evaluation committee for Professorship at Linköping University (SE)
Evaluation of candidate(s) for Professorship at Linköping University (SE)

Body type: University
Degree of recognition: International

Related external organisation

Professorship evaluation
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Head of committee at PhD defense by PhD student Juan Colmenares
Period: 14 Oct 2016
Michael A. E. Andersen (Main supervisor)
Department of Electrical Engineering
Music and CI symposium
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Poster contribution

Poster contribution to the first international symposium on music and cochlear implants

Related event
Music and CI symposium
13/10/2016 → 14/10/2016
Snekkersten, Denmark
Activity: Attending an event › Participating in or organising a conference

External examiner on PhD thesis by PhD student Vita Lystianingrum
Period: 6 Oct 2016
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Ultrasonic lubrication: concept and application
Period: 4 Oct 2016
Tiberiu-Gabriel Zsurzsan (Invited speaker)
Department of Electrical Engineering
Electronics

Related event
69th ICAT International Smart Actuator Symposium
04/10/2016 → 05/10/2016
State College, United States
Activity: Talks and presentations › Conference presentations

5th International Workshop on Power Supply On Chip
Jens Christian Hertel (Participant)
Department of Electrical Engineering
Electronics

Related event
5th International Workshop on Power Supply On Chip
03/10/2016 → 05/10/2016
Madrid, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Interaction of Droop Control Structures and Its Inherent Effect on the Power Transfer Limits in Multi-Terminal VSC-HVD
Period: 16 Sep 2016
Florian Thams (Guest lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Presentation of the journal publication "Interaction of Droop Control Structures and Its Inherent Effect on the Power Transfer Limits in Multi-Terminal VSC-HVD"
Degree of recognition: International

Related event
HVDC Doctoral Colloqulum
14/09/2016 → 16/09/2017
Porto, Portugal
Activity: Talks and presentations › Conference presentations

Beyond the audiogram: How can we achieve better hearing rehabilitation?
Period: 9 Sep 2016
Sébastien Santurette (Invited speaker)
Department of Electrical Engineering
Hearing Systems
Links:
http://dtas.dk/aarsmoede_2016.php

Related event
Dansk Teknisk Audiologisk Selskab
09/09/2016 → 10/09/2016
Stouby, Denmark
Activity: Talks and presentations › Conference presentations

Dansk Teknisk Audiologisk Selskab
Period: 9 Sep 2016
Raul Sanchez Lopez (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Poster presentation: Spectro-temporal modulation sensitivity and discrimination in normal hearing and hearing-impaired listeners
Dansk Teknisk Audiologisk Selskab (DTAS) årsmøde 2016

Related event
Dansk Teknisk Audiologisk Selskab
09/09/2016 → 10/09/2016
Stouby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Effects of musical experience on pitch discrimination
Period: 9 Sep 2016
Sébastien Santurette (Invited speaker)
Department of Electrical Engineering
Hearing Systems

Links:
http://dtas.dk/aarsmoede_2016.php

Related event

Dansk Teknisk Audiologisk Selskab
09/09/2016 → 10/09/2016
Stouby, Denmark
Activity: Talks and presentations › Conference presentations

Interspeech 2016
Period: 8 Sep 2016 → 12 Sep 2016
Thomas Bentsen (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Attending and presenting a poster at the 2016 conference.
Degree of recognition: International

Related event

Interspeech 2016
08/09/2016 → 12/09/2016
San Francisco, Ca, United States
Activity: Attending an event › Participating in or organising a conference

Poster presentation
Period: 8 Sep 2016 → 12 Sep 2016
Thomas Bentsen (Speaker)
Department of Electrical Engineering
Hearing Systems

Description
Poster presentation
Degree of recognition: International

Related event

Interspeech 2016
08/09/2016 → 12/09/2016
San Francisco, Ca, United States
Activity: Talks and presentations › Conference presentations

Risks related to static magnetic fields
Period: 1 Sep 2016
Lars G. Hanson (Invited speaker)
Copenhagen Center for Health Technology
Center for Hyperpolarization in Magnetic Resonance
Department of Electrical Engineering
Center for Magnetic Resonance

Description
Invited oral presentation
Links:
http://dx.doi.org/10.1016/j.ejmp.2016.07.272

**Related event**

**1st European Congress of Medical Physics**  
01/09/2016 → 04/09/2016  
Athens, Greece  
Activity: Talks and presentations › Conference presentations

**Committee member at PhD defense by PhD student Luyu Wang**  
Period: 19 Aug 2016  
Michael A. E. Andersen (External examiner)  
Department of Electrical Engineering  
Electronics  
Activity: Examinations and supervision › External examination

**Academic communication and effective presenting**  
Andreu Paredes Gallardo (Participant)  
Department of Electrical Engineering  
Hearing Systems  
Description  
Participated on the course  
Participation in the course "Academic communication and effective presenting", part of the Tampere University Summer School program.

**Related event**

**Academic communication and effective presenting: University of Tampere Summer School**  
08/08/2016 → 16/08/2016  
Tampere, Finland  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Studies on Low Inertia Systems and Application of Synchronous Condensers: Initial results from Danish Project SCAPP**  
Period: 21 Jul 2016  
Guangya Yang (Speaker)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Electric Power Systems  
Description  
presented some of the thoughts and results from Danish SCAPP project in PES GM.  
Degree of recognition: International  
Documents:  
2016PESGM_presentation

**Related event**

**2016 IEEE Power Engineering Society General Meeting**  
17/07/2016 → 21/07/2016  
Boston, MA, United States  
Activity: Talks and presentations › Conference presentations
NREL Cybersecurity & Resilience Workshop "Security and Resilience of Grid Integration with Distributed Energy Resources: Lessons Learned & Future Outlook"
Anna Magdalena Kosek (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management

Related event
NREL Cybersecurity & Resilience Workshop "Security and Resilience of Grid Integration with Distributed Energy Resources: Lessons Learned & Future Outlook"
13/07/2016 → 14/07/2016
Golden, United States
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

The Future Sustainable Energy System: Synergy between industry, researchers and students as a key to an efficient energy system transformation
Period: 5 Jul 2016
Jacob Østergaard (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
The Future Sustainable Energy System v3

Related event
Technology and the Energy Challenge
05/07/2016 → 05/07/2016
Ballerup, Denmark
Activity: Talks and presentations › Conference presentations

The Future Sustainable Energy System: Synergy between industry, researchers and students as a key to an efficient energy system transformation
Period: 5 Jul 2016
Jacob Østergaard (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
The Future Sustainable Energy System v3 - distrib

Related event
Technology and the Energy Challenge
05/07/2016 → 05/07/2016
Ballerup, Denmark
Activity: Talks and presentations › Conference presentations

DTU Summer School 2016: Uncertainty in Electricity Markets and System Operation
Period: 4 Jul 2016 → 8 Jul 2016
Jalal Kazempour (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Description
Related event

**DTU Summer School 2016: Uncertainty in Electricity Markets and System Operation**
04/07/2016 → 08/07/2016
Activity: Attending an event › Participating in or organising a conference

**Improving Cochlear Implant Performance**
Period: 1 Jul 2016
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

**Description**
Attended the talks and contributed with a poster presentation

Participation in the yearly meeting "Improving Cochlear Implant Performance" organized by UCL (London)

**Related event**

**Workshop on Improving Cochlear Implant Performance**
01/07/2016 → 01/07/2016
London, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**PowerLabDK Grand Opening**
Period: 23 Jun 2016
Thibaut Pierre Richert (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management

**Description**
PhD project presentation at the PowerLab.dk kick off event
Documents:
Poster PowerLab Thibaut Richert

**Related event**

**PowerLabDK Grand Opening**
23/06/2016 → 23/06/2016
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**PowerLabDK Grand Opening: Opening remarks**
Period: 23 Jun 2016
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
PowerLabDK Grand Opening - opening remarks v7
PowerLabDK Grand Opening - Speech manuscript

**Related event**

**PowerLabDK Grand Opening**
International Symposium on Objective Measures in Auditory Implants
Andreu Paredes Gallardo (Speaker)

Department of Electrical Engineering

Description
Oral presentation at the 9th International Symposium on Objective Measures in Auditory Implants (Szeged, Hungary)
Degree of recognition: International
Documents:
OMAI-2016-Abstract-Book
Links:
http://objectivemeasures.org/ (OMAI website)

Related event
International Symposium on Objective Measures in Auditory Implants
15/06/2016 → 18/06/2016
Szeged, Hungary
Activity: Talks and presentations › Conference presentations

Power frequency control provision from electric vehicles in a high voltage system with high wind power penetration
Mattia Marinelli (Participant)

Department of Electrical Engineering
Center for Electric Power and Energy

Distributed Energy Resources

Description
Master thesis by Valgeir Þór Sæmundsson
Documents:
s147489_Thesis
Activity: Other

Fremtidens Energisystem
Period: 14 Jun 2016
Jacob Østergaard (Lecturer)

Department of Electrical Engineering
Center for Electric Power and Energy

Related event
Natur og teknik
14/06/2016 → 14/06/2016
Holte, Denmark
Activity: Talks and presentations › Conference presentations

Fundamentals of Electrical Energy Conversion
Period: 10 Jun 2016
Michael A. E. Andersen (Guest lecturer)

Department of Electrical Engineering
Electronics

Description
EUROTECH Summer Doctoral School 2016

Related external organisation
Ecole Polytechnique Federale de Lausanne (EPFL)
CH-1015, Lausanne, Switzerland
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Distribution grid with distributed energy resources: impact, control, and design: Defense presentation slides
Period: 7 Jun 2016
Xue Han (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy System Management

Description
This file contains the slides I used for the lecture during the defense of my PhD thesis.
Documents:
DefenseSlides

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

EuroTech Summer School 2016 @ EPFL: Energy Systems
Theis Bo Rasmussen (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Participation in the 2016 Eurotech Summerschool: From physics to systems at EPFL in Lausanne Switzerland
Links:
http://eurotech.epfl.ch/

Related event

EuroTech Summer School 2016 @ EPFL: Energy Systems
06/06/2016 → 17/06/2016
Lausanne, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Center for Electric Power and Energy (CEE)
Period: 2 Jun 2016
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Præsentation til Siemens Innovation Days Erlangen

Related event
Siemens Innovation Days  
01/06/2016 → 02/06/2016  
Erlangen, Germany  
Activity: Talks and presentations › Conference presentations

Fremtidens fleksible elforbruger  
Period: 31 May 2016  
Jacob Østergaard (Invited speaker)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Documents:  
Fremtidens fleksible elforbruger v2

Related event  
Kunden i centrum i et nyt elmarked  
31/05/2016 → 31/05/2016  
København, Denmark  
Activity: Talks and presentations › Conference presentations

Danish Cardiovascular Research Academy  
Period: 26 May 2016 → 28 May 2016  
Jens Christian Brasen (Organizer)  
Department of Electrical Engineering  
Biomedical Engineering  
Description  
Organiser of a symposium and chair of the symposium.  
Organiser of a symposium and chair of the symposium.

Related event  
Danish Cardiovascular Research Academy : 2016 Summer Meeting  
26/05/2016 → 28/05/2016  
Sønderborg, Denmark  
Activity: Attending an event › Participating in or organising a conference

CITIES consortium 2016  
Period: 24 May 2016 → 25 May 2016  
Thibaut Pierre Richert (Participant)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Energy System Management  
Description  
Participation in the poster session at the CITIES annual consortium meeting  
Documents:  
Poster CITIES consortium 24-05-16

Related event  
CITIES consortium 2016  
24/05/2016 → 25/05/2016  
Lyngby, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
Integrated and Very High Frequency Converter
Period: 20 May 2016
Michael A. E. Andersen (Speaker)
Department of Electrical Engineering
Electronics

Description
Huawei Technology Workshop 2016
"Power Electronics for Network Energy in 2020, More Silicon - Less Copper"

Related external organisation
Huawei Technologies Sweden AB
Stockholm, Sweden
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

The Role of Smart Grid in Systems Integration
Period: 16 May 2016
Jacob Østergaard (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
The Role of Smart Grid in Systems Integration final

Related event
The UK-Nordic Smart Grid Forum: A Whole Systems Approach to the Smart Grid
16/05/2016 → 16/05/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

OPTIMIZED CHARGING CONTROL METHOD FOR PLUG-IN ELECTRIC VEHICLES IN LV DISTRIBUTION NETWORKS (External organisation)
Period: 6 May 2016
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
I participated as examiner for the PhD defence of Mr. Javier Garcia Villalobos from the University of the Basque Country
Degree of recognition: International
Documents:
JavierGV_thesis_final

Related external organisation
OPTIMIZED CHARGING CONTROL METHOD FOR PLUG-IN ELECTRIC VEHICLES IN LV DISTRIBUTION NETWORKS
Activity: Membership › Membership in review committee

Research in Electric Power Systems and Storage
Period: 20 Apr 2016
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
The shift from centralised large production to distributed energy production has several consequences on the current power system operation. The increasing number of the distributed energy resources (DERs) replacing large power plants influences the dependency of the power system on the small scale, distributed production. Many of these DERs can be accessed and controlled remotely, posing a cyber-security risk. The cyber-physical system analysis helps the power system operator to discover if their assets have been compromised. The cyber-physical intrusion detection systems offer additional monitoring and decision aiding tools to discover malicious operation of the power grid. This talk will present model-based anomaly detection as a component of a cyber-physical intrusion detection system.
Predicting speech intelligibility based on a correlation metric in the modulation power domain
Period: 5 Apr 2016
Helia Relano Iborra (Guest lecturer)
Department of Electrical Engineering
Hearing Systems
Documents:
heliaib_eriksholm_v3

Related external organisation
Eriksholm Research Centre
Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

Enhancing the role of EVs in the smart grid: Resources or threats to power system operation? Trends and research drivers in Europe
Period: 23 Mar 2016
Mattia Marinelli (Keynote speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Documents:
Key note speech ICESI - 23 03 2016 - Mattia Marinelli - ULT

Related event
The 1st Int. Conference on Electric Vehicle, Smart Grid and Information Technology
21/03/2016 → 25/03/2016
Jeju Island, Korea, Democratic People's Republic of
Activity: Talks and presentations › Conference presentations

2016 IEEE International Conference on Industrial Technology
Tiberiu-Gabriel Zsurzsan (Participant)
Department of Electrical Engineering
Electronics

Description
2016 IEEE International Conference on Industrial Technology

Related event
2016 IEEE International Conference on Industrial Technology
14/03/2016 → 17/03/2016
Taipei, Taiwan, Province of China
Activity: Attending an event › Participating in or organising a conference

Teaching and learning DTU
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

**Description**
Participation in the course Teaching and Learning organized by the DTU learning lab

**Related event**

**Teaching and learning DTU**
08/04/2014 → 11/04/2014
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**From Tietgen to Modern Hearing Aids**
Period: 1 Mar 2016
Kaj Bjarne Jakobsen (Invited speaker)
Department of Electrical Engineering
Electromagnetic Systems

**Description**
Fra Tietgen til moderne høreapparater.

Tietgens rolle i udvik­ling­en af høreapparater knytter sig til starten af den historiske udvikling af teknologi i Danmark, der førte fra skabelsen af Store Nordiske Telegraf-Selskab til virksomheden GN. Således kan GN ReSound – som de første i verden - stream­e lyd direkte fra telefon, radio og TV med direkte modtagelse af radio-bølger i frekvens-bånd-­et 2,4 GHz.

Kom og hør om, hvad der forskes i inden for høreapparater på DTU, GN's nye høreapparater, og hvad der kan komme ud af koblingen mellem universitet og industri.

Arrangør: IDA Sundhedsteknologi
Medarrangør: IDA Elteknik, IDA IT, IDA Mechanical og IDA Mechanical København

En række danske virksomheders udviklingsarbejde har sammen med den offentlige forskning ført til udvikling af avanceret teknologi til høreapparater.

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Using auditory steady-state responses to evaluate auditory nerve integrity in normal-hearing and mild hearing-impaired listeners**
Period: 21 Feb 2016
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems

**Description**
Using Auditory Steady-State Responses to Evaluate Compression and Auditory Nerve Integrity in Normal-Hearing and Hearing-Impaired listeners

**Background**
The healthy auditory system has the ability to enable communication in challenging acoustical environments with high levels of background noise. Hearing impairment often leads to a deterioration of this ability, however the degree of which varies widely. It is believed that the specific underlying pathology plays an important part in determining this variability. It has been shown that loss of outer hair cells leads to a reduction in peripheral compression. It has also recently been shown in animal studies that noise over-exposure, producing temporary threshold shifts, can cause auditory nerve fiber (ANF) deafferentation in predominantly low-spontaneous rate (SR) fibers. In this study, auditory steady-state response (ASSR) level growth functions were measured both in normal-hearing (NH) and mildly hearing-impaired (HI) listeners to evaluate the applicability of ASSR to assess peripheral compression and the capacity to code intensity fluctuations at high stimulus levels.
Methods
ASSRs were measured using a 64-channel EEG recording amplifier with active electrodes. ASSR level growth functions were measured in adults at stimulus levels between 20 and 90 dB SPL. Subjects were NH, or mildly HI listeners towards higher frequencies. To evaluate compression, sinusoidally amplitude modulated (SAM) tones at carrier frequencies of 0.5, 1.0, 2.0 and 4.0 kHz were presented simultaneously with a modulation depth of 85%. To evaluate intensity coding at high intensities, a single SAM tone with 2 kHz carrier frequency and modulation depths of 25% and 85% was presented.

Results
For all listeners at frequencies with normal audiometric thresholds, ASSR level growth functions exhibited consistently compression of about 0.25 dB/dB up to 60 dB SPL. At frequencies with impaired audiometric thresholds, an increased slope of the level growth function, i.e. a reduced compression, was found. For the shallow modulation depth of 25% and levels above 60 dB SPL, the growth function slope showed higher variability across NH subjects than for levels below 60 dB SPL. The same effect was found in HI listeners at the non-impaired frequencies.

Conclusions
The results show that compression estimates derived from the slope of ASSR level growth functions are similar to other estimates of peripheral compression. Peripheral compression can be estimated simultaneously at four frequencies for levels up to 60 dB SPL, both for NH and HI listeners. Above 60 dB SPL, the results indicate that the slope of the ASSR level growth function obtained using shallow modulation depths provides information about the capacity to code intensity fluctuations.

Funding
This work was funded by the Oticon Center of Excellence for Hearing and Speech Sciences (CHeSS) at the Technical University of Denmark (DTU).

Degree of recognition: International

Related event
Association for Research in Otolaryngology 39th Annual MidWinter Meeting
20/02/2016 → 24/02/2016
San Diego, California, United States
Activity: Talks and presentations › Conference presentations

5th Neurorobotics Performance Show
Period: 17 Feb 2016 → 19 Feb 2016
Silvia Tolu (Participant)
Department of Electrical Engineering
Automation and Control
Centre for Playware

Description
Participation at the 5th Neurorobotics Performance show (HBP SP 10) in Geneva

5th Neurorobotics Performance show

Related event
5th Neurorobotics Performance Show: HBP SP 10
17/02/2016 → 19/02/2016
Geneva, Switzerland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Special PhD-level course on "Large-scale optimization problems in energy systems: Applications of decomposition techniques", Spring 2016.
Jalal Kazempour (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Related event

Special PhD-level course on "Large-scale optimization problems in energy systems: Applications of decomposition techniques".
15/02/2016 → 15/07/2016
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Investigation of distance relay performance for blackout prevention in low inertia electric power systems
Jundi Jia (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Master Thesis Supervision
Activity: Examinations and supervision › Supervisor activities

advanced NMR spectroscopy
Period: 19 Jan 2016
Lars G. Hanson (Lecturer)
Copenhagen Center for Health Technology
Department of Electrical Engineering

Description
Lecture on Magnetic Resonance Imaging

Related event

Advanced NMR Spectroscopy: PhD course
11/01/2016 → 21/01/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Vision of future grid operation
Period: 18 Jan 2016
Guangya Yang (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Presentation slides
Documents:
Smartgrid workshop 18 Jan 2016 ELSY

Related event

Smart grid workshop
18/01/2016 → 18/01/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

3rd HBP Education Programme
Period: 11 Jan 2016 → 15 Jan 2016
Silvia Tolu (Participant)
Title: A modular cerebellar based control architecture for a modular robot, S. Tolu, D. J. Christensen, H. H. Lund.

Related event

3rd HBP Education Programme: Workshop - Future Computing
11/01/2016 → 15/01/2016
Manchester, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

External examiner on PhD thesis by PhD student Xian Liang
Period: 3 Jan 2016
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Senior Member, IEEE (External organisation)
Period: 1 Jan 2016
Zhe Zhang (Participant)
Department of Electrical Engineering
Electronics
Description
Senior Member, IEEE
Related external organisation
Senior Member, IEEE
Activity: Membership › Board duties in companies, associations, or public organisations

Integrated bidding and operating strategies for wind farm-energy storage systems
Period: 2015
Pierre Pinson (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Related event

European conference for Operational Research 2015
12/07/2015 → 15/07/2015
Glasgow, United Kingdom
Activity: Talks and presentations › Conference presentations

Member of DTU Academic Council (External organisation)
Period: 2015 → …
Ole Ravn (Participant)
Department of Electrical Engineering
Modelling of high-dimensional space-time dynamics of renewables
Period: 2015
Pierre Pinson (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Description
Invited seminar, Universite Paris 7, France

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Renewable energy forecasting
Period: 2015
Pierre Pinson (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Related event
EuroTech Winter School: Smart Energy
02/02/2015 → 15/02/2015
Lausanne, Switzerland
Activity: Talks and presentations › Conference presentations

Secretary, ISMRM study group on Detection & Correction of Motion in MRI & MRS (External organisation)
Period: 2015 → 2016
Lars G. Hanson (Participant)
Biomedical Engineering
Department of Electrical Engineering
Copenhagen Center for Health Technology

Description
Research Network of the International Society for Magnetic Resonance in Medicine
Degree of recognition: International

Related external organisation
Secretary, ISMRM study group on Detection & Correction of Motion in MRI & MRS
Activity: Membership › Membership of research networks or expert groups

The Danavox Jubilee Foundation (Publisher)
Period: 2015 → 2016
Sébastien Santurette (Editor)
Towards future electricity markets with large penetration of renewable generation
Period: 2015
Pierre Pinson (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

Towards the usage of new large datasets for renewable energy applications
Period: 2015
Pierre Pinson (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

6th International Conference on Advanced Mechatronics 2015
Period: 5 Dec 2015 → 8 Dec 2015
Tiberiu-Gabriel Zsurzsan (Participant)
Department of Electrical Engineering
Electronics
EP Master class IV: Cortical Evoked Potentials
Period: 3 Dec 2015
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Introduction to electrophysiological recordings with CI users, theoretical concepts and practice sessions.

Participation in a one day course at Cochlear Academy (Mechelen, Belgium)

Related event

EP Master class IV: Cortical Evoked Potentials
03/12/2015 → 03/12/2015
Mechelen, Belgium
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

HTX, EucSyd Sønderborg
Period: 20 Nov 2015
Kaj Bjørne Jakobsen (Lecturer)
Department of Electrical Engineering
Electromagnetic Systems

Description
Antennas for Body-Centric Communications, Anechoic Chamber

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Risk in MRI associated with the static B0 field
Period: 19 Nov 2015
Lars G. Hanson (Invited speaker)
Copenhagen Center for Health Technology
Department of Electrical Engineering

Description
Invited lecture
Links:

Related event

ESMRMB safety course: ESMRMB School of MRI
19/11/2015 → 21/11/2015
Lund, Sweden
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Talk at Audiological Research Cores in Europe
Period: 17 Nov 2015
Thomas Bentsen (Speaker)
Department of Electrical Engineering
Hearing Systems
Description
Talk at Audiological Research Cores in Europe (ARCHES)
Degree of recognition: International

Related event
Audiological Research Cores in Europe 2015
16/11/2015 → 17/11/2015
Groningen, Netherlands
Activity: Talks and presentations › Conference presentations

Dynamic Modeling, Advanced Control, Diagnosis and Optimization of Large-Scale Lignocellulosic Biorefineries
Period: 11 Nov 2015
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

Related event
2015 AIChE Annual Meeting
08/11/2015 → 13/11/2015
Salt Lake City, United States
Activity: Talks and presentations › Conference presentations

Integrated Smart Infrastructures
Period: 10 Nov 2015
Jacob Østergaard (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Jacob-Oestergaard

Related event
Integrated energy systems 2015: Energy conference: Energy systems integration for the transition to non-fossil energy systems
10/11/2015 → 10/11/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Plantwide Model-Based Optimization of a Large Scale Second Generation Biorefinery
Period: 10 Nov 2015
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

Related event
2015 AIChE Annual Meeting
08/11/2015 → 13/11/2015
Salt Lake City, United States
Activity: Talks and presentations › Conference presentations

2015 41th IEEE Industrial Electronics Society Annual Conference
Period: 9 Nov 2015 → 12 Nov 2015
Tiberiu-Gabriel Zsurzsanzan (Participant)
Department of Electrical Engineering
Related event

2015 41th IEEE Industrial Electronics Society Annual Conference
09/11/2015 → 12/11/2015
Yokohama, Japan
Activity: Attending an event › Participating in or organising a conference

Investigation of stability aspects in a Pan-European interconnected grid with different wind power penetration
Period: 1 Nov 2015 → 30 Apr 2016
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
Master thesis by Caterina Toigo, student at University of Padova (Italy), written during her exchange at DTU between November 2015 and April 2016
Documents:
ThesisCaterinaToigo
Activity: Other

State-Space Modeling of Loudspeakers Using Fractional Derivatives
Period: 30 Oct 2015
Alexander Weider King (Speaker)
Department of Electrical Engineering
Acoustic Technology

Description
This work investigates the use of fractional order derivatives in modeling moving-coil loudspeakers. A fractional order state-space solution is developed, leading the way towards incorporating nonlinearities into a fractional order system. The method is used to calculate the response of a fractional harmonic oscillator, representing the mechanical part of a loudspeaker, showing the effect of the fractional derivative and its relationship to viscoelasticity. Finally, a loudspeaker model with a fractional order viscoelastic suspension and fractional order voice coil is fit to measurement data. It is shown that the identified parameters can be used in a linear fractional order state-space model to simulate the loudspeakers’ time domain response.
Degree of recognition: International

Related event

139th International Audio Engineering Society (AES) Convention
29/10/2015 → 01/11/2015
New York City, United States
Activity: Talks and presentations › Conference presentations

Development and Operation of a Wind Power Based Energy System: Experiences and Research Efforts
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Presentation Jacob Ostergaard RPG2015 2015-10-17 final

Related event

4th Renewable Power Generation Conference
15/10/2015 → 16/10/2015
Beijing, China
Activity: Talks and presentations › Conference presentations

**International Journal of Adaptive Control and Signal Processing (Journal)**
Period: 1 Oct 2015 → 1 May 2017
Mogens Blanke (Reviewer)
Department of Electrical Engineering
Automation and Control

**Description**
Editor for Special Issue on Marine Systems Applications
Degree of recognition: International

**Related journal**
International Journal of Adaptive Control and Signal Processing
0890-6327
Central database
Activity: Research › Journal editor

**EuroAsianPacific Joint Conference on Cognitive Science**
Period: 25 Sep 2015 → 27 Sep 2015
Silvia Tolu (Speaker)
Department of Electrical Engineering
Automation and Control
Centre for Playware

**Description**

Talk: "Cerebellar internal models for a modular robot"
Links:
http://www.eapcogsci2015.it/

**Related event**
EuroAsianPacific Joint Conference on Cognitive Science
25/09/2015 → 27/09/2015
Turin, Italy
Activity: Talks and presentations › Conference presentations

**2015 IEEE Multi-Conference on Systems and Control**
Period: 23 Sep 2015
Dimitrios Papageorgiou (Participant)
Department of Electrical Engineering
Automation and Control

**Related event**
2015 IEEE Multi-Conference on Systems and Control
21/09/2015 → 23/09/2015
Sydney, Australia
Activity: Attending an event › Participating in or organising a conference
European PV Solar Energy Conversion Exhibition and Conference
Period: 23 Sep 2015
Theis Bo Rasmussen (Other)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Præsentation af poster med titlen "Optimal design of PV and HP system"

Related event
31st European Photovoltaic Solar Energy Conference and Exhibition
14/09/2015 → 18/09/2015
Hamburg, Germany
Activity: Talks and presentations › Conference presentations

Philips 7T user meeting 2015
Period: 16 Sep 2015
Vitaliy Zhurbenko (Panel member)
Department of Electrical Engineering
Electromagnetic Systems

Description
Partially provided instrumentation for coil building workshop
Links:
http://www.drcmr.dk/component/jem/event/158-philips-7t-user-meeting-2015

Related event
Philips 7T user meeting 2015
13/09/2015 → 16/09/2015
Hvidovre, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

EcoGrid EU Market Concept: Large-scale Smart Grid demonstration of real time market-based integration of distributed energy resources (DER) and demand response (DR)
Period: 15 Sep 2015
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
150917_EcoGrid-market_concept_dtu_kee

Related event
EcoGrid EU Final Conference
15/09/2015 → 15/09/2015
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Endothelial derived hyperpolarization in renal interlobar arteries
Period: 15 Sep 2015
Jens Christian Brasen (Speaker)
Department of Electrical Engineering
Biomedical Engineering
**Related event**

**Meeting on Endothelium-Dependent Hyperpolarizations in Health and Disease**  
14/09/2015 → 17/09/2015  
Nyborg, Denmark  
Activity: Talks and presentations › Conference presentations

**Rare earth-free permanent magnet and applications**  
Period: 15 Sep 2015  
Muhammed Fasil (Speaker)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Electric Equipment Technologies  

**Description**  
Session 3: Application  
Workshop organised by Nanopyme consortium to present the results of project and to demonstrate the prototype vehicle to scientific community and EU commission.  
Documents:  
Design and fabrication of axial flux ferrite magnet brushless DC motor for electric two-wheelers

**Related event**

**Rare earth-free permanent magnet and applications: Session 2: Simulations and calculations**  
14/09/2015 → 16/09/2015  
Madrid, Spain  
Activity: Talks and presentations › Conference presentations

**Meeting on Endothelium-Dependent Hyperpolarizations in Health and Disease**  
Period: 14 Sep 2015 → 17 Sep 2015  
Jens Christian Brasen (Participant)  
Department of Electrical Engineering  
Biomedical Engineering

**Related event**

**Meeting on Endothelium-Dependent Hyperpolarizations in Health and Disease**  
14/09/2015 → 17/09/2015  
Nyborg, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Rare earth-free permanent magnet and applications**  
Period: 14 Sep 2015  
Muhammed Fasil (Participant)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Electric Equipment Technologies  

**Description**  
Poster presentation  
Workshop organised by Nanopyme consortium to present the results of project and to demonstrate the prototype vehicle to scientific community and EU commission.  
Documents:  
A Comparative Study of Bonded Rare Earth and Ferrite Magnet Motors for Electric Two-wheelers

**Related event**
Rare earth-free permanent magnet and applications: Session 2: Simulations and calculations
14/09/2015 → 16/09/2015
Madrid, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Rare earth-free permanent magnet and applications
Period: 14 Sep 2015
Muhammed Fasil (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Equipment Technologies

Description
Workshop organised by Nanopyme consortium to present the results of project and to demonstrate the prototype vehicle to scientific community and EU commission.
Documents:
FE based performance estimation of PMBLDC motor based drives

Related event

INTERSPEECH 2015
Period: 6 Sep 2015 → 10 Sep 2015
Thomas Bentsen (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Attending the Interspeech 2015 conference
Degree of recognition: International

Related event

INTERSPEECH 2015 : Speech beyond Speech
06/09/2015 → 10/09/2015
Dresden, Germany
Activity: Attending an event › Participating in or organising a conference

50th International Universities Power Engineering Conference
Period: 1 Sep 2015 → 4 Sep 2015
Tiberiu-Gabriel Zsurzsan (Participant)
Department of Electrical Engineering
Electronics

Related event

50th International Universities Power Engineering Conference
01/09/2015 → 04/09/2015
Staffordshire, United Kingdom
Activity: Attending an event › Participating in or organising a conference

Analysis of correlated data: Mixed Linear Models
Period: 1 Sep 2015 → 25 Dec 2015
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Analysis of correlated data: Mixed Linear Models

Related event
Analysis of correlated data: Mixed Linear Models
31/08/2015 → 25/12/2015
Kongens Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Ancillary services analysis and provision by Electric Vehicles in a Danish distribution grid
Period: 1 Sep 2015 → 21 Mar 2016
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
This thesis was completed in the Electrical Engineering Department at the Technical University of Denmark (DTU) in partial fulfillment for acquiring a Master of Science in Engineering, MSc (Eng.) degree in Electrical Engineering, with a specialization in the Electric Energy Systems study line by Jared Balavender. This thesis was completed with collaboration from the Nikola Research Project.
Documents:
Ancillary services analysis and provision by EV - Jared Balavender
Activity: Other

Communicating Advanced Topics in Electrical Engineering
Period: 1 Sep 2015 → 25 Dec 2015
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Communicating Advanced Topics in Electrical Engineering

Related event
Communicating Advanced Topics in Electrical Engineering: Course Number 31920
31/08/2015 → 25/12/2015
Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Magnetic Resonance Angiography in the Pig using Hyperpolarized Water
Period: 1 Sep 2015
Hans Kasper Wigh Lipsø (Speaker)
Department of Electrical Engineering

Description
Introduction: Magnetic Resonance Angiography (MRA) is an important tool in diagnostics of medical conditions such as emboli, stenosis and aneurysms. Sub-millimetre resolution can be obtained with proton imaging, and further optimization can be obtained with Gd-based blood pool agents. However, the acquisition time is several minutes, and conventional MRA methods thus fail to image within a single respiration or heartbeat and therefore suffer from motion artefacts. We demonstrate that hyperpolarized (HP) water can be used as an imaging agent to provide subsecond angiographies in pigs. Previous work on hyperpolarization for imaging agents in large animals has mainly been focused of 13C, but small volumes of hyperpolarized water with lower polarization has been demonstrated. Injection of hyperpolarized protons allows for the use of MRI coils and pulse sequences already existing in the clinic. Secondly, the magnetization...
achievable with hyperpolarized water is superior to other nuclei. Methods A 1 mL sample of 50% water and 50% glycerol with 30 mM TEMPO is polarized in a Spinlab (GE Healthcare) at 5 T, 0.9 K, 139.9 GHz for an hour. The sample is rapidly dissolved in 16 mL deoxygenized dissolution medium (DM) consisting of 1 mM EDTA, 50 mM sodium L-ascorbate, 1.9 mM NaH2PO4 and 8 mM Na2HPO4 dissolved in D2O. The DM is filled in the syringe with 7.6 g nonafluorobutyl methyl ether, which will accelerate the dissolution process and extract radical from the polar phase, and hence extend the T1. 10 mL deoxygenized heptane is added to the receiver to further extract the radical. The polarization is quantified in two ways: 1) the signal integral (FID amplitude) is compared to a thermally polarized, pure water reference sample (110 M) and 2) the line width due to radiation damping is compared to the radiation broadening of a thermally polarized, pure water sample. The two methods agree. Proton concentration is quantified by NMR measurement of the dissolved sample added a reference molecule. The images are acquired on a 3 T MRI system (GE healthcare) with a 4 channel array surface coil with a gradient echo sequence with 5 ° flip angle, slice thickness of 40 mm, TR = 3.4 ms, TE = 0.9840 ms, 256x256 matrix, FOV = (140 mm)2. The acquisition time is 870 ms. 15 mL HP substance is injected over 5 s, initiated 15 s after dissolution through a catheter in the right renal artery of a 40 kg pig. Results The protons are polarized by dissolution DNP to an enhancement of more than 4000 times at 9.4 T, corresponding to a polarization of 13% at time of injection. T1 of ~20 s is achieved in vitro for a 1H concentration of 4.5 M. A zoom of a renal MRA is shown in Figure 1. The image maps minor branches of the renal arteries, and the perfusion can be traced over time (time series not shown).References[1] Howles, G. P., Ghaghada, K. B., Qi, Y., Mukundan, S. & Johnson, G. A, Magn. Reson. Med. 2009, 62:1447–1456.[2] Olsson, L. E. et al., Magn. Reson. Med. 2006, 55:731–737.[3] Golman, K. et al., Magn. Reson. Med. 2001, 46:1–5.[4] Ardenkjaer-Larsen, J. H., Laustsen, C, Bowen, S & Rizi, R, Magn. Reson. Med. 2014, 71:50-56.[5] Harris, T, Szekely, O & Frydman, L, J. Phys. Chem. B 2014, 118:3281–3290.

Documents:
Abstract_DNPSymp2015

Related event
Hyperpolarized Magnetic Resonance: Joint 5th International DNP Symposium and COST action EuroHyperPol Final Meeting
31/08/2015 → 04/09/2015
Egmong Aan Zee, Netherlands
Activity: Talks and presentations › Conference presentations

Evaluation of peripheral compression and auditory nerve fiber intensity coding using Auditory Steady-State Responses (ASSR)
Period: 27 Aug 2015
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems

Description
The compressive nonlinearity of the auditory system is assumed to be an epiphenomenon of a healthy cochlea and particularly, outer-hair cell function. Auditory steady-state responses (ASSR) reflects coding of the stimulus envelope. Recent research in animals shows that noise over-exposure, producing temporary threshold shifts, can cause auditory nerve fiber (ANF) deafferentation in predominantly low-spontaneous rate (SR) fibers. It is hypothesized here that deafferentation of low-SR fibers can lead to a reduction of ASSR amplitude at supra-threshold levels. ASSR input/output (I/O) functions were measured in two groups of normal-hearing adults at stimulus levels ranging from 20 to 90 dB SPL. First, multi-frequency ASSR I/O functions were obtained using a modulation depth of 85%. Secondly, ASSR were obtained using a single sinusoidally amplitude modulated (SAM) tone at four modulation depths (25, 50, 85 and 100%). Results showed that ASSR growth functions exhibit compression of about 0.25 dB/dB. The slope for levels above 60 dB SPL showed more variability across subjects. The slope of ASSR I/O functions could be used to estimate peripheral compression simultaneously at four frequencies below 60 dB SPL, while the slope above 60 dB SPL might be used to evaluate the integrity of intensity coding of low-SR fibers.

Documents:
Encina-Llamas_ISAAR 2015
Links:
http://dx.doi.org/10.13140/RG.2.1.4485.1924

Related event
5th International Symposium on Auditory and Audiological Research
26/08/2015 → 28/08/2015
Nyborg, Denmark
Activity: Talks and presentations › Conference presentations
5th International Symposium on Auditory and Audiological Research
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Presentation of a poster at the International Symposium on Auditory and Audiological Research, At Nyborg, Denmark.

Related event
5th International Symposium on Auditory and Audiological Research
26/08/2015 → 28/08/2015
Nyborg, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

10th IFAC Conference on Manoeuvring and Control of Marine Craft
Period: 24 Aug 2015
Mogens Blanke (Organizer)
Department of Electrical Engineering
Automation and Control

Description
Organiser of 10th IFAC Conference on Marine Craft Manoeuvring and Control (MCMC'2015)
Links:
http://www.mcmc2015.dk

Related event
10th IFAC Conference on Manoeuvring and Control of Marine Craft
24/08/2015 → 26/08/2015
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Dynamic Modeling and Optimization of Large Scale Lignocellulosic Biorefineries
Period: 18 Aug 2015
Remus Mihail Prunescu (Invited speaker)
Department of Electrical Engineering
Automation and Control
Department of Chemical and Biochemical Engineering
CAPEC-PROCESS

Related event
BioPro World Talent Campus 2015
17/08/2015 → 21/08/2015
Søren, Denmark
Activity: Talks and presentations › Conference presentations

The Analysis of Sensory and Consumer Data
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems
Related event

The Analysis of Sensory and Consumer Data: 02930
17/08/2015 → 21/08/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

European conference for Operational Research 2015
Period: 12 Jul 2015 → 15 Jul 2015
Athanasios Papakonstantinou (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Documents:
euro2015

Related event

European conference for Operational Research 2015
12/07/2015 → 15/07/2015
Glasgow, United Kingdom
Activity: Talks and presentations › Conference presentations

MRI simulation for sequence development, protocol optimisation, and education
Period: 29 Jun 2015 → 1 Jul 2015
Lars G. Hanson (Organizer)
Department of Electrical Engineering
Biomedical Engineering
Copenhagen Center for Health Technology
Description
MRI simulation for sequence development, protocol optimisation, and education
Links:

Related event

MRI simulation for sequence development, protocol optimisation, and education: ESMRMB Lectures on MR
29/06/2015 → 01/07/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

ECPE PowerSoC workshop
Period: 17 Jun 2015
Dennis Øland Larsen (Invited speaker)
Department of Electrical Engineering
Electronics

Related event

ECPE PowerSoC workshop
16/06/2015 → 17/06/2015
Munich, Germany
Activity: Talks and presentations › Conference presentations
Field Robot Event 2015
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

Description
Judge of the competition
Field robot competition
Links:
http://fre2015.um.si/ (Robot competition)

Related event
Field Robot Event 2015
16/06/2015 → 18/06/2015
Maribor, Slovenia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DAu Konference: Den 4. Industrielle Revolution
Period: 10 Jun 2015
Ole Ravn (Organizer)
Department of Electrical Engineering
Automation and Control

Related event
DAu Konference: Den 4. Industrielle Revolution: Fra hype til konkrete resultater
10/06/2015 → …
Aarhus, Denmark
Activity: Attending an event › Participating in or organising a conference

Introduction to applied statistics and R for PhD students
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Related event
Introduction to Applied Statistics and R for PhD students 2015
04/06/2015 → 28/06/2015
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Biosimulation
Period: 1 Jun 2015 → 30 Jun 2015
Jens Christian Brasen (External examiner)
Department of Electrical Engineering
Biomedical Engineering
Activity: Examinations and supervision › External examination

IEEE Power Engineering Letters (Journal)
Period: 1 Jun 2015 → …
Guangya Yang (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Related journal**

**IEEE Power Engineering Letters**
Local database
Activity: Research › Journal editor

**IEEE Transactions on Sustainable Energy (Journal)**
Period: 1 Jun 2015 → …
Guangya Yang (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

**Description**
IEEE Transactions on Sustainable Energy
IEEE journal

**Related journal**

**IEEE Transactions on Sustainable Energy**
1949-3029
Central database
Activity: Research › Journal editor

**In committee for PhD thesis evaluation at Linköping University, Sweden (External organisation)**
Period: 22 May 2015
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

**Description**
Thesis by Daniel Jung
Body type: University
Degree of recognition: International

**Related external organisation**

**In committee for PhD thesis evaluation at Linköping University, Sweden**
Activity: Membership › Membership in review committee

**External examiner on PhD thesis by PhD student Ishtiyaq Amhed Makda**
Period: 21 May 2015
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination
Evaluation of cochlear processing and auditory nerve fiber intensity coding using Auditory Steady-State Responses (ASSR)
Period: 11 May 2015
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems

Description
Objectives:
The compressive nonlinearity of the peripheral auditory system is commonly assumed to be a result of healthy outer-hair cell function, and to be a good indicator of the system's integrity. It has recently been shown that auditory steady-state responses (ASSR) elicited by sinusoidally amplitude modulated (SAM) tones, with modulation frequencies around 80 – 100 Hz, show compressive growth as a function of stimulus intensity for medium levels. These responses are thought to reflect coding of the acoustical stimulus envelope at the level of the brainstem, hence after cochlear processing. Recent research in laboratory animals shows that noise exposure producing temporary threshold shifts can cause auditory nerve fiber (ANF) deafferentation, predominantly affecting low-spontaneous rate (SR) fibers. In the present study, it is hypothesized that deafferentation of low SR fibers leads to a reduction of ASSR amplitude at levels coded by this class of fibers.

Methods:
Multi-channel ASSR input/output (I/O) functions were measured in two groups of audiometrically normal-hearing adults. For the first group, ASSR I/O functions were obtained at stimulation sound pressure levels (SPL) ranging from 20 to 80 dB in steps of 5 dB using multi-frequency stimulation with four octave-spaced SAM tones and a fixed modulation depth of 85%. For the second group, ASSR I/O functions were obtained using a single SAM tone presented at 3 levels below 60 dB SPL and at 9 levels in the range from 60 to 90 dB SPL. ASSR growth functions were recorded at four modulation depths (65, 75, 85 and 100%).

Results:
Results showed that ASSR growth functions can be measured in NH listeners for input levels between 20 and 80-90 dB SPL. Significant compression was found for input levels between 30 to 60 dB SPL, and a saturation of the growth functions was observed at levels above 60 dB SPL. The lower-level part of the ASSR I/O functions showed compression of about ~0.25 dB/dB, which is similar to compression recorded directly in animal cochleae. The slope for levels above 60 dB SPL showed larger variability across subjects.

Conclusions:
The slope of ASSR I/O functions could be used to estimate peripheral compression simultaneously at four frequencies. First results suggest, that the slope of ASSR I/O functions above 60 dB SPL might be used to evaluate the integrity of intensity coding of low-SR fibers. Hence, ASSR might prove to be useful for evaluation of both cochlear and ANF integrity.

Funding
This work was funded by the Oticon Center of Excellence for Hearing and Speech Sciences at the Technical University of Denmark.

Documents:
Encina-Llamas_IERASG_2015

Links:
http://dx.doi.org/10.13140/RG.2.1.2912.3280

Related event
XXIV Biennial Symposium of the International Evoked Response Audiometry Study Group
10/05/2015 → 14/05/2015
Busan, Korea, Republic of
Activity: Talks and presentations › Conference presentations

Tutorial: Design and Development of Low Speed 10MW+ Superconducting Wind Turbine Generators
Period: 10 May 2015
Nenad Mijatovic (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Equipment Technologies
Background: Wind energy driven by favorable Cost of Energy (CoE) is taking bigger share in electricity generation. The offshore sector has experienced large growth due to higher wind potential and lower social impact, even though CoE is significantly higher compared to onshore. With the constant pressure to reduce CoE, offshore wind industry has been a strong driver of new machine concepts particularly in the past decade with the development and deployment of offshore wind turbines where direct drive slow rotating generators have been foreseen as advantageous. Depending on the application, trends of development of electrical machines have focused on energy savings, i.e. higher efficiency margins for industrial motors and high torque density motors – a trend dominantly driven by the automotive and wind turbine industry. Most recent development directions in wind turbine generator design have focused more and more on alternatives to permanent magnet synchronous machines (PMSM), that are less dependent on rare earth elements (Nd and Dy in NdFeB based magnets). With focus on torque density and less dependence on rare earth materials, superconducting machines have been proposed and studied as WT generators worldwide. Yet, no in-field demonstration has been accomplished so far although several companies are working on this goal. Structure of the tutorial: The tutorial starts with basic principles of superconducting machines, such as motivation for using superconductors in electrical machines and the potential applications that are expected to benefit from this technology. The brief history of superconducting machines is followed by a presentation of past and present projects and prototypes of the technology. An introduction to superconductivity and industrial conductors which could be used in wind turbine generators, including low temperature superconductors (LTS), first and second generation superconductors (1G and 2G HTS), and the latest development of MgB2 wires will follow. In order to have a comprehensive view point of merits and limitations of each conductor, physical properties of the conductors and materials, AC losses mechanisms, electrothermal instability characteristics and the overview of the production methods will be presented, followed by the present cost and cost forecast in the present and markets to come.

After presenting and comparing different superconducting machine topologies, including topologies that use bulk superconductors, HTS machines and fully superconducting machines, where both rotor and stator contain superconductors, the tutorial presents a design process of a 10MW superconducting wind turbine generator based on both 2G HTS and MgB2 superconductors. Simplified design process carried out will be a combination of conceptual, analytical and FE based approach where several key accepts of the design will be in the focus of the tutorial. Particular attention will be given to electromagnetic, structural and thermal aspect of the design including state of the art in AC loss calculation together with challenges associated with such calculation.

Links:
http://iemdc.org/tutorials#tutorial3

Related event
IEEE International Electric Machine and Drives Conference
10/05/2015 → 13/05/2015
Coeur d’Alène, Idaho, United States
Activity: Talks and presentations › Conference presentations

External examiner on PhD thesis by PhD student Yi Wang
Period: 1 May 2015
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Professorship Evaluation for NTNU - International Chair (External organisation)
Period: 1 May 2015 → 30 Jun 2015
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Evaluation of candidate for position as NTNU International Chair
Body type: International Evaluation Committee
Degree of recognition: International

Related external organisation
Professorship Evaluation for NTNU - International Chair
Activity: Membership › Membership in review committee

External examiner on PhD thesis by PhD student Ciaran Feeney
Period: 27 Apr 2015
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering

Electronics
Activity: Examinations and supervision › External examination

Improving Performance with Cochlear Implants
Period: 21 Apr 2015
Andreu Paredes Gallardo (Participant)
Department of Electrical Engineering
Hearing Systems

Related event
Improving Performance with Cochlear Implants
21/04/2015 → 21/04/2015
London, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Kompetenceudviklingsdage
Period: 21 Apr 2015
Ole Ravn (Speaker)
Department of Electrical Engineering
Automation and Control
Links:
http://www.samtaenkning.dk/Pages/Forside.aspx

Related event
Kompetenceudviklingsdage
21/04/2015 → ...
København, Denmark
Activity: Other

DTU Elektro seminar: Guest lecture
Period: 20 Mar 2015
Silvia Saldaña Cercos (Lecturer)
Department of Electrical Engineering
Department of Photonics Engineering
Metro-Access and Short Range Systems

Related event
DTU Elektro seminar: how to write a scientific article
20/03/2015 → ...
Denmark
Activity: Talks and presentations › Conference presentations

Fra øre til hjerne: tværfaglig forskning i hørelse og kognition
Period: 18 Mar 2015
Sébastien Santurette (Invited speaker)
Department of Electrical Engineering
Hearing Systems

Related event

Nordiske Konference - Hørelse, kognition, kommunikation
18/03/2015 → …
Fredericia, Denmark
Activity: Talks and presentations › Conference presentations

Control of Drones
Period: 11 Mar 2015
Søren Hansen (Lecturer)
Automation and Control
Department of Electrical Engineering

Description
Lecture for UNF

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Visualisation of basic NMR: Quantum and classical aspects
Period: 25 Feb 2015
Lars G. Hanson (Lecturer)
Department of Electrical Engineering
Biomedical Engineering

Description
Invited talk at the MMCE conference, Poland 2015
Documents:
MMCE2015_abstract_LGH
MMCE2015_abstract_LGH.pdf
Links:
http://nmr.cent3.uw.edu.pl/mmce2015/ (Conference homepage)

Related event

Magnetic Moments in Central Europe 2015
25/02/2015 → 01/03/2015
Krynica-Zdrój, Poland
Activity: Talks and presentations › Conference presentations

External examiner on Doctoral Thesis by PhD student Toke Meyer Andersen
Period: 13 Feb 2015
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

MR principles, imaging and contrast
Period: 3 Feb 2015
Lars G. Hanson (Lecturer)
Description
Lecture at PhD course
Documents:
Slides
Links:
http://eprints.drcmr.dk/37/ (Lecture notes)

Related event
Clinical and research applications of diagnostic imaging techniques: MR, PET, SPECT, CT and ultrasound: PhD Course
02/02/2015 → 06/02/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

Modelling and experimental verification of power generation characteristics of different PV technologies under various operation conditions
Period: Jan 2015 → Jul 2015
Mattia Marinelli (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
Master thesis by Søren Peter Nielsen (s103014)

Master project supervisor
Documents:
Modelling and experimental verification of power generation characteristics of different PV technologies under various operation conditions
Activity: Examinations and supervision › Supervisor activities

The Scandinavian Physiological Society - The Special Interest Group (SIG) within Vascular Physiology
Period: 28 Jan 2015
Jens Christian Brasen (Participant)
Department of Electrical Engineering
Biomedical Engineering

Related event
The Scandinavian Physiological Society - The Special Interest Group (SIG) within Vascular Physiology
28/01/2015 → …
København, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Evaluation for University of Cambridge (External organisation)
Period: 25 Jan 2015 → 6 Feb 2015
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Faculty member evaluation

Body type: University
Degree of recognition: International

Related external organisation

Evaluation for University of Cambridge
Activity: Membership › Membership in review committee

7th Workshop on Speech in Noise
Period: 8 Jan 2015 → 9 Jan 2015
Sébastien Santurette (Organizer)
Department of Electrical Engineering
Hearing Systems
Links:
http://www.spin2015.dk

Related event

7th Workshop on Speech in Noise
08/01/2015 → 09/01/2015
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Large-scale energy storage in the future Danish power system by means of Vanadium and Li-Ion batteries
Period: 2 Jan 2015 → 30 Jun 2015
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

Description
Master thesis by Daniel Sandermann Jensen
Documents:
MscThesis_Daniel_Sandermann_Jensen_s132432
Activity: Other

Single Phase Analysis of an Active Low Voltage Grid with Congestion Management Provided by Electric Vehicles
Period: 2 Jan 2015 → 30 Jun 2015
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Wind power plants internal distribution system and grid connection - A technical and economical comparison between a 33 kV and a 66 kV
Period: 2 Jan 2015 → 30 Jun 2015
Mattia Marinelli (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

IEEE Denmark Section - PES Chapter (External organisation)
Period: 1 Jan 2015 → 31 Dec 2018
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

5th International Symposium on Auditory and Audiological Research
Period: 2014 → 2015
Sébastien Santurette (Organizer)
Department of Electrical Engineering
Hearing Systems

Global Energy Forecasting Competition 2014
Period: 2014 → …
Global Energy Forecasting Competition 2014: GEFCom2014

Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

IEEE Spectrum (Journal)
Period: 2014 → …
Jacob Østergaard (Editor)

Activity: Research › Journal editor

IFAC Technical Committee on Marine Systems (External organisation)
Period: 2014 → 2017
Mogens Blanke (Participant)

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Implementation of coordinated voltage control at LV grids for solar integration
Period: 2014
Guangya Yang (Invited speaker)
Implementation of coordinated voltage control at LV grids for solar integration

Related event

2014 IEEE Power & Energy Society General Meeting
27/07/2014 → 31/07/2014
Washington, DC Metro Area, United States
Activity: Talks and presentations › Conference presentations

International Journal of Forecasting (Journal)
Period: 2014 → …
Pierre Pinson (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Department of Applied Mathematics and Computer Science

Related journal
International Journal of Forecasting
0169-2070
Central database
Activity: Research › Journal editor

Member of Expert Pool in EU PV Technology Platform (External organisation)
Period: 2014 → …
Guangya Yang (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Degree of recognition: International

Related external organisation
Member of Expert Pool in EU PV Technology Platform
Activity: Membership › Board duties in companies, associations, or public organisations

PhD Thesis Jury Member at Universitat Politecnica de Catalunya (External organisation)
Period: 2014
Mojtaba Tabatabaeipour (Participant)
Department of Electrical Engineering
Automation and Control
Degree of recognition: International

Related external organisation
PhD Thesis Jury Member at Universitat Politecnica de Catalunya
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Secretary-Elect, ISMRM study group on Detection & Correction of Motion in MRI & MRS (External organisation)
Period: 2014 → 2015
Lars G. Hanson (Secretary)
Department of Electrical Engineering
Biomedical Engineering

Description
Research Network of the International Society for Magnetic Resonance in Medicine
Degree of recognition: International

Related external organisation
Secretary-Elect, ISMRM study group on Detection & Correction of Motion in MRI & MRS
Activity: Membership › Membership of research networks or expert groups

Senior Member, IEEE (External organisation)
Period: 2014
Guangya Yang (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Electric Power Systems

Description
Body type: Public

Related external organisation
Senior Member, IEEE
Activity: Membership › Board duties in companies, associations, or public organisations

Nordic Power Converters Aps (External organisation)
Period: Dec 2014 → …
Michael A. E. Andersen (Participant)
Department of Electrical Engineering
Electronics

Description
Member of the Board
Body type: Start-up company

Related external organisation
Nordic Power Converters Aps
Activity: Membership › Board duties in companies, associations, or public organisations

CST Workshop Series 2014
Period: 25 Nov 2014
Vitaliy Zhurbenko (Organizer)
Department of Electrical Engineering
Electromagnetic Systems

Description
Local coordination of the workshop.
Presentation of simulation activities at EMS, DTU.
Links:
https://www.cst.com/Events/Details/3179 (Workshop description and agenda)

Related event
CST Workshop Series 2014
25/11/2014 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**HTX, EucSyd Sønderborg**
Period: 21 Nov 2014
Kaj Bjarne Jakobsen (Lecturer)
Department of Electrical Engineering
Electromagnetic Systems

**Description**
Antennas for Body-Centric Communications, Anechoic Chamber

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**University of Bordeaux (External organisation)**
Period: 19 Nov 2014
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

**Description**
Opponent on PhD thesis by Robert Fonod

Body type: University
Degree of recognition: International

**Related external organisation**

**University of Bordeaux**
France
Activity: Membership › Membership in review committee

**2014 AIChE Annual Meeting: American Institute of Chemical Engineers**
Period: 17 Nov 2014 → 21 Nov 2014
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

**Description**
Dynamic Simulation, Sensitivity and Uncertainty Analysis of a Demonstration Scale Lignocellulosic Enzymatic Hydrolysis Process

**Related event**

**2014 AIChE Annual Meeting: American Institute of Chemical Engineers**
16/11/2014 → 21/11/2014
Atlanta, United States
Activity: Talks and presentations › Conference presentations

**Dynamic Simulation, Sensitivity and Uncertainty Analysis of a Demonstration Scale Lignocellulosic Enzymatic Hydrolysis Process**
Period: 16 Nov 2014 → 21 Nov 2014
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Model-Based Filtering of Large-Scale Datasets - A Biorefinery Application
Period: 16 Nov 2014 → 21 Nov 2014
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

Aarhus University (External organisation)
Period: 12 Nov 2014
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

**Description**
Opponent on PhD thesis by Martin Andreas Falk Jensen

Body type: University

**Related external organisation**
Aarhus University
Inge Lehmanns Gade 10, 8000, Aarhus C, Denmark
Activity: Membership › Membership in review committee

13th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power (WIW 2014)
Period: 11 Nov 2014 → 13 Nov 2014
Athanasios Papakonstantinou (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets
Documents:
Presentation_WIW14_1072_Athanasios_Papakonstantinou

**Related event**
13th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power (WIW 2014)
Berlin, Germany
Activity: Talks and presentations › Conference presentations

Small Antennas for Wireless Applications (invited): Body-Worn Antennas for Body-Centric Wireless Communications
Period: 10 Nov 2014
Kaj Bjarne Jakobsen (Invited speaker)
Department of Electrical Engineering
Electromagnetic Systems

Description
Opening Session, Invited Talk
IS1: Invited Session 1
2014 Loughborough Antennas and Propagation Conference (LAPC)
United Kingdom

Invited Talk
Degree of recognition: International

Related event

2014 Loughborough Antennas and Propagation Conference
Loughborough, United Kingdom
Activity: Talks and presentations › Conference presentations

IEEE International Power Electronics and Application Conference and Exposition
Period: 5 Nov 2014 → 8 Nov 2014
Tiberiu-Gabriel Zsurzsanz (Participant)
Department of Electrical Engineering
Electronics

Related event

IEEE International Power Electronics and Application Conference and Exposition
05/11/2014 → 08/11/2014
Shanghai, China
Activity: Attending an event › Participating in or organising a conference

University of Cambridge (External organisation)
Period: 3 Nov 2014
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
External examiner of PhD thesis

Body type: University
Degree of recognition: International

Related external organisation

University of Cambridge
United Kingdom
Activity: Membership › Membership in review committee

Mathematical Biosciences (Journal)
Period: 23 Oct 2014 → …
Jens Christian Brasen (Reviewer)
Department of Electrical Engineering

Biomedical Engineering

**Description**
Mathematical Biosciences

Ongoing

**Related journal**

**Mathematical Biosciences**
0025-5564
Central database

**Activity:** Research › Peer review of manuscripts

**Expert Workshop "Challenges ahead in European electricity market design"**
**Period:** 16 Oct 2014

Athanasios Papakonstantinou (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

**Related event**

**Expert Workshop "Challenges ahead in European electricity market design"**
16/10/2014 → 16/10/2014
Brussels, Belgium
**Activity:** Attending an event › Participating in or organising workshops, courses, seminars etc.

**Unbalance analysis of a real low voltage Danish network in presence of electric vehicles and small size photovoltaic plants**
**Period:** 1 Oct 2014 → 31 Mar 2015

Mattia Marinelli (Supervisor)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources

**Description**
Master thesis by Pasqualino Lico, student at Politecnico di Milano (Italy), written during his exchange at DTU between October 2014 and March 2015
Documents:
2015_04_Lico
**Activity:** Examinations and supervision › Supervisor activities

**Opfølgning på Klima- og Energiministerens Smart Grid Strategi:** Forskning, udvikling og demonstration
**Period:** 30 Sep 2014

Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Smart Grid netværk opfølgning - FUD v3

**Related event**

**Status og opfølgning på Klima- og Energiministerens Smart Grid Strategi**
Co-Simulation Hands-On Workshop with Use of Open-Source Tool Mosaik
Period: 24 Sep 2014
Anna Magdalena Kosek (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy

Related event
Co-Simulation Hands-On Workshop with Use of Open-Source Tool Mosaik
24/09/2014 → …
Roskilde, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Future Integration of Wind in the Energy System: The role of state-of-art experimental facilities
Period: 10 Sep 2014
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
LORC 2014-09-10 Presentation Jacob Ostergaard v3

Related event
Grand Opening LORC Nacelle Testing Centre
10/09/2014 → 11/09/2014
Munkebo, Denmark
Activity: Talks and presentations › Conference presentations

Decoupled On-Load Tap-Changer Transformer in a Danish Low Voltage Grid with Unbalanced Distributed Generation
Period: 1 Sep 2014 → 31 Dec 2014
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Description
Master thesis by Antonio Zecchino, student at University of Padova (Italy), written during his exchange at DTU between September 2014 and December 2014
Documents:
Zecchino_thesis_12-02-2015
Activity: Other

Rhythms in complex networks
Period: 1 Sep 2014 → 3 Sep 2014
Jens Christian Brasen (Participant)
Department of Electrical Engineering
Biomedical Engineering
Links:
http://dsin.ku.dk/calendar/workshop_sep14/Conference_Final.pdf

Related event
Rhythms in complex networks  
01/09/2014 → 03/09/2014  
Copenhagen, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Member of the ESMRMB Nomination and Awards Committee (External organisation)  
Lars G. Hanson (Participant)  
Copenhagen Center for Health Technology  
Center for Hyperpolarization in Magnetic Resonance  
Department of Electrical Engineering  
Center for Magnetic Resonance  
Degree of recognition: International  
Related external organisation

Member of the ESMRMB Nomination and Awards Committee  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Smart Grid Labs: Software Infrastructure  
Period: 28 Aug 2014  
Anna Magdalena Kosek (Organizer)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Description  
Smart grid laboratory facilities are facing a dual challenge as the complexity of the testing environment and the associated software requirements are growing together with the complexity of the system under investigation. The RTLabOS project participants from Spirae and DTU will present their main findings and highlight experiences from the feasibility studies. In a following discussion, all participants are invited to share their experience and their views on the project results.

Related event

Smart Grid Labs: Software Infrastructure: Experience & Results from the RTLabOS project  
28/08/2014 → …  
Roskilde, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

16th Conference on Power Electronics and Applications  
Tiberiu-Gabriel Zsurzsan (Participant)  
Department of Electrical Engineering  
Electronics  
Description  
Presented my paper titled “Piezoelectric stack actuator parameter extraction with hysteresis compensation”  
Participation in The 16th European Conference on Power Electronics and Applications  
Related event

16th Conference on Power Electronics and Applications  
26/08/2014 → 28/08/2014  
Lappeenranta, Finland  
Activity: Attending an event › Participating in or organising a conference
Proceedings of the National Academy of Sciences, Physical Sciences (NASA) (Journal)
Period: 2 Jul 2014 → …
Jens Christian Brasen (Reviewer)
Department of Electrical Engineering
Biomedical Engineering

Related journal
Proceedings of the National Academy of Sciences, Physical Sciences (NASA)
Local database
Activity: Research › Peer review of manuscripts

Smart Flexible Energy Solutions for the Future Energy System
Period: 13 Jun 2014
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Jacob Ostergaard - EUEW General Convention - Smart Flexible Energy Solutions

Related event
59th EUEW General Convention
12/06/2014 → 14/06/2014
København, Denmark
Activity: Talks and presentations › Conference presentations

Mathematical models of (spatial and) temporal dynamics in biological and physiological systems
Period: 22 May 2014
Jens Christian Brasen (Invited speaker)
Department of Electrical Engineering
Biomedical Engineering

Description
Talk at ISOLATE workshop
Links:
http://www.isolate.gu.se/meetings/

Related event
ISOLATE Workshop
15/05/2014 → 23/05/2014
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Smart Energy Networks partnerskab
Period: 14 May 2014
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Smart Energy Networks partnerskab v5 distrib

Related event
DGF Gastekniske Dage 2014
14/05/2014 → 15/05/2014
Billund, Denmark
Activity: Talks and presentations › Conference presentations

iPower Annual Conference 2014
Period: 13 May 2014 → 14 May 2014
Rasmus Villefrance (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
iPower annual conference 2014 - Smart Grid in Residential Buildings.
Documents:
iPower Program_13-14 May 2014_tryk
Links:
http://www.ipower-net.dk (iPower home page)

Related event
iPower Annual Conference 2014: Smart Grid in Residential Buildings
13/05/2014 → 14/05/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Reusable Magnets: Discrete Magnets in Wind Turbines and Powder-Pressed Magnets in Rotors
Period: 13 May 2014
Stig Høgberg (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Invited guest lecture given at WEG in Jaraguá do Sul, Brazil

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Linköping University (External organisation)
Period: 25 Apr 2014
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Opponent for the PhD thesis of Christofer Sundström
Body type: University
Degree of recognition: International

Related external organisation
Linköping University
Sweden
Activity: Membership › Membership in review committee

Software Ecosystems for Power System Integration Labs
Period: 4 Apr 2014
Anna Magdalena Kosek (Organizer)
ICT systems are playing a key enabling role in the transformation of traditional power systems into smart grids. This workshop is designed to create a forum for engineers, technicians and researchers focusing on experimental and power system issues, effective practices, methods and software. Software ecosystems in labs should support seamless integration between analysis and development of control algorithms, and mechanisms to monitor and manage lab operation. By bringing together practitioners and researchers who work with complex experiments at leading power system integration labs, this workshop will serve to share experience and best practices.

Related event

Software Ecosystems for Power System Integration Labs
04/04/2014 → …
Roskilde, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Sleep spindle scoring: performance of humans versus machines
Period: 21 Mar 2014
Sabrina Lyngbye Wendt (Speaker)
Department of Electrical Engineering
Department of Applied Mathematics and Computer Science
Links:
http://www.clinph-journal.com/article/S1388-2457(14)50141-1/abstract
http://dx.doi.org/10.1016/S1388-2457(14)50141-1

Related event

30th International Congress of Clinical Neurophysiology
19/03/2014 → 23/03/2014
Berlin, Germany
Activity: Talks and presentations › Conference presentations

Decentralized vs. Centralized Electricity Generation
Period: 10 Mar 2014
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Directors Club talk JAOS presentation final

Related event

Directors’ Club 2014: Changing the Game for Tomorrow’s Electricity Supply
10/03/2014 → 11/03/2014
Abu Dhabi, United Arab Emirates
Activity: Talks and presentations › Conference presentations

A Smart Energy System without Fusil Fuels: Smart Grid Technologies enabling a Secure, Efficient and Sustainable Energy System
Period: 9 Mar 2014
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy

Abstract:
Electricity will play an increasingly important role in a future energy system based on renewable energy. It is expected that
electricity will double to cover 70% of the total Danish energy system in 2050 where all fossil fuels should be phased out and the energy system be 100% based on renewable energy sources. A major transformation of the electricity system into a more intelligent infrastructure is a prerequisite of a cost efficient transition to renewable energy. Therefore a major focus on Smart Grid R&D exists in Denmark. This presentation will provide insight into some of the technical solutions which are under development at Technical University of Denmark.

The presentation will show how distributed energy resources and flexible demand can contribute to the power system balancing. An approach based on two specific control concepts, Frequency controlled demand and a 5-minute real-time market, will be presented. The associated attractive business cases will be presented.

Furthermore results from large-scale demonstrations of several Smart Grid technologies at the island of Bornholm and the world-class PowerLabDK experimental facilities will be presented. The Bornholm power system has 27,000 electricity customers (55 MW peak load) and 50% renewable energy penetration; hereof 33% wind power penetration in the electricity system. The largest demonstration involves 2,000 customers.

Bio, Prof. Jacob Østergaard:
Jacob Østergaard (JØ) received his degree in Electrical Engineering from Technical University of Denmark in 1995. Since 2005 Jacob Østergaard has been Professor in Electric Power Engineering and head of Center for Electric Power and Energy at Department of Electrical Engineering, Technical University of Denmark (www.cee.elektro.dtu.dk). With approx. 100 employees the center is one of the largest European research groups within power and energy. Earlier he has been in the industry with Research Institute of Danish Electric Utilities.

His research focuses on smart energy technology, including integration of renewable energy sources, active distribution grids and power system operation and control. He is the driving force behind large national and international projects, including the European EcoGrid EU project, in which he has developed novel methods for operating power systems through market-based integration of end users. The project was in 2012 awarded by Sustainia as the world’s “Best sustainable IT-solution”. JØ has been the dynamo for establishing of one of world’s most advanced and comprehensive experimental facilities for energy systems of the future, PowerLabDK (www.powerlab.dk), with unique close coupling between physical experiments, computer simulations and real-life full-scale renewable-based energy system, which is included in the experiments.

JØ has received several awards including the IBM Faculty Award in 2009. He serves in several boards and committees. This includes appointments for the European Commission and the Danish Minister for Climate and Energy. He is author and co-author of more than 160 peer reviewed scientific papers, 14 book chapters and more than 50 technical reports.

Documents:
Presentation Masdar 2014-03-02

Related event

Kolloquium at Masdar Institute
09/03/2014 → 09/03/2014
Abu Dhabi, United Arab Emirates
Activity: Talks and presentations › Conference presentations

Comparison of peripheral compression estimates using auditory steady-state responses (ASSR) and distortion product otoacoustic emissions (DPOAE)
Period: 22 Feb 2014 → 26 Feb 2014
Gerard Encina-Llamas (Speaker)
Department of Electrical Engineering
Hearing Systems

Description
Title
Comparison of peripheral compression estimates using auditory steady-state responses and distortion product otoacoustic emissions

Background
The healthy auditory system shows a compressive input/output function, commonly assumed to be a result of healthy outer-hair cell function. Hearing impairment often leads to a decrease in sensitivity and a reduction of compression. Compression estimates in human listeners are commonly based on psychoacoustical procedures, or on measurements of otoacoustic emissions (OAEs). Psychoacoustical procedures are time consuming and rely on assumptions regarding the ability to selectively investigate cochlear processing. OAEs allow to selectively study cochlear processing, but the interpretation of results based on individual data is challenging. Auditory steady-state responses (ASSR) represent a method allowing fast, reliable and frequency-specific objective measurements of hearing function. In the present study it is
investigated if ASSR can be used to estimate compression along the peripheral auditory pathway. It is hypothesized that compressive behaviour is observed in normal-hearing (NH) listeners while in hearing-impaired (HI) listeners, sensitivity and compression are reduced. ASSR data are compared to compression estimated using distortion-product otoacoustic emissions (DPOAEs).

Methods
ASSR were measured using 64-channel EEG with active electrodes. Input-output functions were obtained for NH and HI listeners using multi-frequency stimulation with four sinusoidally amplitude modulated tones (sAM) at carrier frequencies from 500-4000 Hz and modulation frequencies between 80 and 100 Hz. The input level was varied between 20 and 80 dB SPL in steps of 5 dB. Results were compared to compression estimates from DPOAEs within the same listeners.

Results
The data show that ASSR growth functions can be measured in NH listeners for input levels between 20 and 80 dB SPL. Strong compression was found for input levels of 20-30 dB SPL and higher. For HI listeners, the results show a larger variability compared to NH listeners. Reliable responses could only be obtained for levels corresponding to about 30~dB SL and above. The compression estimates obtained with ASSR were larger than those obtained using DPOAE.

Conclusions
ASSR could be used to estimate peripheral compression simultaneously over a large frequency range. For HI listeners, compression estimates are possible for levels corresponding to 30 dB SL and above. ASSR might be a method for fast and reliable estimates of peripheral input-output functions and hence the state of the active process in the inner ear.

Funding
This work was funded by the Oticon Center of Excellence for Hearing and Speech

Degree of recognition: International

Related event
37th Annual MidWinter Meeting of the Association for Research in Otolaryngology
22/02/2014 → 26/02/2014
San Diego, CA, United States
Activity: Talks and presentations › Conference presentations

Kinetik
Period: 18 Feb 2014
Jens Christian Brasen (Guest lecturer)
Department of Electrical Engineering
Biomedical Engineering

Description
På kurset "Modellering af fysiologiske systemer "

Related external organisation
University of Copenhagen
Thorvaldsensvej 40, DK-1871 Frederiksberg C, Copenhagen, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Smart Design for Permanent Magnets in Electrical Machines:: Increasing Torque Density in Magnet Torque Couplings and Reusable Elements in Direct-Drive Wind Turbine Generator
Period: 14 Feb 2014
Stig Høgberg (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Invited guest lecture at Universidade Federal do Espírito Santo in Vitória, Brazil.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
2013 4th IEEE PES Innovative Smart Grid Technologies Europe
Period: 3 Feb 2014 → 14 Oct 2014
Matthew Lee Henriksen (Organizer)
Center for Electric Power and Energy
Department of Electrical Engineering

Description
Scientific review committee

Review and selection of the submitted papers. DTU hosted the conference.

Related event
2013 4th IEEE PES Innovative Smart Grid Technologies Europe
06/10/2013 → 09/10/2013
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Concepts and computational models of robust bottom-up signal encoding
Period: 30 Jan 2014 → 1 Feb 2014
Sébastien Santurette (Organizer)
Department of Electrical Engineering
Hearing Systems

Description
INSPIRE Winter School on concepts and computational models of robust bottom-up signal encoding
Links:
http://www.inspire-itn.eu

Related event
Concepts and computational models of robust bottom-up signal encoding
29/01/2014 → 01/02/2014
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Referee, Professor in Robotics at Queensland University of Technology (External organisation)
Period: 28 Jan 2014 → 10 Feb 2014
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Referee for Employment of Professor in Robotics at Queensland University of Technology
Degree of recognition: International

Related external organisation

Referee, Professor in Robotics at Queensland University of Technology
Activity: Membership › Membership in review committee

DSMMR Course on MRI Methodology
Period: 20 Jan 2014 → 21 Jan 2014
Lars G. Hanson (Organizer)
Department of Electrical Engineering
Biomedical Engineering

Description
Organizer, DSMMR course on MRI Methodology

Organizer and lecturer

Related event

DSMMR Course on MRI Methodology
20/01/2014 → 21/01/2014
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Drones on Autopilot
Period: 14 Jan 2014
Søren Hansen (Lecturer)
Automation and Control

Department of Electrical Engineering

Description
Presentation and tour for E-gruppen, IDA.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

IEEE Transactions on Power Systems (Journal)
Period: 1 Jan 2014 → …
Athanasios Papakonstantinou (Reviewer)

Department of Electrical Engineering

Center for Electric Power and Energy

Energy Analytics and Markets

Related journal

IEEE Transactions on Power Systems
0885-8950
Central database
Activity: Research › Peer review of manuscripts

International Journal of Adaptive Control and Signal Processing (Journal)
Period: 1 Jan 2014 → 1 May 2015
Mogens Blanke (Editor)

Department of Electrical Engineering

Automation and Control

Description
Journal of Adaptive Control and Signal Processing

Special Issue on Adaptive Control and Signal Processing in Marine Systems

Designated Editor for Special Issue on Adaptive control and Signal Processing in Marine Systems

Related journal
International Journal of Adaptive Control and Signal Processing
0890-6327
Central database
Activity: Research › Journal editor

Partnership Smart Energy Network; Research, Development and Demonstration (External organisation)
Period: 1 Jan 2014 → …
Jacob Østergaard (Member)
Department of Electrical Engineering
Center for Electric Power and Energy
Description
Body type: Partnerskab
Links:
http://www.smartenergynetworks.dk
Related external organisation
Partnership Smart Energy Network; Research, Development and Demonstration
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Canada Foundation for Innovation (External organisation)
Period: 2013
Vitaliy Zhurbenko (Member)
Department of Electrical Engineering
Electromagnetic Systems
Description
Expert reviewer
Degree of recognition: International
Related external organisation
Canada Foundation for Innovation
Activity: Membership › Membership in review committee

Discrimination ability of the Energy score(s)
Period: 2013
Pierre Pinson (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science
Description
Invited seminar at University of Heidelberg, Institute of Applied Mathematics, workshop on "Evaluation of multivariate probabilistic forecasts"
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Prevoir l'électricité produite par nos énergies renouvelables
Period: 2013
Pierre Pinson (Participant)
Rendre la consommation d'électricité plus flexible et contrôlabile
Period: 2013
Pierre Pinson (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

Renewable energy forecasts ought to be probabilistic!
Period: 2013
Pierre Pinson (Lecturer)
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

Renewables in electricity markets: Stochastic modelling and optimization
Period: 2013
Pierre Pinson (Lecturer)
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

Stochastic power generation from renewables: forecasting and optimization challenges for its optimal integration.
Period: 2013
Pierre Pinson (Lecturer)
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

**Description**
Invited lecture at "Energy Systems Week", Isaac Newton Institute, University of Cambridge, UK

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**The Danavox Jubilee Foundation (Publisher)**
Period: 2013 → 2014
Sébastien Santurette (Editor)
Department of Electrical Engineering

**Description**
Proceedings of ISAAR: International Symposium on Auditory and Audiological Research
4th ISAAR: Auditory Plasticity - Listening with the Brain

**Related Publisher**
The Danavox Jubilee Foundation
Local database
Activity: Research › Series editor

**The value of probabilistic information for energy applications - from theory to reality.**
Period: 2013
Pierre Pinson (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

**Description**
Invited lecture at the German Weather Service (DWD)

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**52nd IEEE Conference on Decision and Control (CDC 2013)**
Period: 10 Dec 2013 → 13 Dec 2013
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

**Related event**
52nd IEEE Conference on Decision and Control (CDC 2013)
10/12/2013 → 13/12/2013
Florence, Italy
Activity: Talks and presentations › Conference presentations
Committee member at PhD defense by PhD student Jonas Ottosson
Period: 4 Dec 2013
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

MRI simulation for sequence development, protocol optimisation and education
Period: 2 Dec 2013 → 4 Dec 2013
Lars G. Hanson (Organizer)
Department of Electrical Engineering
Biomedical Engineering
Description
Co-organizer
Co-organizer
Links:

Related event
MRI simulation for sequence development, protocol optimisation and education: ESMRMB Lectures on MR
02/12/2013 → 04/12/2013
Bonn, Germany
Activity: Attending an event › Participating in or organising a conference

Electric Vehicle Smart Charging and V2G Service Automation
Period: 1 Dec 2013 → 30 Apr 2014
Mattia Marinelli (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy
Distributed Energy Resources
Description
Master thesis by Sergejus Martinenas
Documents:
Master_thesis_Sergejus_M_v1_4_final
Activity: Other

HTX, EucSyd Sønderborg
Period: 22 Nov 2013
Kaj Bjarne Jakobsen (Lecturer)
Department of Electrical Engineering
Electromagnetic Systems
Description
Antennas for Body-Centric Communications, Anechoic Chamber
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Committee member at PhD defense by PhD student Abdul Majid
Period: 20 Nov 2013
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

CST Workshop Series 2013
Period: 12 Nov 2013
Vitaliy Zhurbenko (Organizer)
Department of Electrical Engineering
Electromagnetic Systems
Description
Local coordination of the workshop.
Presentation of simulation activities at EMS, DTU.
Links:
https://www.cst.com/Events/Details/2794 (Workshop description and agenda)
Related event
CST Workshop Series 2013
12/11/2013 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Debugging - for rigtige programmører
Period: 26 Oct 2013
Rasmus Villefrance (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Description
Den klassiske tilgang til fejlretning er "at hver mand retter sine egne fejl". Vi beskriver her en anderledes tilgang. En virksomhed kan opnå produktivitetsvinder og et forbedret arbejdsmiljø ved at anskue fejlretning som en gruppeopgave. Ved at udpege og opdyrke et specialist team inden for debugging og koble dette team til specialister inden for virksomhedens andre SW kompetenceområder kan man sikre en høj grad af prestige omkring fejlretning, både i specialistteamet og i resten af virksomheden. Endvidere kan man på denne måde sikre at virksomheden har et uformelt netværk af specialister som kan træde til med kort varsel og løse de mest komplicerede fejlretningsopgaver. Endvidere berøres kort hvorledes arbejdsprocesser som Agile spiller sammen med højkvalitets-fejlretningsarbejde.
Documents:
20131020 Debugging er teamwork - updated
Links:
http://www.conferencemanager.dk/debugging/program.html
Related event
Debugging - for rigtige programmører
26/10/2013 → …
København, Denmark
Activity: Other

The Intelligent Energy System
Period: 21 Oct 2013
Jacob Østergaard (Invited speaker)

Links:
http://www.youtube.com/watch?v=ZmO6Q5XEXEg (Video)

Related event

Lecture at Royal Danish Academy of Sciences and Letters
21/10/2013 → 21/10/2014
København, Denmark
Activity: Talks and presentations › Conference presentations

Bornholm Test Island
Period: 9 Oct 2013
Jacob Østergaard (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
The Danish island Bornholm is a full-scale real-life laboratory and test site for Smart Energy solutions. The island is ideal for this purpose because more than 50 % of the electricity consumption of Bornholm's 27,000 customers comes from renewable energy, the island hosts a number of modern power and energy technologies as well as include valuable technical properties. The Bornholm power system is part of PowerLabDK, an experimental platform for electric power and energy, which integrates the Bornholm power system and the laboratories at Technical University of Denmark (www.powerlab.dk). The island host several large present, past and future R&D-activities; among others EDISON, EcoGrid EU and IDE4L. The presentation will outline the activities at Bornholm and elaborate on the perspectives of Bornholm as a European Smart Grid ice breaker and role model.

About the speaker: Since 2005 Østergaard has been Head of Center for Electric Power and Energy (CEE) at Department of Electrical Engineering, Technical University of Denmark (DTU) at which time he was appointed Professor in Electric Power Engineering. After his graduation from DTU in 1995 he was 10 year in industry with Danish Energy Research and Development. His research focuses on Smart Grid technologies with main contributions within services from demand side, advanced control of wind power plants, and fast real-time stability and security assessment. He serves in several national and international boards and committees. He has developed the center to its current level with 95 employees and been responsible for building up PowerLabDK (www.powerlab.dk) including labs at DTU and the Bornholm Island.

Documents:
Bornholm Test Island v4

Related event

2013 4th IEEE PES Innovative Smart Grid Technologies Europe
06/10/2013 → 09/10/2013
2013 4th IEEE PES Innovative Smart Grid Technologies Europe

**Description**
Panel session on Cyber Security.
This Panel session gathers experts from cyber-security in smart grids and consist of three talks and a panel discussion. Invited talks: (1) "Cyber Security Assessment in the Smart Grid", Mathias Ekstedt, Associated professor, KTH Royal Institute of Technology, Sweden; (2) "Why is smart grid security so hard?" Thomas Bleier, Dr.-Ing., CISSP, Program Manager of ICT Security, AIT Austrian Institute of Technology, Austria; (3) "New challenges for Cyber Security in Smart Grids", Gunnar Björkman, Senior Consultant, ABB Mannheim, Germany

Related event

2013 4th IEEE PES Innovative Smart Grid Technologies Europe
06/10/2013 → 09/10/2013
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Renewable Energy, Smart Grid and Japan

**Related event**

Colloquium at Copenhagen University
14/09/2013 → 14/09/2013
København, Denmark
Activity: Talks and presentations › Conference presentations

BioDynamics 2013

**Related event**

BioDynamics 2013: Where Biology, Medicine & Mathematics meet
11/09/2013 → 13/09/2013
Bristol, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

14th International Conference on Systems Biology

**Related event**

14th International Conference on Systems Biology
30 Aug 2013 → 3 Sep 2013
Jens Christian Brasen (Organizer)
Department of Electrical Engineering
Biomedical Engineering

Description
Organizing Committee

Related event

14th International Conference on Systems Biology
30/08/2013 → 03/09/2013
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

14th International Conference on Systems Biology
Period: 30 Aug 2013 → 4 Sep 2013
Jens Christian Brasen (Organizer)
Department of Electrical Engineering
Biomedical Engineering

Description
Main Organizer

Related event

14th International Conference on Systems Biology: Workshops
29/08/2013 → 04/09/2013
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

4th International Symposium on Dynamic Nuclear Polarization
Lars G. Hanson (Organizer)
Department of Electrical Engineering
Biomedical Engineering

Description
Local co-organizer
Links:
http://www.dnpsymposium.org (Conference homepage)

Related event

4th International Symposium on Dynamic Nuclear Polarization
28/08/2013 → 31/08/2013
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

Acquisition Strategies for Hyperpolarised Spin Systems
Lars G. Hanson (Organizer)
Department of Electrical Engineering
Biomedical Engineering

Description
Local co-organizer
Links:
Related event

Acquisition Strategies for Hyperpolarised Spin Systems: ESMRMB Lectures on MRI
25/08/2013 → 27/08/2013
Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Biofuel Session
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

Description
Chairman and Speaker of the Biofuel Session

Related event

9th World Congress of Chemical Engineering Incorporating 15th Asian Pacific Confederation of Chemical Engineering Congress
18/08/2013 → 23/08/2013
Seoul, Korea, Republic of
Activity: Talks and presentations › Conference presentations

Smart Grid Activities at Bornholm
Period: 20 Jun 2013
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
EnergiForsk 2013 - Jacob Østergaard v2

Related event

EnergiForsk 2013
20/06/2013 → 20/06/2013
København, Denmark
Activity: Talks and presentations › Conference presentations

2013 American Control Conference
Period: 17 Jun 2013 → 19 Jun 2013
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

Description
Oral presentation with Best Presentation in Session Award

Related event

2013 American Control Conference
17/06/2013 → 19/06/2013
Washington, DC, United States
Activity: Talks and presentations › Conference presentations

10th IEEE International Conference on Control & Automation
Period: 12 Jun 2013 → 14 Jun 2013
Ole Ravn (Speaker)
Department of Electrical Engineering

Automation and Control

Links:
http://ieee-icca.org/

Related event

10th IEEE International Conference on Control & Automation
12/06/2013 → 14/06/2013
Hangzhou, China
Activity: Talks and presentations › Conference presentations

Designing the Next Generation of Smart Grid Laboratories
Period: 10 Jun 2013
Anna Magdalena Kosek (Organizer)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
The RTLabOS 'Phase I' project aims to investigate software architecture in ICT supported power systems and smart grid laboratories. In this first workshop of the focus will be on sharing experiences, exploring the state-of-the-art and development opportunities. In particular, we are looking for experts with experience in: Software architecture for interconnecting lab facilities Software development and integration of lab components Use cases for complex lab-setups involving software and hardware, including e.g. industrial SCADA systems Complex experiments, mixing different data sources and keeping track of setup and measurement data Integration of simulation tools & technologies such as Real-time simulation, HIL, SiTIL, cross-domain and Co-simulation.

Related event

Designing the Next Generation of Smart Grid Laboratories: Integration Experiences
10/06/2013 → …
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

LabVIEW Introductory on Data Acquisition
Period: 10 Jun 2013 → 28 Jun 2013
Andrei Costache (Participant)
Department of Electrical Engineering
Department of Mechanical Engineering

Description
Broadly appealing LabVIEW course incompasing: - hands-on work with user defined assignments - work in groups of 2 - LabVIEW Core 1, Core 2 and data acquisition module - LabVIEW certification level 1

Related event

LabVIEW Introductory on Data Acquisition
10/06/2013 → 28/06/2013
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

21st International Congress on Acoustics
Period: 2 Jun 2013 → 7 Jun 2013
Nicolas Le Goff (Speaker)
Department of Electrical Engineering
Hearing Systems

Description
Poster presentation on "Spectral Integration of Interaural Time Differences in Auditory Localization"

Poster presentation
Documents:
SPECTRAL INTEGRATION OF INTERAURAL TIME DIFFERENCES IN AUDITORY LOCALIZATION

Related event

21st International Congress on Acoustics
02/06/2013 → 07/06/2013
Montreal, Canada
Activity: Talks and presentations › Conference presentations

RF coils: Design and build your own
Period: 28 May 2013 → 30 May 2013
Vitaliy Zhurbenko (Participant)
Department of Electrical Engineering
Electromagnetic Systems
Links:
http://esmrmb.org/index.php?id=en/lectures_on_mr/courses_2013/rf_coils_design_and_build_your_own.htm (Course description)
http://esmrmb.org/html/img/pool/Agenda_160513.pdf (Programme)

Related event

RF coils: Design and build your own
28/05/2013 → 30/05/2013
Berlin, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Danvak Dagen 2013
Period: 10 Apr 2013
Tobias Gybel Hovgaard (Invited speaker)
Department of Applied Mathematics and Computer Science
Scientific Computing
Department of Electrical Engineering
Automation and Control

Description
Presentation given at "Danvak Dagen 2013" Invited talk after receiving "Prof. P.Ole Fangers Forkningslegat 2013".
Documents:
PDF

Related event

Danvak Dagen 2013
10/04/2013 → …
København, Denmark
Activity: Talks and presentations › Conference presentations

DTU RoboCup 2013
Period: 9 Apr 2013 → 11 Apr 2013
Ole Ravn (Organizer)
Department of Electrical Engineering
Automation and Control

Description
DTU RoboCup 2013: A DTU Blue Dot Project

Links:
http://www.robocup.dtu.dk

Related event

DTU RoboCup 2013
09/04/2013 → 11/04/2013
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

European Robotic Forum 2013
Period: 19 Mar 2013 → 21 Mar 2013
Ole Ravn (Speaker)
Department of Electrical Engineering
Automation and Control
Links:
http://www.eurobotics2013.com/

Related event

European Robotic Forum 2013
19/03/2013 → 21/03/2013
Lyon, France
Activity: Talks and presentations › Conference presentations

37th Enlarged Halden Programme Group Meeting
Period: 10 Mar 2013 → 15 Mar 2013
Xinxin Zhang (Speaker)
Department of Electrical Engineering
Automation and Control

Related event

37th Enlarged Halden Programme Group Meeting
10/03/2013 → 15/03/2013
Storefjell, Norway
Activity: Talks and presentations › Conference presentations

36th Annual Midwinter Meeting of the Association for Research in Otolaryngology
Period: 16 Feb 2013 → 20 Feb 2013
Nicolas Le Goff (Participant)
Department of Electrical Engineering
Hearing Systems

Description
Abstract submission and Poster presentation
Documents:
Abstract
Poster

Related event

36th Annual Midwinter Meeting of the Association for Research in Otolaryngology
16/02/2013 → 16/02/2013
Baltimore, MD, United States
Activity: Attending an event › Participating in or organising a conference
**IEEE (Publisher)**  
Period: 1 Feb 2013 → 31 Dec 2013  
Mattia Marinelli (Editor)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Distributed Energy Resources  

**Description**  
Innovative Smart Grid Technologies Europe (ISGT EUROPE), 2013 4th IEEE/PES  
Scientific Publication Chair of the 4th ISGT Europe Conference 2013  

**Related Publisher**  
IEEE  
Central database  
Activity: Research › Series editor  

**PowerLabDK - Experimental Facilities for Power and Energy**  
Period: 14 Jan 2013  
Jacob Østergaard (Invited speaker)  
Department of Electrical Engineering  
Center for Electric Power and Energy  
Documents:  
PLDK presentationENDK 2013-01-14 distrib  

**Related event**  
**Colloquium at Energinet.dk**  
14/01/2013 → 14/01/2013  
Erritsø, Denmark  
Activity: Talks and presentations › Conference presentations  

**Dansk Standard (External organisation)**  
Period: 1 Jan 2013 → …  
Lars Press Petersen (Participant)  
Department of Electrical Engineering  
Electronics  

**Description**  
Medlem af:  
DS/S-710 - ELEKTROMAGNETISK KOMPATIBILITET  
DS/S-650 - DEN INTERNATIONALE SPECIALKOMITE FOR RADIOFORSTYRRELSER  
Degree of recognition: International  

**Related external organisation**  
**Dansk Standard**  
Denmark  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar  

**European Journal of Operational Research (Journal)**  
Period: 1 Jan 2013 → …  
Athanasios Papakonstantinou (Reviewer)
Department of Electrical Engineering
Center for Electric Power and Energy
Energy Analytics and Markets

**Description**
European Journal of Operational Research

**Related journal**

*European Journal of Operational Research*
0377-2217
Central database
Activity: Research › Peer review of manuscripts

*International Symposium on Auditory and Audiological Research*
Period: 2012 → 2013
Sébastien Santurette (Organizer)
Department of Electrical Engineering

**Description**
Abstract, programme, and manuscript coordinator - Webmaster

Abstract, programme, and manuscript coordinator - Webmaster; International Symposium on Auditory and Audiological Research (ISAAR) 2013

**Related event**

*International Symposium on Auditory and Audiological Research*
28/08/2013 → 30/08/2013
Nyborg, Denmark
Activity: Attending an event › Participating in or organising a conference

*Web-based wind power forecasting competition 2012 - Wind Forecasting*
Period: 2012
Pierre Pinson (Organizer)
Department of Applied Mathematics and Computer Science
Department of Electrical Engineering
Center for Electric Power and Energy

**Description**
Global Energy Forecasting competition

Web-based wind power forecasting competition hosted by Kaggle.com (150 participants worldwide)

**Related event**

*Web-based wind power forecasting competition 2012 - Wind Forecasting: A wind power forecasting problem: predicting hourly power generation up to 48 hours ahead at 7 wind farms*
06/09/2012 → 31/10/2012
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

*Electrical Machines with HTS Technology for Wind Power Applications*
Period: 13 Dec 2012
Nenad Mijatovic (Speaker)
6th Annual Meeting of the Audiological Research Cores in Europe
Period: Nov 2012
Sébastien Santurette (Organizer)
Department of Electrical Engineering
Hearing Systems
Description
6th Meeting of European ARCHES network
Audiological Research Cores in Europe (ARCHES)
Links:
http://www.arches2012.dk
Related event
6th Annual Meeting of the Audiological Research Cores in Europe
26/11/2012 → 27/11/2012
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising a conference

10th European Workshop on Advanced Control and Diagnosis
Period: 8 Nov 2012 → 9 Nov 2012
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control
Related event
10th European Workshop on Advanced Control and Diagnosis
08/11/2012 → 09/11/2012
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

10th European Workshop on Advanced Control and Diagnosis
Period: 8 Nov 2012 → 9 Nov 2012
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control
Related event
10th European Workshop on Advanced Control and Diagnosis
08/11/2012 → 09/11/2012
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

International Workshop on Functional Modelling
Period: 6 Nov 2012 → 7 Nov 2012
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

Related event

International Workshop on Functional Modelling: For Design and Operation of Industrial Systems and Infrastructures
06/11/2012 → 07/11/2012
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

International Workshop on Functional Modelling
Period: 6 Nov 2012 → 7 Nov 2012
Xinxin Zhang (Speaker)
Department of Electrical Engineering
Automation and Control

Description
Organize and participate the International Workshop on Functional Modelling: for Design and Operation of Industrial Systems and Infrastructures.
Links:
http://indico.conferences.dtu.dk/conferenceDisplay.py?confId=121

Related event

International Workshop on Functional Modelling: For Design and Operation of Industrial Systems and Infrastructures
06/11/2012 → 07/11/2012
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Basic MRI Physics: A visual introduction for laymen
Lars G. Hanson (Lecturer)
Department of Electrical Engineering
Biomedical Engineering

Description
Invited oral presentation.
Documents:
prod21351622580391.HansonEANM2012.pdf

Related event

25th Annual EANM Congress: European Association of Nuclear Medicine
27/10/2012 → 31/10/2012
Milan, Italy
Activity: Talks and presentations › Conference presentations

8th HOLMUG meeting
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

Related event

8th HOLMUG meeting: Halden On-Line Monitoring User Group
18/10/2012 → 19/10/2012
Rome, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

8th HOLMUG meeting
Xinxin Zhang (Speaker)
Department of Electrical Engineering
Automation and Control

Description
Presentation on "Apply Functional Modeling to Consequence Analysis in Supervision Systems"

Presentation on the 8th HOLMUG (Halden On-Line Monitoring User Group) Meeting
Documents:
APPLY FUNCTIONAL MODELING TO CONSEQUENCE ANALYSIS IN SUPERVISION SYSTEMS

Related event
8th HOLMUG meeting: Halden On-Line Monitoring User Group
18/10/2012 → 19/10/2012
Rome, Italy
Activity: Talks and presentations › Conference presentations

Committee member of Doctoral Examination of PhD student Frank van der Pijl
Period: 15 Oct 2012
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Aalborg University (External organisation)
Period: 5 Oct 2012 → 18 Dec 2012
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Member of evaluation committee for position as full professor in automation and control

Body type: University

Related external organisation
Aalborg University
A.C. Meyers Vænge 15, 2450 Copenhagen SV, Aalborg, Denmark
Activity: Membership › Membership in review committee

CST System Integrity Workshop Series 2012
Period: 11 Sep 2012
Vitaliy Zhurbenko (Organizer)
Department of Electrical Engineering
Electromagnetic Systems

Description
Coordination of the workshop.
Introducing DTU-Elektro. Presentation of simulation activities at EMS, DTU.
Related event

CST System Integrity Workshop Series 2012
11/09/2012 → 11/09/2012
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Modelling and Control of Stiff Robots for Flexible Manufacturing (External organisation)
Period: 7 Sep 2012
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

Description
Isolde Dressler, LTH, Lund, Sweden

Body type: Ph.D. evaluation committee
Degree of recognition: International

Related external organisation

Modelling and Control of Stiff Robots for Flexible Manufacturing
Activity: Membership › Membership in review committee

1st International Symposium on Socially and Technically Symbiotic Systems
Period: 29 Aug 2012 → 31 Aug 2012
Xinxin Zhang (Speaker)
Department of Electrical Engineering
Automation and Control
Links:
http://stss2012.org/homepage.html

Related event

1st International Symposium on Socially and Technically Symbiotic Systems
29/08/2012 → 31/08/2012
Okayama, Japan
Activity: Talks and presentations › Conference presentations

GreenBelt
Vitaliy Zhurbenko (Participant)
Department of Electrical Engineering
Electromagnetic Systems

Related event

GreenBelt: Cleanroom GreenBelt Course
27/08/2012 → 31/08/2012
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

External examiner on PhD thesis by PhD student Sri Susovon Samanta
Period: Jul 2012
Michael A. E. Andersen (External examiner)
16th IFAC Symposium on System Identification
Period: 11 Jul 2012 → 13 Jul 2012
Ole Ravn (Invited speaker)
Department of Electrical Engineering
Automation and Control
Links:
http://www.sysid2012.org

Related event
16th IFAC Symposium on System Identification
11/07/2012 → 13/07/2012
Brussels, Belgium
Activity: Talks and presentations › Conference presentations

Power-Hardware-in-the-Loop Test of VSC HVDC Connection for Offshore Wind Power Plants
Period: 26 Jun 2012
Seung-Tae Cha (Speaker)
Department of Electrical Engineering
Electric Energy Systems

Description
International Network Program
KEPCO Delegation - DONG external meeting

As part of International Networking Program, 55831 project. There was an external meeting with DONG energy and KEPCO.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Linköping University (External organisation)
Period: 15 Jun 2012
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Official opponent for PhD candidate Carl Svärd's defense for the degree Dr.Ing

Official opponent for PhD candidate Carl Svärd's defense for the degree Dr.Ing

Body type: University
Degree of recognition: International

Related external organisation
Linköping University
Sweden
Activity: Membership › Membership in review committee
IEC61850 and Interoperability in SmartGrid
Period: 11 Jun 2012 → 13 Jun 2012
Anders Bro Pedersen (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
The development towards a sustainable energy system in the electric power industry has led to the emergence of a set of market models and new concepts for optimized operation and control of power systems, e.g. Virtual Power Plants and Microgrid. In these new concepts, the traditional stakeholders are complemented by new actors that take roles such as aggregator, prosumer, dispatchable load etc. Common to all these concepts is that they assume a more flexible and loosely coupled ICT system architecture. In such architectures, ICT components communicate to implement optimization, control and protection functions.

Interoperability is a necessary pre-requisite for such an environment. While standards are a fundamental mean, and provide necessary ingredients they are not sufficient for achieving interoperability. Challenges include insufficient specifications, alternate options for implementation, vendor specific tools, difficulty in cross standard harmonization, integration with high level control and automation systems and steep learning curves for the workforce.

This course will provide fundamental knowledge to the interoperability issues in the Smartgrid, introduction to state of the art systems and technologies, and hands-on practice with relevant industry standard tools.

Talk titled "Virtual power plant for smart electric vehicle charging based on IEC 61850 VPP server"
Documents:
Event program

Related event

IEC 61850 and Interoperability in SmartGrid
11/06/2012 → 13/06/2012
Stockholm, Sweden
Activity: Talks and presentations › Conference presentations

EDISON – ICT architectures for EV integration
Period: 19 Apr 2012
Anders Bro Pedersen (Speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Event program

Related event

Electric Vehicle Seminar
19/04/2012 → …
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

World-class experimental platform for Smart Grid development
Period: 31 Mar 2012
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Center for Electric Power and Energy
Documents:
Smart Utilities Scandinavia JOE presentation

Related event

Smart Utilities Scandinavia 2012: 5th Annual Conference & Exhibition
20/03/2013 → 21/03/2013
København, Denmark
Activity: Talks and presentations › Conference presentations
Aalborg University (External organisation)
Period: 21 Mar 2012
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
Opponent for PhD Candidate Tom Nørgaard Jensen’s Thesis
External examiner for PhD Thesis

Body type: University

Related external organisation
Aalborg University
A.C. Meyers Vænge 15, 2450 Copenhagen SV, Aalborg, Denmark
Activity: Membership › Membership in review committee

DTU RoboCup 2012
Ole Ravn (Organizer)
Department of Electrical Engineering
Automation and Control

Description
DTU RoboCup 2012: A DTU Blue Dot Project

Related event

DTU RoboCup 2012
20/03/2012 → 22/03/2012
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Spontane Otoakustische Emissionen - generiert durch aktive Oszillatoren gruppiert in Frequenzplateaus
Period: 12 Mar 2012
Bastian Epp (Invited speaker)
Department of Electrical Engineering
Hearing Systems

Description
Medautoren:
van Dijk, Pim, Wit, Hero

Related event

Jahrestagung der Deutschen Gesellschaft für Akustik
10/03/2014 → 13/03/2014
Oldenburg, Germany
Activity: Talks and presentations › Conference presentations

European Robotic Forum 2012
Period: 5 Mar 2012 → 7 Mar 2012
Ole Ravn (Speaker)
Department of Electrical Engineering
Automation and Control

**Related event**

**European Robotic Forum 2012**
05/03/2012 → 07/03/2012
Odense, Denmark
Activity: Talks and presentations › Conference presentations

**35th MidWinter Meeting of the Association for Research in Otolaryngology**
Period: Feb 2012
Federica Bianchi (Participant)
Department of Electrical Engineering
Hearing Systems

**Description**
poster presentation

**Documents:**
FedericaBianchi_PosterARO

**Related event**

**35th MidWinter Meeting of the Association for Research in Otolaryngology**
25/02/2012 → 29/02/2012
San Diego, CA, United States
Activity: Attending an event › Participating in or organising a conference

**5th International Conference on Cognitive Systems**
Period: 22 Feb 2012 → 23 Feb 2012
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

**Links:**
http://cogsys2012.acin.tuwien.ac.at/

**Related event**

**5th International Conference on Cognitive Systems**
22/02/2012 → 23/02/2012
Vienna, Austria
Activity: Attending an event › Participating in or organising a conference

**17th Nordic Process Control Workshop**
Period: 25 Jan 2012 → 27 Jan 2012
Remus Mihail Prunescu (Speaker)
Department of Electrical Engineering
Automation and Control

**Related event**

**17th Nordic Process Control Workshop**
25/01/2012 → 27/01/2012
Kongens Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

**Medico Bazar**
Period: 10 Jan 2012
Johan Jacob Mohr (Participant)
Department of Electrical Engineering
Electromagnetic Systems
Links:
http://www.medico-innovation.dk/2011/07/medtech-basar/

Related event
Medico Bazar
10/01/2012 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Vitaliy Zhurbenko (Participant)
Department of Electrical Engineering
Electromagnetic Systems
Links:
http://www.medico-innovation.dk/2011/07/medtech-basar/

Related event
Medico Bazar
10/01/2012 → …
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Innovation Network RoboCluster (External organisation)
Period: 1 Jan 2012 → 31 Dec 2012
Ole Ravn (Chairman)
Department of Electrical Engineering
Automation and Control

Description
RoboCluster is a national innovation network that brings together the Danish competences and expertise within robotics, automation and intelligent mechanical systems.
Links:
http://www.robocluster.dk

Related external organisation

Innovation Network RoboCluster
Activity: Membership › Membership of research networks or expert groups

IEEE Transactions on Power Systems (Journal)
Period: 2011 → …
Pierre Pinson (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

Related journal
IEEE Transactions on Power Systems
0885-8950
**Member IFAC Technical Committee on Marine Systems (External organisation)**

Period: 2011 → 2014

Mogens Blanke (Participant)

Department of Electrical Engineering

**Automation and Control**

**Description**

Member of IFAC TC on Marine Systems 2011 -2014

Member of IFAC TC on Marine Systems 2014 -2017

Body type: International Organization

Degree of recognition: International

**Related external organisation**

**Member IFAC Technical Committee on Marine Systems**

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Springer Science + Business Media (Publisher)**

Period: 2011

Vitaliy Zhurbenko (Reviewer)

Department of Electrical Engineering

**Electromagnetic Systems**

**Description**

Expert reviewer of a book proposal

Degree of recognition: International

**Related Publisher**

**Springer Science + Business Media**

United States

Local database

Activity: Research › Peer review of manuscripts

**Teaching Evaluation Exercise at Aalto University (External organisation)**

Period: 2011 → ...

Ole Ravn (Chairman)

Department of Electrical Engineering

**Automation and Control**

**Description**

Chairman of the Electrical Engineering Panel

Degree of recognition: International

Links:

https://into.aalto.fi/display/enaalto/Teaching+Evaluation+Exercise+%28TEE%29

**Related external organisation**

**Teaching Evaluation Exercise at Aalto University**

Activity: Membership › Membership in review committee

**The Government's Smart Grid Network (External organisation)**

Period: 2011
Anders Troi (Chairman)
Department of Electrical Engineering
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Description
Co Chair with responsibility for the Research, Innovation and Demonstration

Related external organisation
The Government's Smart Grid Network
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Linköping University (External organisation)
Period: 28 Dec 2011 → 1 Mar 2012
Mogens Blanke (Participant)
Department of Electrical Engineering
Automation and Control

Description
External evaluator for promotion to Docent

Evaluation of promotion to Docent

Body type: Evaluation committee
Degree of recognition: International

Related external organisation
Linköping University
Sweden
Activity: Membership › Membership in review committee

iPower - Strategisk platform for innovation og forskning i intelligent el
Period: 8 Dec 2011
Anders Troi (Speaker)
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Description
Place: Temamøde om vindkraftværker og energisystem, Frederiksberg (DK), 8 Dec

Related external organisation

Fremtidens energiforsyning
Period: 5 Dec 2011
Anders Troi (Speaker)
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Description
Place: DTU workshopserie om smart cities. 1. workshop: Energi og vand, Slangerup (DK)

Related external organisation
Smart Charging for Electric Vehicle (EV) Fleet Operators (FOs) and ICT Implementation using IEC 61850
Period: 5 Dec 2011
Anders Bro Pedersen (Lecturer)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Contents
1 Smart Charging for EV FOs
•EV charging management options
•Optimal EV charging management with minimum charging cost for EV FOs
2 Smart Charging with Day-Ahead Tariffs
•Congestion management techniques
•Day-Ahead Tariffs based on Locational Marginal Prices (LMPs)
•Optimal charging management for FOs with day-ahead tariffs
3 ICT Implementation for EV Smart Charging using IEC 61850
•Charging station and EV modeling
•Additions to IEC61850-7-420 for EV modeling
•Communicating the IEC61850 models
•Example/walkthrough of charging process (interactive demo)

Related event
2011 2nd IEEE PES International Conference and Exhibition on "Innovative Smart Grid Technologies" (ISGT Europe): ISGT-EUROPE 2011 05/12/2011 → 07/12/2011 Manchester, United Kingdom
Activity: Talks and presentations › Conference presentations

Modeling & Simulation of Distribution Networks: Multi-agent based LFC for islanding operation
Period: 30 Nov 2011
Seung-Tae Cha (Speaker)
Department of Electrical Engineering

Description
Note: Workshop - DONG Energy
Place: Gentofte, Denmark
Documents:
prod11323942130152.DONG 2011-11[1].pdf

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

DTU-Elektro Project Day
Vitaliy Zhurbenko (Speaker)
Department of Electrical Engineering
Electromagnetic Systems
Links:
http://www.elektro.dtu.dk/English/industrial_collaboration/projectday.aspx (REL-OA)

Related event
DTU-Elektro Project Day 25/10/2011 → 25/10/2011
**The Bornholm Power System: A Full-Scale Laboratory for Smart Grid Research**

**Period:** 18 Oct 2011

Jacob Østergaard (Invited speaker)

Department of Electrical Engineering

Center for Electric Power and Energy

**Description**

**Abstract:**
The Bornholm power system is a Danish distribution system with 33% wind power penetration (yearly average). The distribution system has 28,000 customers and a peak load of 55 MW. The Bornholm power system is part of the Nordic interconnected power system and power market, and it has many of the characteristics of a typical Danish distribution system. The system can be operated isolated from the transmission grid. The Bornholm power system, which is linked with the laboratories at Technical University of Denmark (DTU), is used for a wide number of research activities on smart grid technologies. The research activities are driven by the ambitious Danish targets regarding integration of renewable energy (100% renewable energy in 2050). In the presentation the Bornholm power system will be introduced and examples of the research results involving wind power, demand side and new market designs at Bornholm will be provided. Also the new large European project, EcoGrid EU, focusing on large scale smart grid demonstration on Bornholm will be introduced.

**CV of Professor Østergaard:** Since 2005 Jacob Østergaard has been Professor in Electric Power Engineering and head of Centre of Electric Technology (CET) at Department of Electrical Engineering at Technical University of Denmark. Earlier he has been employed 10 years in industry at Research Institute of Danish Electric Utilities, DEFU. His research focuses on intelligent electric power systems especially new network and control architectures, integration of distributed generation and renewable energy sources and increased flexibility via active demand. He is responsible for leading the center to its present state with 50 staff members and development of the Bornholm power system into an unique experimental platform. He serves in several boards and organizations, including chair of the Danish experimental platform PowerLabDK, chair of the IEEE PES Danish chapter, member of the Advisory Council for the European technology platform SmartGrids and member of the Smart Grid advisory network of the Danish Minister of Energy and Climate.

**Documents:**
The_Bornholm_Power_System

**Related event**

**Kolloquium at ETH Zurich**

18/10/2011 → 18/10/2011

Zurich, Switzerland

**Activity:** Talks and presentations › Conference presentations

**Workshop on Modeling and simulation of modern electricity networks**

**Period:** 22 Sep 2011

Seung-Tae Cha (Speaker)

Department of Electrical Engineering

Electric Energy Systems

**Description**

**Place:** Lund, Sweden

**Related external organisation**

**Unknown external organisation**

**Activity:** Talks and presentations › Conference presentations

**P L o S One (Journal)**

**Period:** 22 Aug 2011 → …

Jens Christian Brasen (Reviewer)

Department of Electrical Engineering

Biomedical Engineering
Description
PLOS One

Related journal

P L o S One
1932-6203
BFI (2018): BFI-level 1, Scopus rating (2017): CiteScore 3.01 SJR 1.164 SNIP 1.111, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Indexed in DOAJ
Central database
Activity: Research › Peer review of manuscripts

2011 American Control Conference
Period: 29 Jun 2011 → 1 Jul 2011
Ole Ravn (Speaker)
Department of Electrical Engineering
Automation and Control

Related event

2011 American Control Conference
29/06/2011 → 01/07/2011
San Francisco, CA, United States
Activity: Talks and presentations › Conference presentations

Real-Time Stability Assessment based on Synchrophasors: IEEE PowerTech 2011
Period: 20 Jun 2011
Hjörtur Jóhannsson (Speaker)
Department of Electrical Engineering
Electric Energy Systems
Centre for Electric Technology

Description
Place: Trondheim

Unknown external organisation

Activity: Talks and presentations › Conference presentations

Power System Balancing by Distributed Energy Resources and Flexible Demand
Period: 18 May 2011 → 20 May 2011
Jacob Østergaard (Invited speaker)
Department of Electrical Engineering
Electric Energy Systems
Centre for Electric Technology

Description
Power System Balancing by Distributed Energy Resources and Flexible Demand
In future power systems distributed energy resources and flexible demand is expected to contribute to power system balancing. In this presentation we suggest an approach based on two control concepts: Frequency controlled demand, and a 5-minute real-time market. To illustrate the concept we use a detailed physical modeling of selected devices in connection with an inertia model of the power system, and the two control concepts. The models are partly based on laboratory experience, partly on literature studies. The results show the behavior of the individual technologies as well as the aggregate behavior of a power system balanced by a coherent set of resources. The results prove that the concepts are feasible. Outline of a planned large-scale demonstration will be provided.
Note: Power System Balancing by Distributed Energy Resources and Flexible Demand
Place: Lund University
Documents:
Power System Balancing by Distributed Energy Resources and Flexible Demand

Related event

Workshop on Dynamics, Control and Pricing in Power Systems (LCCC): Lund Center for Control of Complex Engineering Systems
18/05/2011 → 20/05/2011
Lund, Sweden
Activity: Talks and presentations › Conference presentations

DTU RoboCup 2011
Ole Ravn (Organizer)
Department of Electrical Engineering
Automation and Control

Description
DTU RoboCup 2011: A DTU Blue Dot Project

Related event

DTU RoboCup 2011
22/03/2011 → 24/03/2011
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Forskning, udvikling og demonstration
Period: 2 Mar 2011
Anders Troi (Speaker)
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Description
Note: Intelligent energy systems
Place: Temadag om Smart Grid i Danmark i 2020, Kolding (DK)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Elektrificering af biotransporten og fleksibelt el-net
Period: 26 Jan 2011
Anders Troi (Organizer)
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Related event

Elektrificering af biotransporten og fleksibelt el-net
26/01/2011 → 26/01/2011
Klimaomstilling på Sjælland. Konference med workshops på RUC
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Electromagnetic Analysis using Computer Simulation Technology
Vitaliy Zhurbenko (Organizer)
Related event

25/01/2011 → 25/10/2011
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Udvikling af nye metoder for realtimestabilitetsovervågning af elforsyningssystemer: PMU/WAMS seminar hos Energinet.dk
Period: 1 Jan 2011 → …
Hjörður Jóhannsson (Speaker)

Department of Electrical Engineering
Electric Energy Systems
Centre for Electric Technology

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

IEEE Asia-Pacific Conference on Applied Electromagnetics (External organisation)
Period: 2010
Vitaliy Zhurbenko (Participant)

Department of Electrical Engineering
Electromagnetic Systems
Degree of recognition: International
Documents:
Proceedings

Related external organisation

IEEE Asia-Pacific Conference on Applied Electromagnetics
Activity: Membership › Membership in review committee

IEEE Transactions on Power Electronics (Journal)
Period: 2010 → …
Michael A. E. Andersen (Editor)

Department of Electrical Engineering
Electronics

Description
IEEE Transactions on Power Electronics
Associate Editor.

Related journal

IEEE Transactions on Power Electronics
0885-8993
Central database
Activity: Research › Journal editor
The Minister for Climate, Energy and Building Smart Grid Network (External organisation)
Period: 2010 → 2011
Jacob Østergaard (Participant)
Department of Electrical Engineering
Center for Electric Power and Energy

Description
Body type: Network
Documents:
the_smart_grid_network

Related external organisation
The Minister for Climate, Energy and Building Smart Grid Network
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Wind Energy (Journal)
Period: 2010 → …
Pierre Pinson (Editor)
Department of Electrical Engineering
Center for Electric Power and Energy
Department of Applied Mathematics and Computer Science

Related journal
Wind Energy
1095-4244
BFI (2018): BFI-level 2, Scopus rating (2017): CiteScore 3.18 SJR 1.051 SNIP 1.834, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Journal editor

Assistive Technology for People with Vision and Hearing Impairments
Period: 5 Sep 2010
Hans-Heinrich Bothe (Speaker)
Hearing Systems
Centre for Applied Hearing Research
Department of Electrical Engineering

Description
Audio-visual signal processing – analysis and synthesis of speaking heads

Place: Workshop on Assistive Technology for People with Vision and Hearing Impairments (EU-CWST project). Wroslaw, Poland

Related event
Assistive Technology for People with Vision and Hearing Impairments
05/09/2010 → …
Wroslaw, Poland
Activity: Talks and presentations › Conference presentations

International Development Trends within Smart Grid
Period: 30 Aug 2010
Jacob Østergaard (Invited speaker)
Seminar om Smart Grid - fremtidens intelligente elsystem
30/08/2010 → 30/08/2010
København, Denmark
Activity: Talks and presentations › Conference presentations

Lippenlesen im Dialog mit dem Computer
Period: 9 Aug 2010
Hans-Heinrich Bothe (Speaker)
Hearing Systems
Centre for Applied Hearing Research
Department of Electrical Engineering

Description
Place: Yearly meeting of the German Association for Hard-of-Hearing People (DSB) Hanover, Germany

Related external organisation
unknown external organisation
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations

ThinkingHead – eine dialogfähige Computeranimation, die für das Erlernen des Absehens eingesetzt werden kann
Period: 7 Feb 2010
Hans-Heinrich Bothe (Speaker)
Hearing Systems
Centre for Applied Hearing Research
Department of Electrical Engineering

Description
Place: IKT-Forum für Menschen mit Behinderungen: Praxis – Forschung – Entwicklung. Linz, Austria

Related event
IKT-Forum für Menschen mit Behinderungen: Praxis – Forschung – Entwicklung
08/07/2010 → 09/07/2010
Linz, Austria
Activity: Talks and presentations › Conference presentations

Modelling of power markets with large scale wind power
Period: 25 Jan 2010
Peter Meibom (Speaker)
Risø National Laboratory for Sustainable Energy
Intelligent Energy Systems Programme

Description
Place: Visit at Risø DTU by EPFL (CH)

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations
Journal of Medical Ultrasonics (External organisation)
Period: 1 Jan 2010 → …
Jens E. Wilhjelm (Participant)
Department of Electrical Engineering
Biomedical Engineering

Description
Editorial board (Overseas)
Degree of recognition: International

Related external organisation
Journal of Medical Ultrasonics
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Ultragarsas (External organisation)
Period: 1 Jan 2010 → …
Jens E. Wilhjelm (Participant)
Department of Electrical Engineering
Biomedical Engineering

Description
Member of editorial board

Body type: Scientific journal
Degree of recognition: International

Related external organisation
Ultragarsas
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

External examiner on PhD thesis by PhD student Jelena Haas-Christensen
Period: 2009
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Opponent på Doctoral Thesis af PhD-studerende Konstantin Kostov
Period: 2009
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Models for the dynamics of articulatory lip movements
Period: 5 Jul 2009
Hans-Heinrich Bothe (Speaker)
Department of Electrical Engineering
Hearing Systems
Centre for Applied Hearing Research

Description
Place: Assistive Technology for People with Sensory Impairments: A Hands-On Workshop during ICTA 09. Hammamet, Tunisia
**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Auditory neuroprostheses**
Period: 3 May 2009
Hans-Heinrich Bothe (Speaker)
Hearing Systems
Centre for Applied Hearing Research
Department of Electrical Engineering
Description
Place: Yearly meeting of the Audiological Society of Denmark. Copenhagen, Denmark
Degree of recognition: National

**Related event**

Yearly meeting of the Audiological Society of Denmark
03/05/2009 → …
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**International Congress of Ultrasonics (External organisation)**
Period: 1 Jan 2009 → …
Jens E. Wilhjelm (Participant)
Department of Electrical Engineering
Biomedical Engineering
Description
Member of the board
Degree of recognition: International

**Related external organisation**

International Congress of Ultrasonics
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**The Industrial PhD Programme Committee (External organisation)**
Period: 1 Jan 2009 → 31 Dec 2014
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control
Description
The Industrial PhD Programme Committee (IPPC) is appointed by The Danish Council for Technology and Innovation (DCTI). The committee has 25 members and can be supplemented with members appointed by the Minister.
Links:
http://www.erhvervsphd.dk

**Related external organisation**

The Industrial PhD Programme Committee
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**International Conference On Cognitive Systems**
Period: 2008
Silvia Tolu (Participant)
Description

Related event
International Conference On Cognitive Systems
02/01/2008 → …
Karlsruhe, Germany
Activity: Attending an event › Participating in or organising a conference

Member of the board of DIRA, Danish Industrial Robot Association (External organisation)
Period: 2008 → 2015
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control
Links:
http://www.dira.dk

Related external organisation
Member of the board of DIRA, Danish Industrial Robot Association
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Control Engineering Practice (Journal)
Period: Oct 2008 → …
Mogens Blanke (Reviewer)
Department of Electrical Engineering
Automation and Control
Description
Control Engineering Practice
Associate Editor

Related journal
Control Engineering Practice
0967-0661
Central database
Activity: Research › Journal editor

Moderne Hörhilfen - Auditorische Neuroprothesen
Hans-Heinrich Bothe (Speaker)
Department of Electrical Engineering
Acoustic Technology
Centre for Applied Hearing Research
Description
Place: Johannes-Kepler-Universität Linz, Austria
**Related external organisation**

**Unknown external organisation**  
Activity: Talks and presentations › Conference presentations

**Hearing-impaired, Deaf, and Deaf-blind People (External organisation)**  
Period: 1 Jul 2008  
Hans-Heinrich Bothe (Chairman)  
Department of Electrical Engineering  
Acoustic Technology  
Centre for Applied Hearing Research

**Description**  
Place: 11th Intern. Conf. ICCHP 2008. Linz, Austria

**Related external organisation**

**Hearing-impaired, Deaf, and Deaf-blind People**  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**IDA-Automation (External organisation)**  
Period: 2007 → …  
Anna Friesel (Participant)  
Center for Bachelor of Engineering Studies  
Center for Information Technology and Electronics  
Department of Electrical Engineering

**Description**  
I IDA Automation dækker vi området for automatiseringsteknik.  
Vi søger gennem videnudveksling på såvel nationalt som internationalt niveau at fremme grundlaget for en højere automatiseringsgrad på det produktionstekniske og administrative område.  
Derudover giver vi medlemmerne lejlighed til at holde sig a jour med og præge udviklingen på det automatiseringstekniske område gennem afholdelse af konferencer, foredrag, ekskursioner og studiekredse.

Body type: Ingeniørforening, Erhvervssagfagt forum  
Links:  

**Related external organisation**

**IDA-Automation**  
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**Seventh International Workshop on Information Processing in Cells and Tissues**  
Period: 2007  
Silvia Tolu (Speaker)  
Department of Electrical Engineering  
Automation and Control  
Centre for Playware

**Description**  

**Related event**

**Seventh International Workshop on Information Processing in Cells and Tissues**
IEEE Transactions on Aerospace and Electronic Systems (Journal)
Mogens Blanke (Editor)
Department of Electrical Engineering
Automation and Control

Description
Transactions on Aerospace and Electronic Systems

Technical Editor for Fault-tolerant Systems

Technical editor for Fault-tolerant Systems

Related journal
IEEE Transactions on Aerospace and Electronic Systems
0018-9251
Central database
Activity: Research › Journal editor

International Work Conference on Artificial Neural Networks
Period: Jun 2007
Silvia Tolu (Speaker)
Department of Electrical Engineering
Automation and Control
Centre for Playware

Description
Related event

9th International Work-Conference on Artificial Neural Networks
20/06/2007 → 22/06/2007
San Sebastián, Spain
Activity: Talks and presentations › Conference presentations

The world expedition Galathea 3 seen from Satellite Eye; EGU2007-ES3-1TH4O-001
Period: 1 Jan 2007 → …
Leif Toudal Pedersen (Speaker)
Department of Electrical Engineering
Electromagnetic Systems

Description
Place: Vienna, Austria

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

External examiner on PhD thesis by PhD student Flemming Nyboe
Period: 2006
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

The 2005 Eurosprite Observation Campaign
Period: 28 Aug 2006 → 1 Sep 2006
Thomas Højgaard Allin (Participant)
Department of Electrical Engineering
Measurement & Instrumentation

Related event

The 2005 Eurosprite Observation Campaign
28/08/2006 → 01/09/2006
33rd Annual European Meeting on Atmospheric Studies by Optical Methods, Kiruna, Sweden.
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Member of DTU Academic Council (External organisation)
Period: 2005 → 2011
Ole Ravn (Participant)
Department of Electrical Engineering
Automation and Control

Related external organisation

Member of DTU Academic Council
Activity: Membership › Membership of commitees, commissions, boards, councils, associations, organisations, or similar

Committee member at PhD defense by PhD student Bengt Johansson
Period: 12 Jan 2005
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Opponent on Doctoral Thesis by PhD student Vesa Toumainen
Period: Mar 2004
Michael A. E. Andersen (External examiner)
Department of Electrical Engineering
Electronics
Activity: Examinations and supervision › External examination

Fremtidig dansk deltagelse i udforskningen af Mars
Period: 18 Feb 2003
John Leif Jørgensen (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation
Description
Note: Præsentation i foredragsrækken i anledning af Eksperimentariums særudstilling “Rejsen til Mars”
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Fremtidig dansk deltagelse i udforskningen af Mars
Period: 18 Feb 2003
Fritz Primdahl (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation
Description
Note: Præsentation i foredragsrækken i anledning af Eksperimentariums særudstilling “Rejsen til Mars”
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Development Status of the MagNet Experiment
Period: 1 Jan 2003 → …
Fritz Primdahl (Participant)
Department of Electrical Engineering
Measurement & Instrumentation
Description
Development Status of the MagNet Experiment
Note: Presentation at the NetLander General Assembly, IPGP
Place: Paris, France
Related event
Development Status of the MagNet Experiment
01/01/2003 → …
Paris, France
**Space magnetometry**  
Period: 4 Nov 2002 → 8 Nov 2002  
Fritz Primdahl (Speaker)  
Department of Electrical Engineering  
Measurement & Instrumentation  

**Related external organisation**  
International Science School  
France  
Activity: Other

**Grønlands Indlandsis set med radarøjne: Dansk Naturvidenskabsfestival 2002**  
Period: 1 Oct 2002  
Johan Jacob Mohr (Speaker)  
Department of Electrical Engineering  

**Related external organisation**  
Unknown external organisation  
Activity: Talks and presentations › Conference presentations

**Fluxgate magnetometers**  
Period: 16 Sep 2002 → 18 Sep 2002  
Fritz Primdahl (Invited speaker)  
Measurement & Instrumentation  
Department of Electrical Engineering  

**Related external organisation**  
National Graduate School of Engineering & Research Center  
Caen, France  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**Center for Electrical Energy Systems (CEES) (External organisation)**  
Period: 2001 → …  
Michael A. E. Andersen (Participant)  
Department of Electrical Engineering  
Electronics  

**Description**  
Member of the Board

Body type: Erhvervsdrivende fond  
Links:  
http://www.kees.dk

**Related external organisation**  
Center for Electrical Energy Systems (CEES)  
Activity: Membership › Board duties in companies, associations, or public organisations

**The Ørsted satellite high-precision magnetic vector measurements**  
José M.G. Merayo (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

**Description**
Place: San Fransisco, USA

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**The Ørsted satellite high-precision magnetic vector measurements**
**Period:** 14 Dec 2000 → 19 Dec 2000
Fritz Primdahl (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

**Description**
Place: San Fransisco, USA

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**The Ørsted satellite high-precision magnetic vector measurements**
**Period:** 14 Dec 2000 → 19 Dec 2000
John Leif Jørgensen (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

**Description**
Place: San Fransisco, USA

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**The Ørsted satellite high-precision magnetic vector measurements**
**Period:** 14 Dec 2000 → 19 Dec 2000
Peter Brauer (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

**Description**
Place: San Fransisco, USA

**Related external organisation**

**Unknown external organisation**
Activity: Talks and presentations › Conference presentations

**Magnetiske felter i rummet**
**Period:** 28 Nov 2000
Fritz Primdahl (Participant)
Department of Electrical Engineering
Measurement & Instrumentation

Related external organisation
University of Odense
Activity: Other

Magnetiske felter i rummet
Period: 27 Sep 2000
Fritz Primdahl (Guest lecturer)
Measurement & Instrumentation
Department of Electrical Engineering

Description
Note: Lecture in connection with "Dansk Naturvidenskabsfestival"

Related external organisation
Høje-Taastrup Gymnasium
Fregård Alle 2, 2630, Taastrup, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Magnetiske felter i rummet
Period: 6 Jul 2000
Fritz Primdahl (Lecturer)
Measurement & Instrumentation
Department of Electrical Engineering

Description
Note: Lecture for high-school students attending "Kopernikursus 2000"

Related event
Kopernikursus 2000
02/07/2000 → 09/07/2000
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Period: 25 Apr 2000 → 28 Apr 2000
Fritz Primdahl (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

Description
Note: presented at General assembly of the European Geophysical Society
Place: Nice, France

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Statistics of the plasma domain observed by Astrid-2
Period: 25 Apr 2000 → 28 Apr 2000
Fritz Primdahl (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

Description
Note: Oral presentation at The general assembly of the European Geophysical Society
Place: Nice, France

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Verden set med mikrobølgeøjne: Ungdommens Naturvidenskabelige Forening (UNF)
Period: 1 Jan 2000
Johan Jacob Mohr (Speaker)
Department of Electrical Engineering

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

In-flight calibration methods used for the Ørsted mission
Period: 9 Mar 1999
Peter Brauer (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

Related event
In-flight calibration methods used for the Ørsted mission: workshop on calibration of space-borne magnetometers
09/03/1999 → 09/03/1999
Braunschweig, Germany
Activity: Talks and presentations › Conference presentations

In-flight calibration methods used for the Ørsted mission
Period: 9 Mar 1999
José M.G. Merayo (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

Related event

In-flight calibration methods used for the Ørsted mission: workshop on calibration of space-borne magnetometers
09/03/1999 → 09/03/1999
Braunschweig, Germany
Activity: Talks and presentations › Conference presentations

In-flight calibration methods used for the Ørsted mission
Period: 9 Mar 1999
Fritz Primdahl (Speaker)
Department of Electrical Engineering
Measurement & Instrumentation

Related event

In-flight calibration methods used for the Ørsted mission: workshop on calibration of space-borne magnetometers
09/03/1999 → 09/03/1999
Braunschweig, Germany
Activity: Talks and presentations › Conference presentations

Danish Energy Agency - Energy Research Program - EFP (External organisation)
Period: 1991 → 1992
Michael A. E. Andersen (Participant)
Department of Electrical Engineering
Electronics
Description
EFP - Energy Efficiency in Products and Industrial Processes

Related external organisation

Danish Energy Agency - Energy Research Program - EFP
Activity: Membership › Membership in review committee

ISO TC 43/WG 1: Threshold of hearing (External organisation)
Period: 1980 → …
Torben Poulsen (Participant)
Department of Electrical Engineering
Hearing Systems
Description
International Standardization Organization: Technical Committee 43, Acoustics, Working Group 1: Threshold of hearing
Degree of recognition: International

Related external organisation

ISO TC 43/WG 1: Threshold of hearing
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

ISO TC43/SC 1/WG 17: Methods of measurement of sound attenuation of hearing protectors (External organisation)
Period: 1975 → …
Torben Poulsen (Participant)
Department of Electrical Engineering
Hearing Systems
Degree of recognition: International

Related external organisation

ISO TC43/SC 1/WG 17: Methods of measurement of sound attenuation of hearing protectors
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Prizes:

2013 IEEE ECCE Asia Downunder First Prize Paper
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 3 Jun 2013
Granting Organisations: IEEE Power Electronics Society
Prize: Prizes, scholarships, distinctions

Academic Research Grant 2017
Theis Bo Rasmussen (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description
Recipient of the 2017 National Instrument Academic Research Grant for conference participation at FedCSIS 2017 in Prague, Czech Republic

Details
Awarded date: 2017
Granting Organisations: National Instruments
Prize: Prizes, scholarships, distinctions

AEG Elektronprisen
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 31 Aug 2004
Prize: Prizes, scholarships, distinctions

A. R. Angelo's Grant
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 1990
Granting Organisations: NESA A/S
Prize: Prizes, scholarships, distinctions

Best paper award
Ha Thi Nguyen (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description

Details
Awarded date: 27 Mar 2018
Degree of recognition: International
Granting Organisations: WASET (World Academic of Science, Engineering and Technology)
event: 20th International Conference on Power Systems and Energy Conversion
Prize: Prizes, scholarships, distinctions
Best Paper Award at International Conference on Intelligent Green Building and Smart Grid 2018
Zhe Zhang (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: Apr 2018
Degree of recognition: International
Prize: Prizes, scholarships, distinctions

Best Poster Prize UPEC '91
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 19 Sep 1991
Granting Organisations: Universities Power Engineering Conference
Prize: Prizes, scholarships, distinctions

Best Student E-Poster Award (First Prize)
Lin Fan (Recipient)
Department of Electrical Engineering, Electronics

Description
First Prize Award from IEEE PELS

Details
Awarded date: 4 Oct 2016
Degree of recognition: International
Granting Organisations: IEEE Power Electronics Society
event: 5th International Workshop on Power Supply On Chip
Prize: Prizes, scholarships, distinctions

Best Student Paper Award
Emil Krabbe Nielsen (Recipient)
Department of Electrical Engineering, Automation and Control

Details
Awarded date: 29 Nov 2017
Granting Organisations: Korean Nuclear Society
event: International Symposium on Future Instrumentation & Control for Nuclear Power Plants
Prize: Prizes, scholarships, distinctions

Best Trainee Presentation
Rie Beck Hansen (Recipient)
Department of Electrical Engineering, Center for Magnetic Resonance, Center for Hyperpolarization in Magnetic Resonance

Details
Awarded date: 18 Jun 2018
Prize: Prizes, scholarships, distinctions

Danish Akustisk Selskab Fonden Travel Grant
Alexander Weider King (Recipient)
Department of Electrical Engineering, Acoustic Technology

Details
Awarded date: 2015
Degree of recognition: National
Granting Organisations: Dansk Akustisk Selskab
Prize: Prizes, scholarships, distinctions
DTU Innovation Prize
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 28 Apr 2006
Prize: Prizes, scholarships, distinctions

EliteForsk-rejsestipendium
Rie Beck Hansen (Recipient)
Center for Hyperpolarization in Magnetic Resonance, Department of Electrical Engineering, Center for Magnetic Resonance

Details
Awarded date: 23 Feb 2017
Degree of recognition: National
Granting Organisations: Uddannelses- og Forskningsministeriet
Event: EliteForsk-konferencen
Prize: Prizes, scholarships, distinctions

First Prize UTRC Best Student Paper at ECCE 2013
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 15 Sep 2013
Granting Organisations: IEEE Power Electronics Society
Prize: Prizes, scholarships, distinctions

ISAAR scholarship
Helia Relano Iborra (Recipient)
Department of Electrical Engineering, Hearing Systems

Description
The ISAAR committee offers a limited number of scholarships to young scientists that would like to participate with a scientific contribution at an ISAAR symposium. The scholarship covers the symposium fee for full participation and accommodation. Travel expenses are not covered. The ISAAR scholarships are intended for young scientists (e.g., PhD-students, post-doctoral students, and others) working in Auditory and Audiological Research or related areas.

Details
Awarded date: 2017
Prize: Prizes, scholarships, distinctions

New Investigator Award for Basic Science
Tommaso di Ianni (Recipient)
Department of Electrical Engineering, Biomedical Engineering

Description
American Institute of Ultrasound in Medicine

Details
Awarded date: Mar 2017
Prize: Prizes, scholarships, distinctions

On the list of the 40 outstanding reviewers of IEEE Transactions on Power Systems for 2015
Jalal Kazempour (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets

Details
Awarded date: 2015
Prize: Prizes, scholarships, distinctions
On the list of the 47 outstanding reviewers of IEEE Transactions on Smart Grid for 2016
Jalal Kazempour (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets

Description
On the list of outstanding reviewers of IEEE Transactions on Smart Grid for 2016

Details
Awarded date: 2016
Prize: Prizes, scholarships, distinctions

On the list of the 8 outstanding editorial board members of International Transactions on Electrical Energy Systems (Wiley) for 2017
Jalal Kazempour (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets

Details
Awarded date: 2017
Prize: Prizes, scholarships, distinctions

Oticon Fonden Ph.D. Scholarship
Alexander Weider King (Recipient)
Department of Electrical Engineering, Acoustic Technology

Details
Awarded date: 2016
Degree of recognition: National
Granting Organisations: Oticon Fonden
Prize: Prizes, scholarships, distinctions

Otto Mønsteds Fond - Travel Grant
Florian Thams (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description
Financial Support of the External Research Stay

Details
Awarded date: 19 Nov 2016
Granting Organisations: Otto Mønsteds Fond
Prize: Prizes, scholarships, distinctions

Otto Mønsteds Fond - Travel Grant
Theis Bo Rasmussen (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description
Financial support for external stay at the University of New South Wales, Sydney, Australia

Details
Awarded date: 9 Oct 2017
Prize: Prizes, scholarships, distinctions

Otto Mønsteds Fond - Travel Grant
Jundi Jia (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Details
Awarded date: 12 Jul 2017
Granting Organisations: Otto Mønsteds Fond
Prize: Prizes, scholarships, distinctions
Outstanding Paper by a Young Presenter
A. Josefine Sørensen (Recipient)
Department of Electrical Engineering, Hearing Systems

Details
Awarded date: Nov 2016
Degree of recognition: International
Granting Organisations: Acoustical Society of America
event: 5th Joint Meeting of the Acoustical Society of America and Acoustical Society of Japan
Prize: Prizes, scholarships, distinctions

P. Gorm-Petersen's Memorial Grant
Michael A. E. Andersen (Recipient)
Department of Electrical Engineering, Electronics

Details
Awarded date: 1991
Granting Organisations: Technical University of Denmark
Prize: Prizes, scholarships, distinctions

Reinholdt W. Jorck og Hustrus Fond - Travel Grant
Florian Thams (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description
Financial Support of the External Research Stay

Details
Awarded date: 10 Nov 2016
Granting Organisations: Reinholdt W. Jorck og Hustrus Fond
Prize: Prizes, scholarships, distinctions

Student Travel Award
Andreu Paredes Gallardo (Recipient)
Department of Electrical Engineering, Hearing Systems

Description
Student Travel Award to attend the 2017 Conference on Implantable Auditory Prostheses (CIAP) at Granlibakken Conference center

Details
Awarded date: 16 Jul 2017
event: Conference on Implantable Auditory Prosthesis
Prize: Prizes, scholarships, distinctions

Travel grant
Theis Bo Rasmussen (Recipient)
Department of Electrical Engineering, Center for Electric Power and Energy, Electric Power Systems

Description
Recipient of Idella Foundation travel grant for external stay during PhD studies

Details
Awarded date: 2017
Granting Organisations: Foundation Idella
Prize: Prizes, scholarships, distinctions

Young Researcher Award 2016
A. Josefine Sørensen (Recipient), Lærke Cecilie Bjerre (Recipient) & Thea Mathilde Larsen (Recipient)
Department of Electrical Engineering, Hearing Systems
Details
Awarded date: 12 May 2016
Degree of recognition: National
Granting Organisations: Danish Sound Innovation Network
Event: Danish Sound Day
Prize: Prizes, scholarships, distinctions

Press clippings:

Europractice Activity Report 2016
Pere Llimos Muntal
01/05/2017

Description
Activity report from Europractice during 2016.

Subject
Integrated circuit design projects done using Europractice during 2016.
Department of Electrical Engineering, Electronics

Media contribution (1)

Europractice Activity Report 2016
01/05/2017
Denmark
Pere Llimos Muntal
Press / Media

Hvad gør jeg, hvis jeg taber min mobil i toilettet?
Ivan Harald Holger Jørgensen
11/03/2017

Description
Artikel om hvad man skal gøre hvis ens mobiltelefon tabes i vand.

Subject
Hvordan redder du egentlig mest effektivt din mobil fra at lide druknedøden, hvis du har tabt den i toilettet? Og hvad skal du gøre ved computeren, hvis du har hældt kaffe ned i den?
Department of Electrical Engineering, Electronics

Media contribution (1)

Hvad gør jeg, hvis jeg taber min mobil i toilettet?
11/03/2017
Videnskab.dk (National), Denmark, Web
http://videnskab.dk/kultur-samfund/hvad-goer-jeg-hvis-jeg-taber-min-mobil-i-toilettet
Ivan Harald Holger Jørgensen
Press / Media

Nye løsninger kan tage livet af den irriterende klods på ledningen
Michael A. E. Andersen
25/04/2016
Department of Electrical Engineering, Electronics

Media contribution (1)

Nye løsninger kan tage livet af den irriterende klods på ledningen
25/04/2016
Videnskab.dk, Web
Michael A. E. Andersen
Department of Electrical Engineering, Electronics
Press / Media
Mord på film: Batman
Alexander Weider King
30/03/2016

Description
Demonstrated and explained how sound can break glass.
Acoustic Technology, Department of Electrical Engineering

Media contribution (1)

Mord på film: Batman
30/03/2016
DR (National), Denmark, Television
Alexander Weider King
Department of Electrical Engineering, Acoustic Technology
Press / Media

New Universal Robots Driver Makes Manipulation Research Easier
Thomas Timm Andersen
09/02/2016
Automation and Control, Department of Electrical Engineering

Media contribution (1)

New Universal Robots Driver Makes Manipulation Research Easier
09/02/2016
ROS Spotlight, Web
Clearpath Robotics
http://www.clearpathrobotics.com/2016/02/new-universal-robots-driver-makes-manipulation-easier/
Thomas Timm Andersen
Automation and Control, Department of Electrical Engineering

Relations
Research outputs:
Optimizing the Universal Robots ROS driver.
Press / Media

CLEAN REVOLUTION: Denmark is striving to become the world's first carbon-neutral nation
Jacob Østergaard
27/11/2015

Description
Department of Electrical Engineering, Center for Electric Power and Energy

Media contribution (1)

CLEAN REVOLUTION: Denmark is striving to become the world's first carbon-neutral nation
27/11/2015
SCIENCE, Print
AAAS
http://www.sciencemag.org/content/350/6264/1020.full.pdf?sid=39146665-3dc4-4db7-b4ce-598adc0699cc
Article at sciencemag.org
Jacob Østergaard
Department of Electrical Engineering, Center for Electric Power and Energy

Relations
Projects:
EcoGrid EU - Large scale Smart Grids demonstration of real time market-based integration of DER and DR
Press / Media
Fremtiden er sammentænkte energiløsninger

Jacob Østergaard
15/11/2015

Subject

Danmark skal i fremtiden leve af at udvikle intelligente energiløsninger, som vi kan vise frem og eksportere til udlandet. Og vi er godt i gang allerede. Københavns Nordhavn er f.eks. blevet demonstrationsplatform for morgendagens energiløsninger.

Department of Electrical Engineering, Center for Electric Power and Energy

Media contribution (1)

Fremtiden er sammentænkte energiløsninger
15/11/2015
Jyllands-Posten, Print
Jacob Østergaard
Department of Electrical Engineering, Center for Electric Power and Energy

Press / Media

Go morgen P3

Ole Ravn
24/06/2015

Description

Talking about Terminator
Automation and Control, Department of Electrical Engineering

Media contribution (1)

Go morgen P3
24/06/2015
Radio
Ole Ravn
Department of Electrical Engineering, Automation and Control

Press / Media

Spådommen, der blev til lov: Gordon Moore forudså smartphones og iPads i 1965

Ivan Harald Holger Jørgensen
11/06/2015

Description

Article about Moore's Law
Department of Electrical Engineering, Electronics

Media contribution (1)

Spådommen, der blev til lov: Gordon Moore forudså smartphones og iPads i 1965
11/06/2015
Politiken.dk, Web
Ivan Harald Holger Jørgensen
Department of Electrical Engineering, Electronics

Press / Media

Tag iPad'en med hjem

Jari Due Jessen
23/04/2015
Automation and Control, Department of Electrical Engineering, Centre for Playware

Media contribution (1)

Tag iPad'en med hjem
23/04/2015
Børn og Unge, Print
Interview for theme in "Børn og Unge" about digital technology and programming in daycare.
Jari Due Jessen
Centre for Playware, Automation and Control, Department of Electrical Engineering

Spotlight on Denmark
Pierre Pinson
01/01/2015
Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets

Media contribution (1)

La France sans nucleaire, c'est possible!
Pierre Pinson
01/01/2015
Department of Electrical Engineering, Center for Electric Power and Energy, Energy Analytics and Markets

Media contribution (1)

Jacob Østergaard: From Smart Grids to Smart Energy
Jacob Østergaard
01/12/2014

Description
The rise of decentralized energy is shaping the future of energy markets worldwide. What does that mean for technological innovation – and for business? Danish Professor Jacob Østergaard has answers for both questions. Department of Electrical Engineering, Center for Electric Power and Energy

Media contribution (1)

Go morgen P3
Ole Ravn
28/10/2014
Automation and Control, Department of Electrical Engineering

Media contribution (1)
DR2 Morgen
Ole Ravn
24/10/2014

Subject
Robotter skal passe ebola-syne
Automation and Control, Department of Electrical Engineering

Media contribution (1)

DR2 Morgen
24/10/2014
DR2, Television
Ole Ravn
Department of Electrical Engineering, Automation and Control

P1 Morgen
Ole Ravn
24/10/2014

Description
For at mindske smittefaren ved den frygtede sygdom ebola skal robotter tages i brug for at behandele og pleje patienter, der er ramt af sygdommen. Det mener de amerikanske myndigheder, som nu sætter gang i møder med ledende amerikanske robotforskere. Men hvad kan robotter hjælpe med - og hvilken effekt vil en ren maskinel behandling have på patienterne? Medvirkende: Ole Ravn, robotforsker, Danmarks Tekniske Universitet

Subject
USA vil bruge bedemands-robotter i kampen mod ebola
Automation and Control, Department of Electrical Engineering

Media contribution (1)

Nørderne kommer
Sébastien Santurette
17/05/2014

Description
Interview on singers' vibrato for DR P2
Hearing Systems, Department of Electrical Engineering

Media contribution (1)
**Børn koder robotter: Coding Pirates**  
Jari Due Jessen  
20/03/2014  
Automation and Control, Centre for Playware, Department of Electrical Engineering

**Media contribution (1)**

**Børn koder robotter: Coding Pirates**  
20/03/2014  
TV2 Lorry, Print  
Michael Olsson  
Jari Due Jessen  
Department of Electrical Engineering, Automation and Control, Centre for Playware  
Press / Media

**Microprocessoren er ved at løbe tør for atomer**  
Ivan Harald Holger Jørgensen  
17/01/2014

**Description**  
Interview about Moore's law and IC processes.  
Department of Electrical Engineering, Electronics

**Media contribution (1)**

**Microprocessoren er ved at løbe tør for atomer**  
17/01/2014  
Ingeniøren, Print  
Ivan Harald Holger Jørgensen  
Department of Electrical Engineering, Electronics  
Press / Media

**Derfor er det smart at dreje batterierne i fjernbetjeningen**  
Ole Ravn  
16/01/2014  
Automation and Control, Department of Electrical Engineering

**Media contribution (1)**

**Derfor er det smart at dreje batterierne i fjernbetjeningen**  
16/01/2014  
Jyllands-Posten, Web  
http://jyllands-posten.dk/nyviden/ECE6409958/derfor-er-det-smart-at-dreje-batterierne-i-fjernbetjeningen/  
Ole Ravn  
Department of Electrical Engineering, Automation and Control  
Press / Media

**DR2 Dagen**  
Ole Ravn  
18/12/2013  
Automation and Control, Department of Electrical Engineering

**Media contribution (1)**

**DR2 Dagen**  
18/12/2013  
DR2, Television  
Ole Ravn  
Department of Electrical Engineering, Automation and Control  
Press / Media
Automatiske dræber-robotter møder kritik
Ole Ravn
31/05/2013
Automation and Control, Department of Electrical Engineering

Automatiske dræber-robotter møder kritik
31/05/2013
TV2 News, Television
http://nyhederne.tv2.dk/article.php/id-69000609:tv-automatiske-dr%C3%A6berrobotter-m%C3%B8der-kritik.html
Ole Ravn
Department of Electrical Engineering, Automation and Control

Aftenshowet
Ole Ravn
11/04/2013
Automation and Control, Department of Electrical Engineering

Magnetopolerne flytter sig
Fritz Primdahl
23/09/2002
Measurement & Instrumentation, Department of Electrical Engineering

Magnetopolerne flytter sig
23/09/2002
Radio
Fritz Primdahl
Department of Electrical Engineering, Measurement & Instrumentation