Aberrant intestinal microbiota in individuals with prediabetes

Aims/hypothesis: Individuals with type 2 diabetes have aberrant intestinal microbiota. However, recent studies suggest that metformin alters the composition and functional potential of gut microbiota, thereby interfering with the diabetes-related microbial signatures. We tested whether specific gut microbiota profiles are associated with prediabetes (defined as fasting plasma glucose of 6.1–7.0 mmol/l or HbA1c of 42–48 mmol/mol [6.0–6.5%]) and a range of clinical biomarkers of poor metabolic health. Methods: In the present case–control study, we analysed the gut microbiota of 134 Danish adults with prediabetes, overweight, insulin resistance, dyslipidaemia and low-grade inflammation and 134 age- and sex-matched individuals with normal glucose regulation. Results: We found that five bacterial genera and 36 operational taxonomic units (OTUs) were differentially abundant between individuals with prediabetes and those with normal glucose regulation. At the genus level, the abundance of Clostridium was decreased (mean log2 fold change −0.64 (SEM 0.23), padj = 0.0497), whereas the abundances of Dorea, Ruminococcus, Sutterella and Streptococcus were increased (mean log2 fold change 0.51 (SEM 0.12), 0.51 (SEM 0.11), 0.60 (SEM 0.21), padj = 0.0497; and 0.92 (SEM 0.21), padj = 4 × 10−4, respectively). The two OTUs that differed the most were a member of the order Clostridiales (OTU 146564) and Akkermansia muciniphila, which both displayed lower abundance among individuals with prediabetes (mean log2 fold change −1.74 (SEM 0.41), padj = 2 × 10−3 and −1.65 (SEM 0.34), padj = 4 × 10−4, respectively). Faecal transfer from donors with prediabetes or screen-detected, drug-naive type 2 diabetes to germfree Swiss Webster or conventional C57BL/6 J mice did not induce impaired glucose regulation in recipient mice. Conclusions/interpretation: Collectively, our data show that individuals with prediabetes have aberrant intestinal microbiota characterised by a decreased abundance of the genus Clostridium and the mucin-degrading bacterium A. muciniphila. Our findings are comparable to observations in overt chronic diseases characterised by low-grade inflammation.
Akkermansia muciniphila, Clostridium, Faecal transfer, Gut microbiota, Hyperglycaemia, Intestinal microbiota, Low-grade inflammation, Prediabetes

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Fast and stable gratings inscription in POFs made of different materials with pulsed 248 nm KrF laser

This paper presents fiber Bragg grating (FBG) inscription with a pulsed 248 nm UV KrF laser in polymer optical fibers (POFs) made of different polymers, namely polymethyl methacrylate (PMMA), cyclic-olefin polymer and co-polymer, and Polycarbonate. The inscribed gratings and the corresponding inscription parameters are compared with grating inscribed in POFs made of the aforementioned materials but with the hitherto most used laser for inscription, which is a continuous wave 325 nm UV HeCd laser. Results show a reduction of the inscription time of at least 16 times. The maximum time reduction is more than 130 times. In addition, a reflectivity and a bandwidth close to or higher than the ones with the 325 nm laser were obtained. The polymer optical fiber Bragg gratings (POFBGs) inscribed with the 248 nm laser setup present high stability with small variations in their central wavelength, bandwidth, and reflectivity after 40 days.
Activation energy of time-dependent martensite formation in steel

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Villa, M. (Intern), Somers, M. A. J. (Intern)
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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.

General information
State: Published
Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering, Solid Mechanics, KU Leuven, Oticon A/S
Authors: Creixell Mediante, E. (Intern), Jensen, J. S. (Intern), Naets, F. (Ekstern), Brunskog, J. (Intern), Larsen, M. (Ekstern)
Pages: 208–223
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Web of Science (2018): Indexed yes
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.09 SJR 1.462 SNIP 2.162
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.391 SNIP 2.142 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.447 SNIP 2.38 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 2.992 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.441 SNIP 2.698 CiteScore 2.05
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.218 SNIP 2.069
A homogenization method for ductile-brittle composite laminates at large deformations

This paper presents a high fidelity homogenization method for periodically layered composite structures that accounts for plasticity in the matrix material and quasi-brittle damage in the reinforcing layers, combined with strong geometrical nonlinearities. A set of deliberately chosen internal kinematic variables results in a rigorous representation of the kinematics of the two constituents, which in turn allows for complex constitutive laws per constituent to be employed directly in the formulation. The model accounts for hyper-elastoplastic behavior in the matrix phase and hyper-elastic behavior in the reinforcement as well as for the bending stiffness of the reinforcement layers. Additionally to previously proposed models, the present method includes Lemaitre type damage for the reinforcement, making it applicable to a wider range of engineering applications. The capability of the proposed method in representing the combined effect of plasticity, damage and buckling at microlevel within a homogenized setting is demonstrated by means of direct comparisons to a reference discrete model.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Poulios, K. (Intern), Niordson, C. F. (Intern)
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Publication date: 2018
Main Research Area: Technical/natural sciences

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Volume: 113
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An experimental and numerical study of floating breakwaters

Abstract Breakwaters are used to provide sheltered areas for loading and unloading of ships, and coastal protection. Often the breakwaters are bottom mounted such as rubble mound breakwaters. However, there can be several advantages to use a Floating Breakwater (FB). Therefore, the objective of this paper is to study the effect of two different damping mechanisms of a floating breakwater. Three basic cross-sections of FBs were tested and analysed in 2D; a regular pontoon (RG), a regular pontoon with wing plates attached (WP), and a regular pontoon with wing plates and porous media attached to the sides (WP P100). The damping of the FB motions was due to wave radiation and viscous damping. The viscous damping originated mainly from vortex generation around the edges of the structure and due to energy loss inside the porous material attached to the vertical sides of the floating breakwater. Attaching wing plates to the floating breakwater significantly reduced the motion, which was also anticipated. When the porous sides were attached the motion of the FB increased compared to the (WP) cross-section, but the wave transmission was reduced. The possibility for incorporating the effect of the damping in the radiation/diffraction code WAMIT was assessed. The study showed that the cross section with wing plates reduced the motions of the breakwater to the largest extend, while the cross section with wing plates and porous media attached to the sides reduced the reflection and transmission most effectively.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Sweco Denmark Inc., COWI A/S
Authors: Christensen, E. D. (Intern), Bingham, H. B. (Intern), Skou Friis, A. P. (Ekstern), Larsen, A. K. (Ekstern), Jensen, K. L. (Intern)
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.44 SJR 1.98 SNIP 2.252
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.925 SNIP 2.097 CiteScore 2.9
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.785 SNIP 2.123 CiteScore 2.55
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.727 SNIP 2.264 CiteScore 2.58
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.912 SNIP 2.226 CiteScore 2.21
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.616 SNIP 2.502 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.898 SNIP 2.332
Web of Science (2010): Indexed yes
A novel numerical framework for self-similarity in plasticity: Wedge indentation in single crystals

A novel numerical framework for analyzing self-similar problems in plasticity is developed and demonstrated. Self-similar problems of this kind include processes such as stationary cracks, void growth, indentation etc. The proposed technique offers a simple and efficient method for handling this class of complex problems by avoiding issues related to traditional Lagrangian procedures. Moreover, the proposed technique allows for focusing the mesh in the region of interest. In the present paper, the technique is exploited to analyze the well-known wedge indentation problem of an elastic-viscoplastic single crystal. However, the framework may be readily adapted to any constitutive law of interest. The main focus herein is the development of the self-similar framework, while the indentation study serves primarily as verification of the technique by comparing to existing numerical and analytical studies. In this study, the three most common metal crystal structures will be investigated, namely the face-centered cubic (FCC), body-centered cubic (BCC), and hexagonal close packed (HCP) crystal structures, where the stress and slip rate fields around the moving contact point singularity are presented.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Columbia University
Authors: Juul, K. J. (Intern), Niordson, C. F. (Intern), Nielsen, K. L. (Intern), Kysar, J. W. (Ekstern)
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Journal: Journal of the Mechanics and Physics of Solids
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A "poor man's approach" to topology optimization of cooling channels based on a Darcy flow model

A topology optimization methodology for optimizing cooling channels using an approximate but low-cost flow and heat transfer model is presented. The fluid flow is modeled using the Darcy model, which is a linear problem that can be solved
very efficiently compared to the Navier–Stokes equations. The obtained fluid velocity is subsequently used in a stabilized convection–diffusion heat transfer model to calculate the temperature distribution. The governing equations are cast in a monolithic form such that both the solid and fluid can be modeled using a single equation set. The material properties: permeability, conductivity, density and specific heat capacity are interpolated using the Solid Isotropic Material with Penalization (SIMP) scheme. Manufacturable cooling-channel designs with clear topologies are obtained with the help of a pressure drop constraint and a geometric length-scale constraint. Several numerical examples demonstrate the applicability of this approach. Verification studies with a full turbulence model show that, although the equivalent model has limitations in yielding a perfect realistic velocity field, it generally provides well-performing cooling channel designs.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Dalian University of Technology, Shanghai Jiao Tong University
Authors: Zhao, X. (Ekstern), Zhou, M. (Ekstern), Sigmund, O. (Intern), Andreasen, C. S. (Intern)
Pages: 1108-1123
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 3.75 SJR 1.623 SNIP 2.005
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.797 SNIP 1.941 CiteScore 3.09
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.624 SNIP 2.008 CiteScore 2.97
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.868 SNIP 2.164 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.688 SNIP 2.17 CiteScore 2.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.085 SNIP 1.978 CiteScore 3.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.647 SNIP 2.12
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.712 SNIP 2.123
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.579 SNIP 1.957
Scopus rating (2007): SJR 1.76 SNIP 1.949
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.809 SNIP 1.962
Scopus rating (2005): SJR 1.818 SNIP 1.885
Scopus rating (2004): SJR 1.266 SNIP 1.918
A Preliminary Study to Enhance the Tribological Performance of CoCrMo Alloy by Fibre Laser Remelting for Articular Joint Implant Applications

CoCrMo alloy has long been used as a pairing femoral head material for articular joint implant applications because of its biocompatibility and reliable tribological performance. However, friction and wear issues are still present for CoCrMo (metal)/CoCrMo (metal) or CoCrMo (metal)/ultrahigh molecular weight polyethylene (UHMWPE) (plastic) pairs in clinical observations. The particulate wear debris generated from the worn surfaces of CoCrMo or UHMWPE can pose a severe threat to human tissues, eventually resulting in the failure of implants and the need for revision surgeries. As a result, a further improvement in tribological properties of this alloy is still needed, and it is of great interest to both the implant manufacturers and clinical surgeons. In this study, the surface of CoCrMo alloy was laser-treated by a fibre laser system in an open-air condition (i.e., no gas chamber required). The CoCrMo surfaces before and after laser remelting were analysed and characterised by a range of mechanical tests (i.e., surface roughness measurement and Vickers micro-hardness test) and microstructural analysis (i.e., XRD phase detection). The tribological properties were assessed by pin-on-disk tribometry and dynamic light scattering (DLS). Our results indicate that the laser-treated surfaces demonstrated a friction-reducing effect for all the tribopairs (i.e., CoCrMo against CoCrMo and CoCrMo against UHMWPE) and enhanced wear resistance for the CoCrMo/CoCrMo pair. Such beneficial effects are chiefly attributable to the presence of the laser-formed hard coating on the surface. Laser remelting possesses several competitive advantages of being a clean, non-contact, fast, highly accurate and automated process compared to other surface coating methods. The promising results of this study point to the possibility that laser remelting can be a practical and effective surface modification technique to further improve the tribological performance of CoCr-based orthopaedic implants.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Queen's University Belfast, University of Chester
Authors: Chan, C. (Ekstern), Smith, G. (Ekstern), Lee, S. (Intern)
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A regularization method for solving the Poisson equation for mixed unbounded-periodic domains

Abstract Regularized Green's functions for mixed unbounded-periodic domains are derived. The regularization of the Green's function removes its singularity by introducing a regularization radius which is related to the discretization length and hence imposes a minimum resolved scale. In this way the regularized unbounded-periodic Green's functions can be implemented in an FFT-based Poisson solver to obtain a convergence rate corresponding to the regularization order of the Green's function. The high order is achieved without any additional computational cost from the conventional FFT-based Poisson solver and enables the calculation of the derivative of the solution to the same high order by direct spectral differentiation. We illustrate an application of the FFT-based Poisson solver by using it with a vortex particle mesh method for the approximation of incompressible flow for a problem with a single periodic and two unbounded directions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Spietz, H. J. (Intern), Mølholm Hejlesen, M. (Intern), Walther, J. H. (Intern)
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.12 SJR 2.034 SNIP 1.822
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 2.098 SNIP 1.988 CiteScore 2.92
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.166 SNIP 2.193 CiteScore 3.12
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.227 SNIP 2.45 CiteScore 3.3
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.161 SNIP 2.052 CiteScore 2.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.06 SNIP 2.194 CiteScore 2.99
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.185 SNIP 2.096
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.439 SNIP 2.219
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
A systematic comparison of on-axis and off-axis transmission Kikuchi diffraction

Abstract The capabilities of the novel on-axis transmission Kikuchi diffraction (TKD) technique were explored in a systematic comparison with conventional off-axis TKD. The effect of experimental parameters on the appearance of on-axis and off-axis Kikuchi patterns was measured and discussed. In contrast to off-axis TKD, on-axis TKD is more sensitive to changes in beam current and beam energy and less sensitive to changes in working distance and detector distance. Moreover, on-axis TKD has a distinct advantage over off-axis TKD due to enhanced pattern intensity, which allows reduction of the beam current or an increase in the acquisition rate. The physical and effective spatial resolution were measured with detector-typical parameters. Even though the spatial resolution of both configurations did not differ significantly under test conditions, on-axis TKD enables measurement over large areas with the determined resolution, whereas off-axis TKD is more sensitive to beam drift. Band detection by the Hough-transform led to indexing of, on average, one additional Kikuchi band when measuring with on-axis TKD compared to off-axis TKD and operated more stable on on-axis patterns.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Center for Electron Nanoscopy
Authors: Niessen, F. (Intern), Burrows, A. (Intern), Fanta, A. B. D. S. (Intern)
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Web of Science (2018): Indexed yes
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.82 SJR 1.915 SNIP 1.233
Web of Science (2016): Indexed yes
Low-carbon martensitic stainless steels with 11.5–16 wt-% Cr and < 0.07 wt-% C are characterised by high corrosion resistance, strength, ductility and impact toughness, obtained by formation of fine-grained reverted austenite from lath martensite upon inter-critical annealing. The review treats the mechanisms governing the formation and stabilisation of reverted austenite and is assisted by the computation of phase equilibria. Literature data on Cr and Ni concentrations of the reverted austenite/martensite dual-phase microstructure are assessed with respect to predicted concentrations.

Reasonable agreement was found for concentrations in martensite. Systematic excess of Cr in austenite of approx. 2 wt-%
relative to calculations was suspected to originate from the growth of M23C6 with a coherent interface to austenite. Within large scatter, measured values of Ni in austenite were on average 2 wt-% below predictions. Complex equilibration of the microstructure and experimental error are discussed as possible origins of the discrepancies.
Oxidation of Ni₂Al₃ produced by pack aluminizing of pure nickel was studied with and without 0.10 mg cm⁻² KCl(s) deposit in an environment containing 5% O₂, 40% H₂O and 55% N₂ at 600 °C for up to 168 h. Oxide microstructure and composition was investigated by SEM/EDX, BIB, TEM and GDOES. Oxidised Ni₂Al₃ shows minimal weight gain, while adding KCl results in a small weight loss consistent with evaporation of KCl. On the surface of samples exposed to the gas environment only, a 30 nm oxide of Al oxide was present, but where KCl was present as deposit, 50–250 nm thick nodules form that are enriched in K, O and Al.

**Characterization of pack cemented Ni₂Al₃ coating exposed to KCl(s) induced corrosion at 600 °C**

Oxidation of Ni₂Al₃ produced by pack aluminizing of pure nickel was studied with and without 0.10 mg cm⁻² KCl(s) deposit in an environment containing 5% O₂, 40% H₂O and 55% N₂ at 600 °C for up to 168 h. Oxide microstructure and composition was investigated by SEM/EDX, BIB, TEM and GDOES. Oxidised Ni₂Al₃ shows minimal weight gain, while adding KCl results in a small weight loss consistent with evaporation of KCl. On the surface of samples exposed to the gas environment only, a 30 nm oxide of Al oxide was present, but where KCl was present as deposit, 50–250 nm thick nodules form that are enriched in K, O and Al.
Component level study of an actively lubricated LEG Tilting Pad Bearing: Theory and experiment

This article constitutes the second step in a research effort aiming at evaluating the feasibility of introducing active characteristics into standard leading edge groove (LEG) tilting pad journal bearings. The strategy proposed is to control the LEG inlet flow using a servovalve. This work portrays the first experimental study for the "proof of concept" of this configuration, as well as a comparison with theoretical results. A simplified setup, featuring a rigid rotor supported by a single pad arrangement is the subject of study. The obtained results prove the viability of the proposed active bearing design, validate the available simulation tool and exemplify on a conceptual level the operational benefits from introducing this technology into standard LEG Tilting Pad Bearings.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Cerda Varela, A. J. (Intern), Santos, I. F. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Compressed collagen constructs with optimized mechanical properties and cell interactions for tissue engineering applications

In this study, we are introducing a simple, fast and reliable add-in to the technique of plastic compression (PC) to obtain collagen sheets with decreased fibrillar densities, representing improved cell-interactions and mechanical properties. Collagen hydrogels with different initial concentrations (1.64mg/mL-0.41mg/mL) were compressed around an electrospun sheet of PLGA. The scaffolds were then studied as non-seeded, or seeded with 3T3 fibroblast cells and cultured for 7 days. Confocal microscopy and TEM imaging of non-seeded scaffolds showed that by decreasing the share of collagen in the hydrogel formula, collagen sheets with similar thickness but lower fibrous densities were achieved. Nanomechanical characterization of compressed collagen sheets by AFM showed that Young's modulus was inversely proportional to the final concentration of collagen. Similarly, according to SEM, MTS, and cell nuclei counting, all the scaffolds supported cell adhesion and proliferation, whilst the highest metabolic activities and proliferation were seen in the scaffolds with lowest collagen content in hydrogel formula. We conclude that by decreasing the collagen content in the formula of collagen
hydrogel for plastic compression, not only a better cell environment and optimum mechanical properties are achieved, but also the application costs of this biopolymer is reduced.

**General information**
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering, Isfahan University of Technology, Karolinska Institutet
Authors: Ajalloueian, F. (Intern), Nikogeorgos, N. (Intern), Ajalloueian, A. (Ekstern), Fossum, M. (Ekstern), Lee, S. (Intern), Chronakis, I. S. (Intern)
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.872 SNIP 1.288
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.815 SNIP 1.316 CiteScore 3.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.861 SNIP 1.325 CiteScore 3.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.849 SNIP 1.452 CiteScore 3.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.796 SNIP 1.313 CiteScore 2.77
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.689 SNIP 1.21 CiteScore 2.73
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.865 SNIP 1.211
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.799 SNIP 1.189
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.749 SNIP 0.98
Scopus rating (2007): SJR 0.627 SNIP 1.001
Scopus rating (2006): SJR 0.51 SNIP 0.806
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.564 SNIP 1.179
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.587 SNIP 0.929
Scopus rating (2003): SJR 0.527 SNIP 0.993
Web of Science (2003): Indexed yes
Hydrodynamic and aerodynamic lubrication regimes in their controllable forms have been intensively investigated over the last two decades. With the aim of reducing friction and improving thermal, static, and dynamic characteristics of radial sliding bearings, different types of electro-mechanical actuators have been coupled to such bearings. Depending on (i) the actuator type; (ii) the actuation principle, i.e., hydraulic, pneumatic, piezoelectric or magnetic among others; and (iii) how such an actuator is coupled to the sliding bearings, different regulation and control actions of fluid film pressure and lubricant flow can be obtained. The most common actions are: (a) the control of the injection pressure to modify the fluid film pressure statically as well as dynamically; (b) the adjustment of the angle and direction of injection flow (mostly passive action); (c) the control of the sliding bearing gap and its preload via moveable and compliant sliding surfaces; and (d) the control of the lubricant viscosity. All four parameters, i.e., pressure, flow (velocity profiles), gap and viscosity, are explicit parameters in the modified form of Reynolds’ equations for active lubrication. In this framework, this paper gives one main original contribution to the state-of-the-art of radial sliding bearings and controllable lubrication: a comprehensive overview about the different types of controllable sliding bearings and principles used by several authors. The paper ends with some conclusive remarks about advantages and drawbacks of the different design solutions for controllable sliding bearings and the main challenges to be overcome towards industrial applications.

Damping analysis of cylindrical composite structures with enhanced viscoelastic properties
Constrained layer damping treatments are widely used in mechanical structures to damp acoustic noise and mechanical vibrations. A viscoelastic layer is thereby applied to a structure and covered by a stiff constraining layer. When the structure vibrates in a bending mode, the viscoelastic layer is forced to deform in shear mode. Thus, the vibration energy is dissipated as low grade frictional heat. This paper documents the efficiency of passive constrained layer damping
treatments for low frequency vibrations of cylindrical composite specimens made of glass fibre-reinforced plastics. Different cross section geometries with shear webs have been investigated in order to study a beneficial effect on the damping characteristics of the cylinder. The viscoelastic damping layers are placed at different locations within the composite cylinder e.g. circumferential and along the neutral plane to evaluate the location-dependent efficiency of constrained layer damping treatments. The results of the study provide a thorough understanding of constrained layer damping treatments and an improved damping design of the cylindrical composite structure. The highest damping is achieved when placing the damping layer in the neutral plane perpendicular to the bending load. The results are based on free decay tests of the composite structure.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, Ghent University, Technische Universität Dresden, Leichtbau-Zentrum Sachsen GmbH, Ecole Polytechnique de Montreal
Authors: Kliem, M. (Intern), Høgsberg, J. B. (Intern), Vanwalleghem, J. (Ekstern), Filippatos, A. (Ekstern), Hoschützky, S. (Ekstern), Fotsing, E. (Ekstern), Berggreen, C. (Intern)
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BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.49 SJR 0.554 SNIP 1.104
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.661 SNIP 1.225 CiteScore 1.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.788 SNIP 1.186 CiteScore 1.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.709 SNIP 1.878 CiteScore 1.44
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.513 SNIP 1.147 CiteScore 0.92
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.448 SNIP 1.292 CiteScore 1.02
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.613 SNIP 1.268
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.59 SNIP 1.423
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.652 SNIP 1.43
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.399 SNIP 0.658
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.358 SNIP 0.809
Web of Science (2006): Indexed yes
Damping properties of non-conductive composite materials for applications in power transmission pylons

This study aims to characterize the fibre direction dependent damping properties of non-conductive composite materials to be used in newly designed electrical power transmission pylons, on which the conducting cables will be directly connected. Thus, the composite structure can be designed both to insulate and to act as a damper to avoid, for example, conductor line galloping. In order to predict the damping of the composite materials, a comprehensive analysis on a representative unidirectional laminate was carried out. The fibre direction dependent damping analysis of glass andaramid reinforced epoxy and vinylester, partly reinforced with nanoclay or fibre-hybridized, was investigated using a Dynamic Mechanical Thermal Analysis and a Vibrating Beam Testing procedure for five different fibre orientations (0°, 30°, 45°, 60°, and 90°). The focus was on damping behaviour evaluation at low temperatures (-20°C and 0°C) and low vibration frequencies (0.5 Hz, 1 Hz and 2 Hz), in order to represent the environmental conditions of vibrating conductor lines during. The prediction of the damping behaviour for coupon-level specimens with three balanced laminates was successfully carried out with a maximal deviation of maximal 12.1%.

General information

State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Physics, Neutrons and X-rays for Materials Physics, Hochschule für Technik
Authors: Kliem, M. (Intern), Rüppel, M. (Ekstern), Høgsberg, J. (Intern), Berggreen, C. (Intern), Baier, S. (Intern)
Number of pages: 19
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Main Research Area: Technical/natural sciences

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Journal: Journal of Composite Materials
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.42 SJR 0.517 SNIP 0.781
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.586 SNIP 0.88 CiteScore 1.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.606 SNIP 1.183 CiteScore 1.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.624 SNIP 1.207 CiteScore 1.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.607 SNIP 1.26 CiteScore 1.21
Design and analysis of a waste gasification energy system with solid oxide fuel cells and absorption chillers

Energy saving is an open point in most European countries where energy policies are oriented to reduce the use of fossil fuels, greenhouses emissions and energy independence, and to increase the use of renewable energies. In the last several years, new technologies have been developed and some of them received subsidies to increase installation and reduce cost. This article presents a new sustainable trigeneration system (power, heat and cool) based on a solid oxide fuel cell (SOFC) system integrated with an absorption chiller for special applications such as hotels, resorts, hospitals, etc. with a focus on plant design and performance. The proposal system is based on the idea of gasifying the municipal waste, producing syngas serving as fuel for the trigeneration system. Such advanced system when improved is thus self-sustainable without dependency on net grid, district heating and district cooling. Other advantage of such waste to energy system is waste management, less disposal to sanitary landfills, saving large municipal fields for other human activity and considerable less environmental impact. Although plant electrical efficiency of such system is not significant but fuel utilization factor along with free fuel, significant less pollutant emissions and self-sustainability are importance points of the proposed system. It is shown that the energy efficiency of such small tri-generation system is more than 83% with net power of 170 kW and district energy of about 250 kW.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Rokni, M. (Intern)
Pages: 5922-5938
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Main Research Area: Technical/natural sciences

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ISSN (Print): 0360-3199
Ratings:
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Web of Science (2018): Indexed yes
Design for manufacturability of macro and micro products: a case study of heat exchanger design

In this paper, a novel methodology in designing a micro heat exchanger is proposed by modifying a conventional design methodology for macro products with the considerations of differences between design of a micro and a macro product.
The methodology starts with the identification of differences in design considerations for micro scale products compared to the macro scale. These design considerations consist of material selection, manufacturing process, physical phenomena and shape and geometry design. Manufacturability criteria are defined and various potential manufacturing processes for fabricating micro heat exchangers are ranked based on the defined criteria. Following the design methodology, primary design ideas for micro heat exchangers are generated according to the heat transfer principles for macro heat exchangers. Taking micro design considerations into account, the designs from next iteration are created. Finally, the performances of the designs for micro heat exchangers are compared with their macro counterparts. The most appropriate designs for micro heat exchangers are finalized. The micro specific design guidelines obtained by the designer through evaluating the modeling results and the design criteria are formulated in a knowledge-based unit called “Rules To Consider” (RTC). The proposed methodology provides an interactive design process through the RTC unit. The RTC data is used by the designer in the subsequent iterations of the micro-product design as well as can be used by designers/engineers in design of the same category of micro products. Furthermore, through utilization of the proposed methodology by designers/engineers for design of other micro products, the RTC unit can be enriched with micro-oriented design principles and accordingly provide a basic guideline for design of micro products.

General information
State: Accepted/In press
Organisations: Manufacturing Engineering, Department of Mechanical Engineering, Department of Wind Energy, Wind Turbine Structures and Component Design, Engineering Design and Product Development, National University of Singapore
Authors: Omidvarnia, F. (Intern), Weng Feng, L. (Ekstern), Hansen, H. N. (Intern), Sarhadi, A. (Intern), Lenau, T. A. (Intern), Mortensen, N. H. (Intern)
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Journal: International Journal on Interactive Design and Manufacturing
ISSN (Print): 1955-2505
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Web of Science (2018): Indexed yes
Scopus rating (2016): CiteScore 1.15
Scopus rating (2015): CiteScore 0.71
Scopus rating (2014): CiteScore 0.83
Scopus rating (2013): CiteScore 0.88
Scopus rating (2012): CiteScore 0.72
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Original language: English
Design methodology, Design for manufacturing, Micro manufacturing, Size effect, Heat exchanger
DOIs: 10.1007/s12008-018-0457-9
Source: PublicationPreSubmission
Source-ID: 143697448
Publication: Research - peer-review › Journal article – Annual report year: 2018

Design of passive coolers for light-emitting diode lamps using topology optimisation
Topology optimised designs for passive cooling of light-emitting diode (LED) lamps are investigated through extensive numerical parameter studies. The designs are optimised for either horizontal or vertical orientations and are compared to a lattice-fin design as well as a simple parameter optimised commercial pin fin design. The different orientations result in significant differences in topologies. The optimisation favours placing material at outer boundaries of the design domain, leaving a hollow core that allows the buoyancy forces to accelerate the air to higher speeds. Investigations show that increasing design symmetry yields performance with less sensitivity to orientation with a minor loss in mean performance. The topology-optimised designs of heat sinks for natural convection yield a 26% lower package temperature using around 12% less material compared to the lattice-fin design, while maintaining low sensitivity to orientation. Furthermore, they exhibit several defining features and provide insight and general guidelines for the design of passive coolers for LED lamps.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Alexandersen, J. (Intern), Sigmund, O. (Intern), Meyer, K. E. (Intern), Lazarov, B. S. (Intern)
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BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 1  
Scopus rating (2016): CiteScore 3.75 SJR 1.623 SNIP 2.005  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 1.797 SNIP 1.941 CiteScore 3.09  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 1.624 SNIP 2.008 CiteScore 2.97  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 0.868 SNIP 2.164 CiteScore 3.38  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 1.688 SNIP 2.17 CiteScore 2.79  
ISI indexed (2012): ISI indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 1.085 SNIP 1.978 CiteScore 3.04  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.647 SNIP 2.12  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.712 SNIP 2.123  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 1.579 SNIP 1.957  
Scopus rating (2007): SJR 1.76 SNIP 1.949  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.809 SNIP 1.962  
Scopus rating (2005): SJR 1.818 SNIP 1.885  
Scopus rating (2004): SJR 1.266 SNIP 1.918  
Scopus rating (2003): SJR 1.492 SNIP 1.781  
Scopus rating (2002): SJR 1.105 SNIP 1.974  
Web of Science (2002): Indexed yes  
Scopus rating (2001): SJR 1.546 SNIP 1.777  
Web of Science (2001): Indexed yes  
Scopus rating (2000): SJR 1.319 SNIP 1.458  
Scopus rating (1999): SJR 0.835 SNIP 1.381  
Original language: English  
Light-emitting diode, LED lamp, Heat sink design, Natural convection, Passive cooling, Topology optimisation  
Electronic versions: preprint.pdf  
DOIs: 10.1016/j.ijheatmasstransfer.2018.01.103
Determination of Viscosity Versus Pressure by Means of a Clearance Seal

This paper describes the construction and testing of a simple, experimental tool setup that enables determination of the pressure–viscosity relationship for high viscosity oils. Comparing the determined pressure–viscosity relationship with a reference rheometer measuring the viscosity at ambient pressure yields reasonable agreement. The computed viscosity at elevated pressures was well represented by the Chu and Cameron model.
Development of Goss texture in Al–0.3%Cu annealed after heavy rolling

The evolution of the microstructure and texture during annealing has been studied in the center layer of 95% cold rolled Al–0.3%Cu with a large initial grain size. The cold-rolled condition is characterized by a strong Brass texture component and a deformed microstructure comprising lamellar structures intersected by a large number of shear bands. Recrystallization and precipitation take place during annealing at 200°C, and a strong Goss texture develops. In the beginning of recrystallization, Goss oriented grains nucleate preferentially at the shear bands. At a later stage of recrystallization, new Goss nuclei can appear in regions where lamellae of the dominant Brass component are interspersed with Goss-oriented subgrains. When recrystallization is almost complete, recrystallized Goss-oriented grains grow into grains of other orientations, which results in a rapid increase in the average grain size of Goss-oriented grains and strengthening of the Goss texture. As a result, new low angle boundaries are formed between Goss-oriented grains in this strongly textured material.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Materials science and characterization, Chongqing University
Authors: Shuai, L. F. (Ekstern), Huang, T. L. (Ekstern), Wu, G. L. (Ekstern), Huang, X. (Intern), Mishin, O. V. (Intern)
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Journal: Journal of Alloys and Compounds
Volume: 749
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.05 SJR 0.961 SNIP 1.321
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.987 SNIP 1.43 CiteScore 3.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.135 SNIP 1.66 CiteScore 3.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.064 SNIP 1.597 CiteScore 2.73
ISI indexed (2013): ISI indexed yes
Dynamic exergoeconomic analysis of a heat pump system used for ancillary services in an integrated energy system

The integration of different energy sectors, such as the electricity and heating sector, is an effective way to integrate large shares of renewable energy into the energy system. Heat pumps allow efficient heat production based on electricity. As such, they may be used to provide two different services - the generation of heat and the provision of demand flexibility as ancillary services for the power system. The paper presents a method to assess the impact of providing demand flexibility on the performance of the conversion system based on a dynamic exergoeconomic analysis. A way to allocate the cost of heat and flexibility products based on the difference in exergy destruction was proposed. The method was applied to a case of a groundwater-source heat pump system supplying a district heating island system. It was found that providing demand flexibility causes higher exergy destruction, mainly due to heat losses during storage and the need to reheat the fluid using an electric heater. The major part of the additional exergy destruction was not related to heat pump regulation. When providing flexibility the overall cost of the system increased and according to the proposed allocation, demand flexibility accounted for 12% of the overall cost.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Meesenburg, W. (Intern), Ommen, T. (Intern), Elmegaard, B. (Intern)
Ecodesign Implementation and LCA
Ecodesign is a proactive product development approach that integrates environmental considerations into the early stages of the product development process so to improve the environmental performance of products. In this chapter, the ecodesign concept will be discussed, in terms of its implementation into manufacturing companies. Existing methods and tools for ecodesign implementation will be described, focusing on a multifaceted approach to environmental improvement through product development. Additionally, the use of LCA in an ecodesign implementation context will be further described in terms of the challenges and opportunities, together with the discussion of a selection of simplified LCA tools. Finally, a seven-step approach for ecodesign implementation which has been applied by several companies will be described.

Effect of microstructure on KCl corrosion attack of modified AISI 310 steel
The effect of microstructure on KCl corrosion attack was studied using a specifically chosen modified AISI 310 austenitic steel in a 15% (v/v) H2O (g) + 5%(v/v) O2 (g) + N2 (g) (balance) atmosphere at 600°C for 168 h. The material was a targeted choice as it allows investigation of different microstructures i.e. as-received (without sigma phase) and heat-treated (29% σ-phase per area) microstructures. The corrosion attack was studied with light optical, scanning electron and transmission electron microscopy as well as X-ray diffraction. The heat-treated sample showed a corrosion attack that was 5 times higher than the as-received sample. In the heat-treated sample, the σ-phase was selectively attacked. At the corrosion front, chlorine (but not potassium) was detected in the selectively attacked σ-phase but not in the unattacked adjacent matrix. Therefore, the corrosion attack was propagated by preferential σ-phase attack by chlorine species.
Effect of process parameters on flow length and flash formation in injection moulding of high aspect ratio polymeric micro features

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
Authors: Eladl, A. (Ekstern), Mostafa, R. (Ekstern), Islam, A. (Intern), Loaldi, D. (Intern), Soltan, H. (Ekstern), Hansen, H. N. (Intern), Tosello, G. (Intern)
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Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.83 SJR 0.382 SNIP 0.766
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.438 SNIP 0.931 CiteScore 1.78
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.638 SNIP 1.384 CiteScore 2.1
Scopus rating (2013): SJR 0.479 SNIP 1.151 CiteScore 1.73
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.477 SNIP 1.34 CiteScore 1.28
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.226 SNIP 0.892
ISI indexed (2011): ISI indexed no
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Effect of Properties and Turgor Pressure on the Indentation Response of Plant Cells
The indentation of plant cells by a conical indenter is modeled. The cell wall is represented as a spherical shell consisting of a relatively stiff thin outer layer and a softer thicker inner layer. The state of the interior of the cell is idealized as a specified turgor pressure. Attention is restricted to axisymmetric deformations, and the wall material is characterized as a viscoelastic solid with different properties for the inner and outer layers. Finite deformation, quasi-static calculations are carried out. The effects of outer layer stiffness, outer layer thickness, turgor pressure, indenter sharpness, cell wall thickness, and loading rate on the indentation hardness are considered. The calculations indicate that the small indenter depth response is dominated by the cell wall material properties, whereas for a sufficiently large indenter depth, the value of the turgor pressure plays a major role. The indentation hardness is found to increase approximately linearly with a measure of indenter sharpness over the range considered. The value of the indentation hardness is affected by the rate of indentation, with a much more rapid decay of the hardness for slow loading, because there is more time for viscous relaxation during indentation.
Effects of micro-injection moulding process parameters on accuracy and precision of thermoplastic elastomer micro rings

Micro-injection moulding (μIM) represents the only technology currently capable of enabling the mass production of polymer micro-components. Although this process is mainly utilized to process rigid thermoplastics, the development of new fields of application asks for the extension of the technology potential to novel types of polymeric materials such as soft thermoplastic elastomers (TPEs). In this work, the authors studied the μIM technology of TPE micro suspension rings for sensor applications. An initial benchmark study, based on microscopy inspections and weld line depth measurements, allowed identifying suitable process parameters settings. Then, the effects of the process parameters on the dimensional
variation of the outer and inner diameter of the produced micro rings were quantified. A focus variation microscope was employed for the measurements of both parts and mould cavities. The results of this study showed that the outer ring diameter was mostly affected by mould temperature and holding pressure, while the inner one depended mainly on mould and melt temperature. It was also found that the investigated process parameters had an opposite effect on the outer and inner diameter variations, posing great challenges in the achievement of the part geometry specified in the design.
Effects of Plastic Anisotropy and Void Shape on Full Three-Dimensional Void Growth

Void growth in an anisotropic ductile solid is studied by numerical analyses for three dimensional unit cells initially containing a void. The effect of plastic anisotropy on void growth is the main focus, but the studies include effects of different void shapes, including oblate, prolate or general ellipsoidal voids. Also other 3D effects such as those of different spacings of voids in different material directions, and effects of different macroscopic principal stresses in three directions are accounted for. It is found that the presence of plastic anisotropy amplifies the differences between predictions obtained for different initial void shapes. Also, differences between principal transverse stresses show a strong interaction with the plastic anisotropy, such that the response is very different for different anisotropies. The studies are carried out for one particular choice of void volume fraction and stress triaxiality.
Electrochemical profiling of multi-clad aluminium sheets used in automotive heat exchangers

A combination of glow discharge optical emission spectroscopy sputtering and local electrochemical measurements was used to determine electrochemical changes upon brazing in a multi-layered Aluminium sheet (AA4343/AA3xxx/AA4343) with an additional low-Cu (AA3xxx) interlayer. Ecorr values from potentiodynamic polarization, galvanic corrosion behaviour by ZRA, microstructure and composition by SEM and TEM were investigated and compared to those obtained for sheet without the interlayer. Inward diffusion of Si from clad, and outward diffusion of Cu from core are found to degrade the corrosion properties of conventional sheet, whereas presence of interlayer reduced outward diffusion of Cu and hence improved corrosion protection.

General information

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Constellium Technology Center
Authors: Bordo, K. (Intern), C. Gudla, V. (Intern), Peguet, L. (Ekstern), Afseth, A. (Ekstern), Ambat, R. (Intern)
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Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information

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  BFI (2018): BFI-level 1
  Web of Science (2018): Indexed yes
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  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 1
  Scopus rating (2016): CiteScore 5.19 SJR 1.863 SNIP 2.307
  BFI (2015): BFI-level 1
  Scopus rating (2015): SJR 1.904 SNIP 2.788 CiteScore 5.62
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 1
  Scopus rating (2014): SJR 1.892 SNIP 3.032 CiteScore 5.08
  BFI (2013): BFI-level 1
  Scopus rating (2013): SJR 1.592 SNIP 3.052 CiteScore 4.57
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 1
  Scopus rating (2012): SJR 1.508 SNIP 2.812 CiteScore 4.3
  ISI indexed (2012): ISI indexed yes
  BFI (2011): BFI-level 1
  Scopus rating (2011): SJR 1.391 SNIP 2.78 CiteScore 4.26
  ISI indexed (2011): ISI indexed yes
  Web of Science (2011): Indexed yes
  BFI (2010): BFI-level 1
  Scopus rating (2010): SJR 1.402 SNIP 2.531
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 1

10.1115/1.4039172
Electrochemical profiling of multi-clad aluminium sheets used in automotive heat exchangers

A combination of glow discharge optical emission spectroscopy sputtering and local electrochemical measurements was used to determine electrochemical changes upon brazing in a multi-layered Aluminium sheet (AA4343/AA3xxx/AA4343) with an additional low-Cu (AA3xxx) interlayer. Ecorr values from potentiodynamic polarization, galvanic corrosion behaviour by ZRA, microstructure and composition by SEM and TEM were investigated and compared to those obtained for sheet without the interlayer. Inward diffusion of Si from clad, and outward diffusion of Cu from core are found to degrade the corrosion properties of conventional sheet, whereas presence of interlayer reduced outward diffusion of Cu and hence improved corrosion protection.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Constellium Technology Center
Authors: Bordo, K. (Intern), Gudla, V. C. (Intern), Peguet, L. (Ekstern), Afseth, A. (Ekstern), Ambat, R. (Intern)
Pages: 28-37
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication Information
Journal: Corrosion Science
Volume: 131
ISSN (Print): 0010-938X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 5.19 SJR 1.863 SNIP 2.307
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.904 SNIP 2.788 CiteScore 5.62
Web of Science (2015): Indexed yes
Energieffektivitet ved udnyttelse af overskudsvarme i industrien
Analyse viser, at der er et stort økonomisk potentiale for at bruge overskudsvarme fra industrien. To eksempler fra fødevareproduktion demonstrerer økonomisk attraktiv udnyttelse af overskudsvarme

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Viegand Maagøe A/S
Authors: Bühler, F. (Intern), Elmegaard, B. (Intern), Holm, F. M. (Ekstern)
Pages: 10-14
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Plus Proces
Estimation of hysteretic damping of structures by stochastic subspace identification

Output-only system identification techniques can estimate modal parameters of structures represented by linear time-invariant systems. However, the extension of the techniques to structures exhibiting non-linear behavior has not received much attention. This paper presents an output-only system identification method suitable for random response of dynamic systems with hysteretic damping. The method applies the concept of Stochastic Subspace Identification (SSI) to estimate the model parameters of a dynamic system with hysteretic damping. The restoring force is represented by the Bouc-Wen model, for which an equivalent linear relaxation model is derived. Hysteretic properties can be encountered in engineering structures exposed to severe cyclic environmental loads, as well as in vibration mitigation devices, such as Magnetorheological (MR) dampers. The identification technique incorporates the equivalent linear damper model in the estimation procedure. Synthetic data, representing the random vibrations of systems with hysteresis, validate the estimated system parameters by the presented identification method at low and high-levels of excitation amplitudes.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Bajric, A. (Intern), Høgsberg, J. B. (Intern)
Pages: 36-50
Publication information
Journal: Mechanical Systems and Signal Processing
Volume: 105
ISSN (Print): 0888-3270
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.84 SJR 2.067 SNIP 3.023
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.792 SNIP 2.993 CiteScore 4.14
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.001 SNIP 3.522 CiteScore 3.76
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.676 SNIP 3.781 CiteScore 3.77
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.686 SNIP 4.081 CiteScore 3.26
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.677 SNIP 3.683 CiteScore 3.17
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.542 SNIP 3.109
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.046 SNIP 3.716
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.306 SNIP 2.733
Scopus rating (2007): SJR 1.384 SNIP 2.752
Scopus rating (2006): SJR 1.068 SNIP 2.02
Scopus rating (2005): SJR 0.991 SNIP 2.01
Scopus rating (2004): SJR 0.956 SNIP 1.432
Scopus rating (2003): SJR 1.062 SNIP 1.63
Scopus rating (2002): SJR 0.722 SNIP 1.187
Scopus rating (2001): SJR 0.91 SNIP 1.893
Scopus rating (2000): SJR 0.665 SNIP 1.363
Scopus rating (1999): SJR 0.62 SNIP 1.015
Original language: English
Output-only system identification, Non-linear restoring force, Hysteretic damping, Linearization, Relaxation damping,
Random vibrations
DOI: 10.1016/j.ymssp.2017.11.042
Source: FindIt
Source-ID: 2394989171
Publication: Research - peer-review › Journal article – Annual report year: 2018
Evaluation of a Lagrangian Soot Tracking Method for the prediction of primary soot particle size under engine-like conditions

This paper reports the implementation and evaluation of a Lagrangian soot tracking (LST) method for the modeling of soot in diesel engines. The LST model employed here has the tracking capability of a Lagrangian method and the ability to predict primary soot particle sizing. The Moss-Brookes soot model is used here as the Eulerian method to simulate soot formation and oxidation processes. The inception, surface growth and oxidation models are adopted and modified such that the associated reaction rates can be computed using the Lagrangian approach. The soot nuclei are treated as Lagrangian particles when the mass of incipient soot exceeds a designated threshold value. Their trajectories are then computed using the particle momentum equation. The change of primary soot particle size is dependent on the modified Lagrangian surface growth and soot oxidation models. Performance of the LST model in predicting temporal soot cloud development, mean soot diameter and primary soot size distribution is evaluated using measurements of n-heptane and n-dodecane spray combustion obtained under diesel engine-like conditions. In addition, sensitivity studies are carried out to investigate the influence of soot surface ageing and oxidation rates on the primary soot particle size distribution. With the use of surface ageing, the predicted maximum primary soot particle sizes are closer to the experimentally measured maximum primary soot sizes. Also, the associated particle size distribution shows a lognormal shape. A higher rate of soot oxidation due to OH causes the soot particles to be fully oxidized downstream of the flame. In general, the LST model performs better than the Eulerian method in terms of predicting soot sizing and accessing information of individual soot particles, both of which are shortcomings of the Eulerian method.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, University of Nottingham, Malaysia Campus
Authors: Cai Ong, J. (Ekstern), Pang, K. M. (Intern), Walther, J. H. (Intern), Ho, J. (Ekstern), Kiat Ng, H. (Ekstern)
Pages: 70-95
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Aerosol Science
Volume: 70-95
ISSN (Print): 0021-8502
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.21 SJR 0.843 SNIP 1.199
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.072 SNIP 1.318 CiteScore 2.47
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.068 SNIP 1.586 CiteScore 2.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.187 SNIP 1.858 CiteScore 2.9
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.294 SNIP 1.638 CiteScore 2.64
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.137 SNIP 1.623 CiteScore 2.63
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.169 SNIP 1.604
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.457 SNIP 1.782
Web of Science (2009): Indexed yes
Evaluation of damping estimates by automated Operational Modal Analysis for offshore wind turbine tower vibrations

Reliable predictions of the lifetime of offshore wind turbine structures are influenced by the limited knowledge concerning the inherent level of damping during downtime. Error measures and an automated procedure for covariance driven Operational Modal Analysis (OMA) techniques has been proposed with a particular focus on damping estimation of wind turbine towers. In the design of offshore structures the estimates of damping are crucial for tuning of the numerical model. The errors of damping estimates are evaluated from simulated tower response of an aeroelastic model of an 8 MW offshore wind turbine. In order to obtain algorithmic independent answers, three identification techniques are compared: Eigensystem Realization Algorithm (ERA), covariance driven Stochastic Subspace Identification (COV-SSI) and the Enhanced Frequency Domain Decomposition (EFDD). Discrepancies between automated identification techniques are discussed and illustrated with respect to signal noise, measurement time, vibration amplitudes and stationarity of the ambient response. The best bias-variance error trade-off of damping estimates is obtained by the COV-SSI. The proposed automated procedure is validated by real vibration measurements of an offshore wind turbine in non-operating conditions from a 24-h monitoring period.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, DONG Energy A/S
Authors: Bajrić, A. (Intern), Høgsberg, J. B. (Intern), Rüdinger, F. (Ekstern)
Pages: 153-163
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Renewable Energy
Volume: 116
ISSN (Print): 0960-1481
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.83 SJR 1.697 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.845 SNIP 2.118 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.983 SNIP 2.687 CiteScore 4.51
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Experimental comparison of the nonlinear dynamic behavior of a rigid rotor interacting with two types of different radial backup bearings: Ball & pinned

Rotors on magnetic bearings rely on external controls to guarantee stability and are designed in case of partial or total failures, when impacts happen and potentially lead to a breakdown. Therefore backup bearings are indispensable. In such rotor-stator interactions the main undesired phenomenon is the backward whirl. The current work investigates the experimental behavior of a horizontal rigid rotor interacting laterally with two types of backup bearings during run up testing. The experimental data is analyzed by orbit analysis, spectrum analyzers, and force magnitudes collected by sensors installed. It is shown experimentally the nonlinear behavior of the rotor-bearing system and the elimination of backward whirl. The advantages and drawbacks of each type of backup bearing are given.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark, Pontifícia Universidade Católica
False-positive result when a diphenylcarbazide spot test is used on trivalent chromium-passivated zinc surfaces

A colorimetric 1,5-diphenylcarbazide (DPC)-based spot test can be used to identify hexavalent chromium on various metallic and leather surfaces. DPC testing on trivalent chromium-passivated zinc surfaces has unexpectedly given positive results in some cases, apparently indicating the presence of hexavalent chromium; however, the presence of hexavalent chromium has never been confirmed with more sensitive and accurate test methods.

Objectives
To examine the presence of hexavalent chromium on trivalent chromium-passivated zinc surfaces with a DPC-based spot test.

Methods
A colorimetric DPC spot test was used for the initial detection of hexavalent chromium on new and 1-year-aged trivalent chromium-passivated zinc surfaces. Then, X-ray photoelectron spectroscopy (XPS) was performed for all samples.

Results
The DPC spot test indicated the presence of hexavalent chromium in aged, but not new, trivalent chromium passivation on zinc; however, subsequent analysis by XPS could not confirm the presence of chromium in a hexavalent state.

Conclusions
Unintended oxidation of DPC induced by atmospheric corrosion is suggested as a possible reason for the false-positive reaction of the DPC test on a trivalent chromium-passivated zinc surface. Further validation of the use of the DPC test for chromium-containing metallic surfaces is required.
Fracture Mechanics Analysis of Reinforced DCB Sandwich Debond Specimen Loaded by Moments

Analytical expressions for the energy release rate and mode-mixity phase angle are derived for a sandwich composite double-cantilever beam fracture specimen with the face sheets reinforced by stiff plates. The sandwich beam is considered symmetric, with identical top and bottom facesheets. Only a pure moment loading is considered. The J-integral coupled with laminate beam theory is employed to derive closed-form expression for the energy releaserate in terms of the applied moments, geometry, and material properties. A scalar quantityuis obtained to express the mode-mixity phase angle. It is shown that ω is independent of the applied loading conditions. The value of ω is found to be moderately influenced by reinforcement thicknesses.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Florida Atlantic University
Authors: Saseendran, V. (Intern), Berggreen, C. (Intern), Carlsson, L. A. (Ekstern)
Pages: 413-422
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication Information
Journal: A I A A Journal
Volume: 56
Issue number: 1
ISSN (Print): 0001-1452
Ratings:
Fracture mechanics approach to optimize inspection planning of offshore welds for wind turbines

General information
State: Published
Frequency response as a surrogate eigenvalue problem in topology optimization

This article discusses the use of frequency response surrogates for eigenvalue optimization problems in topology optimization that may be used to avoid solving the eigenvalue problem. The motivation is to avoid complications that arise from multiple eigenvalues and the computational complexity associated with computation of eigenvalues in very large problems.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Università degli Studi di Modena e Reggio Emilia, Michigan State University
Authors: Andreassen, E. (Intern), Ferrari, F. (Ekstern), Sigmund, O. (Intern), Diaz, A. R. (Ekstern)
Pages: 1214-1229
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Volume: 113
Issue number: 8
ISSN (Print): 0029-5981
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.64 SJR 1.743 SNIP 1.566
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.912 SNIP 1.689 CiteScore 2.67
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.935 SNIP 1.927 CiteScore 2.73
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.415 SNIP 1.894 CiteScore 2.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.47 SNIP 2.103 CiteScore 2.7
Hardening and strengthening behavior in rate-independent strain gradient crystal plasticity

Two rate-independent strain gradient crystal plasticity models, one new and one previously published, are compared and a numerical framework that encompasses both is developed. The model previously published is briefly outlined, while an in-depth description is given for the new, yet somewhat related, model. The difference between the two models is found in the definitions of the plastic work expended in the material and their relation to spatial gradients of plastic strains. The model predictions are highly relevant to the ongoing discussion in the literature, concerning 1) what governs the increase in the apparent yield stress due to strain gradients (also referred to as strengthening)? And 2), what is the implication of such strengthening in relation to crystalline material behavior at the micron scale? The present work characterizes material behavior, and the corresponding plastic slip evolution, by use of the finite element method. The pure shear problem of an infinite material slab is investigated, with the previously published model displaying strengthening, while the new model does not. In addition to the numerical approach an exact closed form solution, to the pure shear problem, is obtained for the new model, and it is demonstrated that the model predicts proportional straining in the entire plastic regime. Somewhat surprising it is found that the predictions for strain gradient hardening coincide for the two models.
High temperature solution-nitriding and low-temperature nitriding of AISI 316: Effect on pitting potential and crevice corrosion performance

Stainless steels grade AISI 316 was subjected to high temperature solution nitriding and low-temperature nitriding in order to dissolve various amounts of nitrogen in the bulk (up to approx. 0.45wt%) and in a surface layer (up to approx. 13wt%), respectively. Potentiodynamic polarization tests in a 0.1M NaCl solution and crevice corrosion immersion tests in 3wt% FeCl₃ solution were studied before and after the bulk and surface treatments. Nitrogen addition in the bulk proved to have a beneficial effect on the pitting resistance of the alloy. The formation of a zone of expanded austenite at the material surface through low-temperature nitriding resulted in a considerable improvement of the pitting potential and the crevice corrosion performance of the steels.
This paper presents a projection method to obtain high-resolution, manufacturable structures from efficient and coarse-scale, homogenization-based topology optimization results. The presented approach bridges coarse and fine scale, such that the complex periodic micro-structures can be represented by a smooth and continuous lattice on the fine mesh. A heuristic methodology allows control of the projected topology, such that a minimum length-scale on both solid and void features is ensured in the final result. Numerical examples show excellent behavior of the method, where performances of the projected designs are almost equal to the homogenization-based solutions. A significant reduction in computational cost is observed compared to conventional topology optimization approaches.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Solid Mechanics  
Authors: Groen, J. P. (Intern), Sigmund, O. (Intern)  
Pages: 1148-1163  
Publication date: 2018  
Main Research Area: Technical/natural sciences

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Volume: 113  
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ISSN (Print): 0029-5981  
Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 2  
Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Scopus rating (2016): CiteScore 2.64 SJR 1.743 SNIP 1.566  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2
Impact damage reduction by structured surface geometry

Repeated impacts can cause damage to not only a surface but also inside the material. Mechanisms include stress-wave propagation into the material, reflection of the waves at the back surface, and subsequent repeated reflections in the vicinity of the impact and the back surface. Impact damage performance was observed for polyurethane-coated fibre composites with structured geometries at the back surfaces. Repeated impacts by rubber balls on the coated side caused damage and delamination of the coating. The laminates with structured back surfaces showed longer durability than those with a flat back surface. The in-situ acoustic measurement indicates that the acoustic power within the pulse duration
was 25–40% lower using the structured back surfaces. The observed effect can be attributed to scattered reflection at the back surface to reduce the high intensity duration of the acoustic waves.

**General information**

**State:** Published  
**Organisations:** Department of Wind Energy, Composites and Materials Mechanics, Wind Turbines, Department of Mechanical Engineering, Materials and Surface Engineering  
**Authors:** Kusano, Y. (Intern), Fedorov, V. (Intern), McGugan, M. (Intern), Andersen, T. L. (Intern), Johansen, N. F. (Intern)  
**Pages:** 296-300  
**Publication date:** 2018  
**Main Research Area:** Technical/natural sciences

**Publication information**

**Journal:** Materials Letters  
**Volume:** 221  
**ISSN (Print):** 0167-577X  
**Ratings:**  
- BFI (2018): BFI-level 1  
- Web of Science (2018): Indexed yes  
- BFI (2017): BFI-level 1  
- Web of Science (2017): Indexed yes  
- BFI (2016): BFI-level 1  
- Scopus rating (2016): CiteScore 2.51 SJR 0.757 SNIP 0.935  
- Web of Science (2016): Indexed yes  
- BFI (2015): BFI-level 1  
- Scopus rating (2015): SJR 0.792 SNIP 1.021 CiteScore 2.5  
- Web of Science (2015): Indexed yes  
- BFI (2014): BFI-level 1  
- Scopus rating (2014): SJR 0.895 SNIP 1.315 CiteScore 2.64  
- Web of Science (2014): Indexed yes  
- BFI (2013): BFI-level 1  
- Scopus rating (2013): SJR 0.83 SNIP 1.237 CiteScore 2.41  
- ISI indexed (2013): ISI indexed yes  
- Web of Science (2013): Indexed yes  
- BFI (2012): BFI-level 1  
- Scopus rating (2012): SJR 0.924 SNIP 1.404 CiteScore 2.41  
- ISI indexed (2012): ISI indexed yes  
- Web of Science (2012): Indexed yes  
- BFI (2011): BFI-level 1  
- Scopus rating (2011): SJR 1.017 SNIP 1.568 CiteScore 2.54  
- ISI indexed (2011): ISI indexed yes  
- Web of Science (2011): Indexed yes  
- BFI (2010): BFI-level 1  
- Scopus rating (2010): SJR 1.059 SNIP 1.29  
- BFI (2009): BFI-level 1  
- Scopus rating (2009): SJR 1.043 SNIP 1.276  
- BFI (2008): BFI-level 1  
- Scopus rating (2008): SJR 0.979 SNIP 1.3  
- Web of Science (2008): Indexed yes  
- Scopus rating (2007): SJR 0.943 SNIP 1.31  
- Web of Science (2007): Indexed yes  
- Scopus rating (2006): SJR 0.846 SNIP 1.16  
- Web of Science (2006): Indexed yes  
- Scopus rating (2005): SJR 0.775 SNIP 1.167  
- Scopus rating (2004): SJR 0.644 SNIP 1.031  
- Scopus rating (2003): SJR 0.602 SNIP 0.828
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.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology, Technische Universität München
Authors: Wu, J. (Intern), Aage, N. (Intern), Westermann, R. (Ekstern), Sigmund, O. (Intern)
Pages: 1127 - 1140
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Volume: 24
Issue number: 2
ISSN (Print): 1077-2626
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.94 SJR 1.365 SNIP 2.356
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.82 SNIP 2.08 CiteScore 2.91
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.208 SNIP 2.591 CiteScore 3.37
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.166 SNIP 2.605 CiteScore 3.39
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.853 SNIP 2.505 CiteScore 2.96
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.115 SNIP 2.774 CiteScore 3.39
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Influence of Preoxidation on High-Temperature Corrosion of a FeCrAl Alloy Under Conditions Relevant to Biomass Firing

Preoxidation of a commercial FeCrAl alloy (Kanthal APM) was evaluated as a surface modification approach to reduce alkali chloride-induced corrosion during biomass firing in power plants. Samples of the alloy preoxidized at 900 °C in O₂ or O₂ + 10 vol% H₂O, and at 1100 °C in O₂, were coated with KCl and exposed at 560 °C to a gas mixture comprising of 12 vol% CO₂, 6 vol% O₂, 3 vol% H₂O, 400 ppmv HCl and 60 ppmv SO₂. The oxide formed at 1100 °C showed no reactivity with the corrosive species. By contrast, all samples preoxidized at 900 °C suffered severe attack, resulting in formation of Fe-, Cr- and Al-containing corrosion products in a heterogeneous morphology, similar to non-preoxidized samples. The observed differences with respect to the degree of corrosion attack on the preoxidized samples are discussed in terms of the composition and thickness of the different types of Al₂O₃ layers obtained by the preoxidation treatment.

General Information

State: Published
Organisations: Department of Chemical and Biochemical Engineering, Department of Mechanical Engineering, Materials and Surface Engineering, CHEC Research Centre
Authors: Okoro, S. C. (Intern), Montgomery, M. (Intern), Jappe Frandsen, F. (Intern), Pantleon, K. (Intern)
Pages: 99–122
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication Information

Journal: Oxidation of Metals
Volume: 89
Issue number: 1-2
ISSN (Print): 0030-770X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.22 SJR 0.659 SNIP 0.865
BFI (2015): BFI-level 1
Abstract In the present work a new method for thermal compensation in dimensional metrology of polymer parts in a production environment based on 3D thermomechanical simulations is developed. A fixture for measuring the length dimension of a classical polymer part is placed in a production environment and equipped with sensors in terms of thermocouples for temperature measurements of the part and the fixture and a contact probe for measuring the dimension. A 3D thermomechanical model is developed in ABAQUS, emulating the thermoelastic conditions of the polymer part when placed in the fixture. Knowledge from classical heat transfer and elasticity theory is then applied to derive a more generic, yet simple expression for the compensation from the transient 3D temperature and displacement fields, based on dimensionless values, which makes applicable for a wide range of initial and surrounding conditions found in a production environment. The developed expression is then used for length compensation on 24 samples measured inline ten minutes after production. The results reveals a significant improvement in capturing the transient behavior of the part with a reduced error from 13μm to 3μm, applying the developed formula instead of using more classical 1D standard thermal compensation.

General information

State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Publication information
Journal: Precision Engineering
ISSN (Print): 0141-6359
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.77 SJR 1.024 SNIP 2.201
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.054 SNIP 2.103 CiteScore 2.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.254 SNIP 2.478 CiteScore 2.39
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.384 SNIP 2.989 CiteScore 2.54
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.387 SNIP 3.26 CiteScore 2.2
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.374 SNIP 2.719 CiteScore 2.03
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.613 SNIP 2.958
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.121 SNIP 2.752
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.917 SNIP 1.767
Scopus rating (2007): SJR 0.991 SNIP 1.557
Scopus rating (2006): SJR 0.828 SNIP 1.663
Scopus rating (2005): SJR 0.931 SNIP 1.954
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.627 SNIP 2.556
Scopus rating (2003): SJR 0.82 SNIP 1.609
Scopus rating (2002): SJR 0.646 SNIP 1.801
Scopus rating (2001): SJR 0.533 SNIP 1.92
Scopus rating (2000): SJR 0.554 SNIP 1.374
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.507 SNIP 1.503
Original language: English
Production environment, Temperature compensation, Thermomechanical modelling, Polymer parts, Multisensory fixture, Online compensation
DOIs:
10.1016/j.precisioneng.2018.02.013
Source: RIS
Source-ID: urn:C018F74DD82560B1115BC1CF2AD6643C
Publication: Research - peer-review › Journal article – Annual report year: 2018
Innovation i Naturvidenskab - Et kompendium til gymnasielærere om innovation som undervisningsmetode

Dette kompendium er udarbejdet i forbindelse med kurset Innovation i Naturvidenskab. Kurset udbedes af Danske Science Gymnasier (DASG)og gennemføres som et samarbejdskursus mellem DASG og Danmarks Tekniske Universitet (DTU). Vi håber, at kompetidet kan hjælpe gymnasielærere i de naturvidenskabelige fag i gang med innovation som undervisningsmetode. Vi har forsøgt at skrive kompetidet, så det er anvendeligt, uanset om man har deltaget i kurset eller ej.


General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Hansen, C. T. (Intern), Boelskifte, P. (Intern)
Number of pages: 64
Publication date: 2018

Publication information
Publisher: Fysikforlaget
Original language: Danish
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 144763171
Publication: Education › Compendium/lecture notes – Annual report year: 2018

In Situ Investigation of the Evolution of Lattice Strain and Stresses in Austenite and Martensite During Quenching and Tempering of Steel

Energy dispersive synchrotron X-ray diffraction was applied to investigate in situ the evolution of lattice strains and stresses in austenite and martensite during quenching and tempering of a soft martensitic stainless steel. In one experiment, lattice strains in austenite and martensite were measured in situ in the direction perpendicular to the sample surface during an austenitization, quenching, and tempering cycle. In a second experiment, the sin²ψ method was applied in situ during the austenite-to-martensite transformation to distinguish between macro- and phase-specific micro-stresses and to follow the evolution of these stresses during transformation. Martensite formation evokes compressive stress in austenite that is balanced by tensile stress in martensite. Tempering to 748 K (475 °C) leads to partial relaxation of these stresses. Additionally, data reveal that (elastic) lattice strain in austenite is not hydrostatic but hkl dependent, which is ascribed to plastic deformation of this phase during martensite formation and is considered responsible for anomalous behavior of the 200 γ reflection.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Centre for oil and gas – DTU
Authors: Villa, M. (Intern), Niessen, F. (Intern), Somers, M. A. J. (Intern)
Pages: 28–40
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Volume: 49
Issue number: 1
ISSN (Print): 1073-5623
Ratings:
BFI (2018): BFI-level 1
Martensite, Synchrotron X-ray diffraction (XRD), Residual stresses, Tempering, Steel

DOIs:
10.1007/s11661-017-4387-0

Source: Scopus
Source-ID: 85033402028
Interlaboratory Comparison of a physical and a virtual assembly measured by CT

In a comparison including 20 laboratories, a physical as well as a virtual assembly provided as two data sets were used to investigate measuring and post-processing approaches in Computed Tomography, CT. Different procedures were used in the comparison including one simulating in-line measurement. The comparison demonstrated that: (i) a tangible improvement in the use of CT compared to previous comparisons; (ii) most of the participants were able to reduce their scanning time by more than 70% without increasing the length measurement errors; and (iii) most of the participants can further reduce their uncertainties, thereby reducing the tolerance size that can be inspected using CT in industry.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
Pages: 263-270
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Precision Engineering
Volume: 51
ISSN (Print): 0141-6359
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.77 SJR 1.024 SNIP 2.201
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.054 SNIP 2.103 CiteScore 2.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.254 SNIP 2.478 CiteScore 2.39
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.384 SNIP 2.989 CiteScore 2.54
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.387 SNIP 3.26 CiteScore 2.2
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.374 SNIP 2.719 CiteScore 2.03
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.613 SNIP 2.958
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.121 SNIP 2.752
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.917 SNIP 1.767
Scopus rating (2007): SJR 0.991 SNIP 1.557
Scopus rating (2006): SJR 0.828 SNIP 1.663
Scopus rating (2005): SJR 0.931 SNIP 1.954
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.627 SNIP 2.556
Scopus rating (2003): SJR 0.82 SNIP 1.609
Life Cycle Costing: An Introduction
The chapter gives an introduction to life cycle costing (LCC) and how it can be used to support decision-making. It can form the economic pillar in a full life cycle sustainability assessment, but often system delimitations differ depending on the goal and scope of the study. To provide a profound understanding this chapter describes several approaches and terms, fundamental principles and different types of costs. A brief introduction is given to conventional LCC and societal LCC but the main focus is on environmental Life Cycle Costing (eLCC) as the LCC approach that is compatible with environmental Life Cycle Assessment (LCA) in terms of system delimitation. Differences are explained and addressed, and an overview is given of the main cost categories to consider from different user perspectives. As inventory data is often sensitive in financial analyses, a list of relevant databases is provided as well as guidance on how to collect data to overcome this hurdle. In an illustrative case study on window frames, the eLCC theory is applied and demonstrated with each step along the eLCC procedure described in detail. A final section about advanced LCC introduces how to monetarise externalities and how to do discounting.

Local analytical sensitivity analysis for design of continua with optimized 3D buckling behavior
The localized analytical sensitivity for eigenfrequency is extended to the non-linear problem of 3D continuum buckling analysis. Implemented in a finite element approach the inherent complexity of mode switching and multiple eigenvalues is found not to be a practical problem. The number of necessary redesigns is of the order 10-20 as illustrated by a specific example, where also different cases of stiffness interpolation are exemplified.
Mathieu's Equation and Its Generalizations: Overview of Stability Charts and their Features

This work is concerned with Mathieu's equation - a classical differential equation, which has the form of a linear second-order ordinary differential equation with Cosine-type periodic forcing of the stiffness coefficient, and its different generalizations/extensions. These extensions include: the effects of linear viscous damping, geometric nonlinearity, damping nonlinearity, fractional derivative terms, delay terms, quasiperiodic excitation or elliptic-type excitation. The aim is to provide a systematic overview of the methods to determine the corresponding stability chart, its structure and features, and how it differs from that of the classical Mathieu's equation.

General information
Microstructural investigations of Ni and Ni2Al3 coatings exposed in biomass power plants

The present work investigates the corrosion resistance of Ni and Ni2Al3 coated austenitic stainless steel (TP347H) tubes, which were exposed in a biomass-fired boiler with an outlet steam temperature of 540 °C for 6757 h. The Ni2Al3 coating was produced by electroplating Ni followed by low temperature pack cementation. After exposure, microstructural investigations were performed by light optical and electron microscopy (SEM-EDS). Electroplated Ni coatings were not protective in straw firing power plants and exhibited similar corrosion morphology as uncoated tubes. For Ni2Al3 coatings, the nickel aluminide layer was no longer adherent to the tube and was only found within the deposit. However, Ni2Al3 coatings had provided some protection compared to uncoated and Ni coated tubes. The formation of nickel chloride binds aggressive chlorine and slows down the active oxidation mechanism. In local areas, sulphidation corrosion attack of Ni was detected.
Modeling and simulation in tribology across scales: An overview

This review summarizes recent advances in the area of tribology based on the outcome of a Lorentz Center workshop surveying various physical, chemical and mechanical phenomena across scales. Among the main themes discussed were those of rough surface representations, the breakdown of continuum theories at the nano- and micro-scales, as well as multiscale and multiphysics aspects for analytical and computational models relevant to applications spanning a variety of sectors, from automotive to biotribology and nanotechnology. Significant effort is still required to account for complementary nonlinear effects of plasticity, adhesion, friction, wear, lubrication and surface chemistry in tribological models. For each topic, we propose some research directions.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, University of Groningen, PSL Research University, University of Lyon, Delft University of Technology, Imperial College London, Lulea University of Technology, IMT School for Advanced Studies Lucca, University of Southampton, Swiss Federal Institute of Technology, Aarhus University, King's College London, Hamburg University of Technology, Czech Technical University, Politecnico di Bari, Polish Academy of Sciences, University of Torino, University of Trento, Saarland University
Number of pages: 85
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Tribology International
ISSN (Print): 0301-679X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.437 SNIP 2.04 CiteScore 2.61
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 2.5 CiteScore 2.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.473 SNIP 2.793 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.406 SNIP 2.331 CiteScore 1.96
Modeling the condensation of sulfuric acid and water on the cylinder liner of a large two-stroke marine diesel engine

Corrosive wear of cylinder liners in large two-stroke marine diesel engines that burn heavy fuel oil containing sulfur is coupled to the formation of gaseous sulfur trioxide (SO₃) and subsequent combined condensation of sulfuric acid (H₂SO₄) and water (H₂O) vapor. The present work seeks to address how fuel sulfur content, charge air humidity and liner temperature variations affect the deposition of water and sulfuric acid at low load operation. A phenomenological engine model is applied to simulate the formation of cylinder/bulk gas combustion products and dew points comply with H₂O–H₂SO₄ vapor liquid equilibrium. By assuming homogenous cylinder gas mixtures condensation is modeled using a convective heat and mass transfer analogy combined with realistic liner temperature profiles. Condensation of water is significantly altered by the liner temperature and charge air humidity while sulfuric acid condensation (the order is a few mg per cylinder every cycle) is proportional to the fuel sulfur content. Condensation takes place primarily in the upper part of the cylinder liner where a reduction of the surface temperature or saturated charge air provides that the deposited acid can be highly diluted with water.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, MAN Diesel & Turbo SE
Authors: Cordtz, R. F. (Intern), Mayer, S. (Ekstern), Eskildsen, S. S. (Ekstern), Schramm, J. (Intern)
Pages: 178–187
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Marine Science and Technology
Near-wellbore modeling of a horizontal well with Computational Fluid Dynamics

The oil production by horizontal wells is a complex phenomenon that involves flow through the porous reservoir, completion interface and the well itself. Conventional reservoir simulators can hardly resolve the flow through the completion into the wellbore. On the contrary, Computational Fluid Dynamics (CFD) is capable of modeling the complex interaction between the creeping reservoir flow and turbulent well flow for single phases, while capturing both the completion geometry and formation damage. A series of single phase steady-state simulations are undertaken, using such fully coupled three dimensional numerical models, to predict the inflow to the well. The present study considers the applicability of CFD for near-wellbore modeling through benchmark cases with available analytical solutions. Moreover, single phase steady-state numerical investigations are performed on a specific perforated horizontal well producing from the Siri field, offshore Denmark. The performance of the well is investigated with an emphasis on the inflow profile and the productivity index for different formation damage scenarios. A considerable redistribution of the inflow profile were found when the filtrate invasion extended beyond the tip of the perforations.

General information

State: Published
Organisations: Department of Mechanical Engineering, Scientific Computing, Fluid Mechanics, Coastal and Maritime Engineering, Department of Chemistry, CERE – Center for Energy Ressources Engineering, Technical University of Denmark, Lloyd’s Register Consulting
Numerical modeling of the strand deposition flow in extrusion-based additive manufacturing

Abstract We propose a numerical model to simulate the extrusion of a strand of semi-molten material on a moving substrate, within the computation fluid dynamics paradigm. According to the literature, the deposition flow of the strands has an impact on the inter-layer bond formation in extrusion-based additive manufacturing, as well as the surface roughness of the fabricated part. Under the assumptions of an isothermal Newtonian fluid and a creeping laminar flow, the deposition flow is controlled by two parameters: the gap distance between the extrusion nozzle and the substrate, and the velocity ratio of the substrate to the average velocity of the flow inside the nozzle. The numerical simulation fully resolves the deposition flow and provides the cross-section of the printed strand. For the first time, we have quantified the effect of the gap distance and the velocity ratio on the size and the shape of the strand. The cross-section of the strand ranges from being almost cylindrical (for a fast printing and with a large gap) to a flat cuboid with rounded edges (for a slow printing and with a small gap), which substantially differs from the idealized cross-section typically assumed in the literature. Finally, we found that the printing force applied by the extruded material on the substrate has a negative linear relationship with the velocity ratio, for a constant gap.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Comminal, R. (Intern), Serdeczny, M. P. (Intern), Pedersen, D. B. (Intern), Spangenberg, J. (Intern)
Pages: 68-76
Publication date: 2018
Main Research Area: Technical/natural sciences

Numerical simulation of condensation of sulfuric acid and water in a large two-stroke marine diesel engine

In the present study, three-dimensional (3D) computational fluid dynamics simulations are performed to examine the process of sulfuric acid (H2SO4) and water (H2O) condensation in a large two-stroke marine diesel engine. A skeletal n-heptane chemical mechanism is coupled with a sulfur (S) subset to simulate the combustion process as well as the formation of sulfuric oxides (SOx) and H2SO4. The condensation process is simulated using a fluid film model which is coupled with the in-cylinder gas phase. Prior to the engine simulations, the fluid film condensation model is validated using the experimental data of sulfuric acid condensation rate in a laminar pipe flow. Next, the engine model is validated against the experimental sulfur dioxide (SO2) to sulfur trioxide (SO3) conversion obtained from the corresponding test engine. Both of the validation studies show a good agreement with the experimental data. The engine model is then utilized to simulate condensation for different operating conditions. The engine simulation results reveal that the fluid film has a significant effect on the total mass of sulfuric acid vapor and a marginal effect on the total mass of water vapor. A close to linear correlation is found between the fuel sulfur content and the total condensed mass of sulfuric acid. The level of humidity of the scavenging air does not affect the condensation of sulfuric acid considerably, relative to the humidity increase, but it has a high impact on water condensation. The study of the scavenging pressure level reveals a counter intuitive behavior where the condensation rates decrease with higher scavenging pressures due to the flow regime and flame size. Next, increasing the cylinder liner temperature decreases significantly the water condensation contrary to the sulfuric acid condensation which is marginally affected. The increase in lubricant film thickness results in a decrease for both the sulfuric acid and water condensation with a more pronounced reduction for water. Finally, a comparison between
the high and low load operating conditions reveals a small drop in the total condensed mass of sulfuric acid and water for the low load conditions.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, MAN B&W Diesel A/S
Authors: Karvounis, N. (Intern), Pang, K. M. (Intern), Mayer, S. (Ekstern), Walther, J. H. (Intern)
Pages: 1009-1020
Publication date: 2018
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Applied Energy
Volume: 211
ISSN (Print): 0306-2619
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.164 SNIP 3.377 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.854 SNIP 3.108 CiteScore 5.69
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.473 SNIP 2.84 CiteScore 5.5
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.516 SNIP 2.25
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.003 SNIP 1.781
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.974 SNIP 1.215
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.179 SNIP 1.709
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.979 SNIP 1.293
Scopus rating (2005): SJR 1.043 SNIP 0.996
Web of Science (2005): Indexed yes
Numerical simulation of the planar extrudate swell of pseudoplastic and viscoelastic fluids with the streamfunction and the VOF methods

Abstract We present an Eulerian free-surface flow solver for incompressible pseudoplastic and viscoelastic non-Newtonian fluids. The free-surface flow solver is based on the streamfunction flow formulation and the volume-of-fluid method. The streamfunction solver computes the vector potential of a solenoidal velocity field, which ensures by construction the mass conservation of the solution, and removes the pressure unknown. Pseudoplastic liquids are modelled with a Carreau model. The viscoelastic fluids are governed by differential constitutive models reformulated with the log-conformation approach, in order to preserve the positive-definiteness of the conformation tensor, and to circumvent the high Weissenberg number problem. The volume fraction of the fluid is advected with a geometric conservative unsplit scheme that preserves a sharp interface representation. For the sake of comparison, we also implemented an algebraic advection scheme for the liquid volume fraction. The proposed numerical method is tested by simulating the planar extrudate swell with the Carreau, Oldroyd-B and Giesekus constitutive models. The swell ratio of the extrudates are compared with the data available in the literature, as well as with numerical simulations performed with the open-source rheoTool toolbox in OpenFOAM®. While the simulations of the generalized Newtonian fluids achieved mesh independence for all the methods tested, the flow simulations of the viscoelastic fluids are more sensitive to mesh refinement and the choice of numerical scheme. Moreover, the simulations of Oldroyd-B fluid flows above a critical Weissenberg number are prone to artificial surface instabilities. These numerical artifacts are due to discretization errors within the Eulerian surface-capturing method. However, the numerical issues arise from the stress singularity at the die exit corner, and the unphysical predictions of the Oldroyd-B model in the skin layer of the extrudate after the die exit, where large extensional deformations occur.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Porto
Authors: Comminal, R. (Intern), Pimenta, F. (Ekstern), Hattel, J. H. (Intern), Alves, M. A. (Ekstern), Spangenberg, J. (Intern)
Pages: 1–18
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Non-Newtonian Fluid Mechanics
Volume: 252
ISSN (Print): 0377-0257
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.43 SJR 1.079 SNIP 1.555
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.158 SNIP 1.496 CiteScore 2.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.986 SNIP 1.342 CiteScore 1.96
On the non-optimality of tree structures for heat conduction

This paper revisits topology optimization of heat conduction structures for minimum thermal compliance and minimum maximum temperature, respectively. For both optimization problems, volume-to-line and volume-to-point structures are optimized based on three material interpolation models describing different design spaces regarding the relation between material density and effective conductivity. The numerical results are backed up by analytical studies. Comparisons of results show that lamellar needle structures, rather than commonly seen tree structures, constitute the optimal topologies for heat conduction. This contradicts the usual hypothesis drawn from the observation of natural transferring systems and designs from numerous related studies. The conclusion still holds when a minimum length scale is imposed for both high and low conductive phases. Finally, the minimum thermal compliance problem and the min-max temperature problem are compared in terms of optimal microstructures. Lamellar microstructures with the normal to the material layers bisecting the gradients of direct and adjoint solutions are optimal for both types of problems. The variable thickness sheet model is
optimal only for the self-adjoint minimum thermal compliance problem.
On the prediction of thermophysical properties of innovative fluids

Optimal design of robust piezoelectric microgrippers undergoing large displacements
Optimal design of robust piezoelectric unimorph microgrippers

Topology optimization can be used to design piezoelectric actuators by simultaneous design of host structure and polarization profile. Subsequent micro-scale fabrication leads us to overcome important manufacturing limitations: difficulties in placing a piezoelectric layer on both top and bottom of the host layer. Unsymmetrical layer placement makes the actuator bend, spoiling the predicted performance of the device. The aim of this work is to maximize the in-plane displacement of a microgripper-type actuator while out-of-plane displacement at some points of interest is suppressed. This last issue is the main novelty introduced in this work, and the emphasis is placed on the modelling and its applicability rather than numerical methods. In addition, a robust formulation of the problem has been used in order to ensure minimum length scale in the optimal designs, which it is crucial from the manufacturability point of view.
Optimization of organic Rankine cycle power systems considering multistage axial turbine design

Organic Rankine cycle power systems represent a viable and efficient solution for the exploitation of medium-to-low temperature heat sources. Despite the large number of commissioned units, there is limited literature on the design and optimization of organic Rankine cycle power systems considering multistage turbine design. This work presents a preliminary design methodology and working fluid selection for organic Rankine cycle units featuring multistage axial turbines. The method is then applied to the case of waste heat recovery from a large marine diesel engine. A multistage axial turbine model is presented and validated with the best available data from literature. The methodology allows the identification of the most suitable working fluid considering the trade-off between cycle and multistage turbine designs. The results of the optimization of cycle and turbine suggest that the fluid n-butane yields the best compromise in terms of cycle net power output, turbine cost and efficiency for the considered case study. When a conservative design approach is adopted, the turbine features a two-stage configuration with supersonic converging nozzles and post-expansion. Conversely, a single-stage turbine featuring a supersonic converging-diverging nozzle and Mach number up to 2 is the
resulting ideal choice when a more advanced design approach is implemented.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Politecnico di Milano
Authors: Meroni, A. (Intern), Andreasen, J. G. (Intern), Persico, G. (Ekstern), Haglind, F. (Intern)
Pages: 339-354
Publication date: 2018
Main Research Area: Technical/natural sciences

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- BFI (2018): BFI-level 2
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 3.164 SNIP 3.377 CiteScore 6.59
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 2.854 SNIP 3.108 CiteScore 5.69
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 2.473 SNIP 2.84 CiteScore 5.5
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.516 SNIP 2.25
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.003 SNIP 1.781
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 0.974 SNIP 1.215
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.179 SNIP 1.709
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.979 SNIP 1.293
- Scopus rating (2005): SJR 1.043 SNIP 0.996
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 0.643 SNIP 0.839
- Web of Science (2004): Indexed yes
Probing the chemistry of adhesion between a 316L substrate and spin-on-glass coating

Hydrogen silsesquioxane (\(\text{HSiO}_{3/2}\)) based "spin-on-glass" has been deposited on 316L substrate and cured in \(\text{Ar/H}_2\) gas atmosphere at 600 °C to form a continuous surface coating with sub-micrometer thickness. The coating functionality depends primarily on the adhesion to the substrate, which is largely affected by the chemical interaction at the interface between the coating and the substrate. We have investigated this interface by transmission electron microscopy and electron energy loss spectroscopy. The analysis identified a 5-10 nm thick interaction zone containing signals from O, Si, Cr and Fe. Analysis of the energy loss near edge structure of the present elements identified predominantly signal from \([\text{SiO}_4]^{4-}\) units together with \(\text{Fe}^{2+}, \text{Cr}^{2+}\) and traces of \(\text{Cr}^{3+}\). High-resolution transmission electron microscopy images of the interface region confirm a crystalline \(\text{Fe}_2\text{SiO}_4\) interfacial region. In agreement with computational thermodynamics, it is proposed that the spin-on-glass forms a chemically bonded silicate-rich interaction zone with the substrate. It was further suggested that this zone is composed of a corundum-type oxide at the substrate surface, followed by an olivine-structure intermediate phase and a spinel-type oxide in the outer regions of the interfacial zone.

General information

State: Accepted/In press
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Center for Electron Nanoscopy, DTU Danchip, SiOx ApS
Authors: Lampert, F. (Intern), Kadkhodazadeh, S. (Intern), Kasama, T. (Intern), Dahl, K. V. (Intern), Christiansen, A. B. (Ekstern), Møller, P. (Intern)
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Langmuir
ISSN (Print): 0743-7463
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.99 SJR 1.55 SNIP 1.188
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.686 SNIP 1.308 CiteScore 4.33
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.816 SNIP 1.391 CiteScore 4.59
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.895 SNIP 1.356 CiteScore 4.55
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.177 SNIP 1.382 CiteScore 4.37
Spin-on-glass deposition was investigated as viable alternative to increase the durability and performance of 316L steel in chloride environment. The buildup of a detrimental interface oxide was prevented by non-oxidative thermal curing of the coatings, which leads to a transformation to an inorganic, SiO₂-like material. The degree of polymerization was found dependent on the curing temperature; however, even curing at the maximum investigated curing temperature of 800 °C led to still incomplete transformation, showing less SiO₂-like character with respect to thermally grown oxide or fused silica. Electrochemical analysis by cyclic polarization indicated that the coatings behave as imperfect barrier coatings, which may enhance the passive properties of the substrates; however, there is still some statistical scatter in the quality of the coatings. While there is a tendency for an increase of the upper limit of the breakdown potential, there is also a decrease of the lower limit. It was found that such lower quality coatings showed, in association with substrate defects, unevenly distributed coating flaws, which may act as initiation points of pitting corrosion and decrease the corrosion resistance of coated substrates. Further, the films showed instability in aqueous environment due to imperfect polymerization.

Properties and performance of spin-on-glass coatings for the corrosion protection of stainless steels in chloride media
Spin-on-glass deposition was investigated as viable alternative to increase the durability and performance of 316L steel in chloride environment. The buildup of a detrimental interface oxide was prevented by non-oxidative thermal curing of the coatings, which leads to a transformation to an inorganic, SiO₂-like material. The degree of polymerization was found dependent on the curing temperature; however, even curing at the maximum investigated curing temperature of 800 °C led to still incomplete transformation, showing less SiO₂-like character with respect to thermally grown oxide or fused silica. Electrochemical analysis by cyclic polarization indicated that the coatings behave as imperfect barrier coatings, which may enhance the passive properties of the substrates; however, there is still some statistical scatter in the quality of the coatings. While there is a tendency for an increase of the upper limit of the breakdown potential, there is also a decrease of the lower limit. It was found that such lower quality coatings showed, in association with substrate defects, unevenly distributed coating flaws, which may act as initiation points of pitting corrosion and decrease the corrosion resistance of coated substrates. Further, the films showed instability in aqueous environment due to imperfect polymerization.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, SiOx ApS, Delft University of Technology
Authors: Lampert, F. (Intern), Jensen, A. H. (Ekstern), Din, R. U. (Intern), Gonzalez-Garcia, Y. (Ekstern), Møller, P. (Intern)
Qualification and testing of CT systems
This chapter focuses on system verification and conformance to specifications. System qualification is carried out to ensure that the system and its components achieve the best performance—usually corresponding to the specifications made by the manufacturer. Acceptance and re-verification testing are undertaken on the overall integrated system to check whether the system performs as specified.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Physikalisch-Technische Bundesanstalt, University of Padua
Authors: Bartscher, M. (Ekstern), Neuschaefer-Rube, U. (Ekstern), Illemann, J. (Ekstern), Borges de Oliveira, F. (Ekstern), Stolfi, A. (Intern), Carmignato, S. (Ekstern)
Pages: 185-228
Publication date: 2018

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Title of host publication: Industrial X-Ray Computed Tomography
Publisher: Springer
Editors: Carmignato, S., Dewulf, W., Leach, R.
ISBN (Print): 978-3-319-59571-9
ISBN (Electronic): 978-3-319-59573-3
Chapter: 6
Main Research Area: Technical/natural sciences
DOIs:
10.1007/978-3-319-59573-3_6
Publication: Research - peer-review › Book chapter – Annual report year: 2018

Quantification of local mobilities
A new method for quantification of mobilities of local recrystallization boundary segments is presented. The quantification is based on microstructures characterized using electron microscopy and on determination of migration velocities and driving forces for local boundary segments. Pure aluminium is investigated and the results show that even for a single recrystallization boundary, different boundary segments migrate differently, and the differences can be understood based on variations in mobilities and local deformed microstructures. The present work has important implications for understanding of recrystallization boundary migration, and suggests an experimental way forward for how to determine boundary mobilities during recrystallization.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials science and characterization
Authors: Zhang, Y. B. (Intern)
Pages: 286-289
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Main Research Area: Technical/natural sciences

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Journal: Scripta Materialia
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Recent research trends in organic Rankine cycle technology: A bibliometric approach

This work describes the contribution of researchers around the world in the field of the organic Rankine cycle in the period 2000–2016. A bibliometric approach was applied to analyze the scientific publications in the field using the Scopus Elsevier database, together with Science Citation Index Expanded. Different aspects of the publications were analyzed, such as publication type, major research areas, journals, citations, authorship pattern, affiliations as well as the keyword occurrence frequency. The impact factor, h-index and number of citations were used to investigate the strength of active countries, institutes, authors, and journals in the organic Rankine cycle technology field. From 2000 to 2016, there were 2120 articles published by 3443 authors from 997 research institutes scattered over 71 countries. The total number of citations and impact factor are 36,739 and 4597, respectively, corresponding to 17 citations per paper and an impact factor of 2.168 per publication. The research articles originate primarily from China, the USA, and European countries. Results indicate that China, the United States, Italy, Greece, Belgium, Spain, Germany and the United Kingdom are the leading countries in organic Rankine cycle research and account for 64% of the total number of publications. The core research activities in the field are mainly focused on applications of the organic Rankine cycle technology, working fluids selection/performance, cycle architecture, and design/optimization. The most productive journal, author, institution, and country are Energy, Ibrahim Dincer, Tianjin University China and China, respectively.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, City University of Hong Kong, University of Science and Technology of China
Authors: Imran, M. (Intern), Haglind, F. (Intern), Asim, M. (Ekstern), Zeb Alvi, J. (Ekstern)
Pages: 552-562
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Renewable and Sustainable Energy Reviews
Volume: 81
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Web of Science (2016): Indexed yes
Scopus rating (2016): CiteScore 9.52 SJR 3.051 SNIP 3.454
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.999 SNIP 3.387 CiteScore 8.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.106 SNIP 3.761 CiteScore 7.79
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.072 SNIP 3.889 CiteScore 7.88
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.814 SNIP 3.915 CiteScore 7.24
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.787 SNIP 3.901 CiteScore 7.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.374 SNIP 3.112
Response of oxide nanoparticles in an oxide dispersion strengthened steel to dynamic plastic deformation

The behavior of oxide nanoparticles in an oxide dispersion strengthened (ODS) steel subjected to dynamic plastic deformation (DPD) was investigated by transmission electron microscopy (TEM) and high resolution TEM (HRTEM). Contrary to the motivation for dispersing oxides in a ferritic matrix that the hard particles would be non-deformable and constitute obstacles of plastic deformation, it is discovered that oxide nanoparticles with sizes smaller than 20 nm were appreciably deformed to an average equivalent strain of 1.2 in the sample after DPD to a strain of 2.1. The plastic distortion of the oxide nanoparticles by compression increases with the externally applied strain. HRTEM analysis demonstrates that deformation twinning is the dominant mechanism of plastic deformation for the oxide nanoparticles. In addition, experimental results show that the deformation of oxide nanoparticles does not only occur at high strain rates, but also at lower strain rates, and does not rely on the interfacial coherency between the oxide nanoparticle and the ferritic steel matrix. Due to the incompatible deformation between the oxide nanoparticles and matrix, nanoscale voids form at their interface during deformation at low strains, and evolve with increasing deformation in distinctively different manner around larger and smaller particles. The reasons for the size effect on the deformation of oxide nanoparticles and on the co-deformation between oxide nanoparticles and ferritic matrix in the ODS steel are discussed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, University of Manchester
Authors: Zhang, Z. (Ekstern), Pantleon, W. (Intern)
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Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
Journal: Acta Materialia
Volume: 149
ISSN (Print): 1359-6454
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.67 SJR 3.283 SNIP 2.674
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Response predictions using the observed autocorrelation function

This article studies a procedure that facilitates short-time, deterministic predictions of the wave-induced motion of a marine vessel, where it is understood that the future motion of the vessel is calculated ahead of time. Such predictions are valuable to assist in the execution of many marine operations (crane lifts, helicopter landings, etc.), as a specific prediction can be used to inform whether it is safe, or not, to carry out the particular operation within the nearest time horizon. The examined prediction procedure relies on observations of the correlation structure of the wave-induced response in study.
Thus, predicted (future) values ahead of time for a given time history recording are computed through a mathematical combination of the sample autocorrelation function and previous measurements recorded just prior to the moment of action. Importantly, the procedure does not need input about the exciting wave system, and neither does it rely on o-line training. In the article, the prediction procedure is applied to experimental data obtained through model-scale tests, and the procedure's predictive performance is investigated for various irregular wave scenarios. The presented results show that predictions can be successfully made in a time horizon corresponding to about 8-9 wave periods ahead of current time (the moment of action).

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Norwegian University of Science and Technology
Authors: Nielsen, U. D. (Intern), H. Brodtkorb, A. (Ekstern), Jensen, J. J. (Intern)
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Main Research Area: Technical/natural sciences

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Journal: Marine Structures
Volume: 58
ISSN (Print): 0951-8339
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.618 SNIP 2.602 CiteScore 2.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.431 SNIP 3.026 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.314 SNIP 2.871 CiteScore 2.42
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.836 SNIP 3.464 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.611 SNIP 2.795 CiteScore 1.82
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.136 SNIP 2.518
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.165 SNIP 2.795
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.821 SNIP 2.891
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.185 SNIP 1.652
Scopus rating (2006): SJR 1.404 SNIP 1.983
Review of experiments and calculation procedures for ship collision and grounding damage

Abstract The paper presents a review of experiments and calculation procedures for the resistances of ship structural components subjected to impact loadings. The purpose of the paper is to highlight the importance of large-scale collision and grounding experiments and to discuss the technical difficulties and challenges in analytical, empirical and numerical analyses. Experiments on ship structural components are benchmarks and baselines, used to propose analytical or empirical formulae for the structural energy absorptions and/or to validate numerical analyses considering the actual structural and material characteristics. In recent literature, analytical and numerical calculations provide relatively accurate prediction of the purely plastic responses of ship structures under impact loads, but universal approaches have not been found for fracture predictions. The existing formulae for failure criteria still show limitations when evaluating material fracture in various damage patterns. Recently, semi-analytical approaches have been developed to evaluate the relationship between the absorbed energy and the damaged material volume, taking into account the structural arrangements. It seems that these semi-analytical methods often show better accuracy than the numerical simulations when predicting the experimental results.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Wuhan University of Technology, Lloyd's Register EMEA
Authors: Liu, B. (Ekstern), Pedersen, P. T. (Intern), Zhu, L. (Ekstern), Zhang, S. (Ekstern)
Pages: 105-121
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Marine Structures
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.49 SJR 1.655 SNIP 2.636
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.618 SNIP 2.602 CiteScore 2.77
Abstract In metal forming processes, friction between tool and workpiece is an important parameter influencing the material flow, surface quality and tool life. Theoretical models of friction in metal forming are based on analysis of the real contact area in tool-workpiece interfaces. Several research groups have studied and modeled the asperity flattening of workpiece material against tool surface in dry contact or in contact interfaces with only thin layers of lubrication with the aim to improve understanding of friction in metal forming. This paper aims at giving a review of the most important contributions during the last 80 years covering experimental techniques, upper bound solutions, slip-line analyses and numerical simulations. Each of the contributions shed light on the importance of the real contact area and the influencing parameters including the material properties, surface conditions, normal pressure, sliding length and speed, temperature changes, friction on the flattened plateaus and deformation of the underlying material. The review illustrates the
development in the understanding of asperity flattening and the methods of analysis.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Nielsen, C. (Intern), Bay, N. (Intern)
Pages: 234–241
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Journal of Materials Processing Technology
Volume: 255
ISSN (Print): 0924-0136
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed Yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 3.62 SJR 1.701 SNIP 2.569
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 1.406 SNIP 2.49 CiteScore 2.9
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 2.15 SNIP 3.893 CiteScore 3.43
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.717 SNIP 3.479 CiteScore 2.87
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.733 SNIP 3.766 CiteScore 2.71
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 1.349 SNIP 3.216 CiteScore 2.52
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 1.215 SNIP 2.381
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.001 SNIP 1.755
- Scopus rating (2007): SJR 0.809 SNIP 1.562
- Scopus rating (2006): SJR 0.768 SNIP 1.384
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.767 SNIP 1.063
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 0.716 SNIP 1.249
- Web of Science (2004): Indexed yes
- Scopus rating (2003): SJR 0.622 SNIP 1.027
- Web of Science (2003): Indexed yes
Sea State Estimation Using Vessel Response in Dynamic Positioning

This paper presents a novel method for estimating the sea state parameters based on the heave, roll and pitch response of a vessel in dynamic positioning (DP), i.e., without forward speed. The algorithm finds the wave spectrum estimate from the response measurements by directly solving a set of linear equations, and as a result it is computationally efficient. The main vessel parameters are required as input. Apart from this the method is signal-based, with no assumptions on the wave spectrum shape. Performance of the proposed algorithm is demonstrated on full-scale experimental DP data of a vessel in three different sea states at head, bow, beam, quartering and following sea waves, respectively.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Norwegian University of Science and Technology
Authors: H. Brodtkorb, A. (Ekstern), Nielsen, U. D. (Intern), J. Sørensen, A. (Ekstern)
Pages: 76–86
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Applied Ocean Research
Volume: 70
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.16 SJR 1.202 SNIP 1.75
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.245 SNIP 1.999 CiteScore 2.1
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.442 SNIP 2.244 CiteScore 1.91
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.243 SNIP 2.332 CiteScore 1.84
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.234 SNIP 1.922 CiteScore 1.46
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.496 SNIP 1.975 CiteScore 1.73
ISI indexed (2011): ISI indexed yes
Second-harmonic-generation-based technique for examining laser diode wavelength dynamics in the μs to ms range

Wavelength information is essential for any researcher in optics and photonics, and for this reason, a wide range of devices is available for measuring it. However, the techniques available today are limited either to a resolution of nanometers or a measurement rate of kHz. In this paper, we present a simple but highly versatile technique based on second-harmonic generation to measure fast wavelength dynamics of laser diodes. We demonstrate a resolution of 0.7 pm and a measurement rate in the MHz range. The measurement rate is limited only by the photodetector, and the wavelength resolution is limited mainly by the length of the nonlinear crystal and the noise of the detectors. The technique can, e.g., be used to investigate the mode-hop behavior of laser diodes during pulsed operation. To demonstrate this, we show the wavelength changes of a laser diode during a single pulse. (c) 2018 Optical Society of America

General information
State: Published
Organisations: Department of Photonics Engineering, Diode Lasers and LED Systems, Department of Mechanical Engineering
Authors: Christensen, M. (Intern), Hansen, A. K. (Intern), Noordegraaf, D. (Intern), Skovgaard, P. M. W. (Intern), Jensen, O. B. (Intern)
Pages: 1432-1436
Publication date: 2018
Main Research Area: Technical/natural sciences

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Journal: Applied Optics
Volume: 57
Issue number: 6
ISSN (Print): 1559-128X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.61 SJR 0.633 SNIP 1.095
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
We present a novel numerical model for simulating current and wave interaction with a floater–net system. The main contribution of the paper is the integration of the floater motion and the fluid–structure interaction analysis of the net structure in the same modelling framework via the computational fluid dynamic approach. The sinker and the mooring lines were not directly resolved, but their effects were partially modelled. The model couples a hydrodynamic solver, a rigid
body motion solver, a mesh motion solver and a structural solver in a segregated manner. In the numerical model, the net structure was modelled as a set of dynamic porous zones. A lumped mass model was coupled with it to realize fluid–structure interaction analysis for the net structure. The floater was treated as a rigid body, which was resolved by the body-fitted computational mesh in the fluid domain. The motion equation for the floater was set up based on the principle of linear and angular momentum balance. Different motion integration schemes were implemented and tested in the numerical model. The numerical model was validated against three sets of available experimental data in the open literature. The first set of validation cases treated the floater motion in regular waves. The second set of validation cases focused on the fluid–structure interaction analysis of the net structure. The final one was related to the whole floater–net system in regular waves, and combined current and wave condition.
Solution for the future smart energy system: A polygeneration plant based on reversible solid oxide cells and biomass gasification producing either electrofuel or power

The Danish energy system will continue to evolve in the years ahead as the goal is to be independent of fossil fuels by 2050. This introduces several challenges in dealing with intermittent energy sources, such as wind and solar. A novel biomass-based polygeneration system concept is proposed, which can offer certain solutions to these challenges. The main concept is storing electricity by producing bio-SNG from syngas generated by biomass gasification and electrolytic hydrogen when electricity prices are low, and producing electricity when prices are high. The analytical framework is built on thermodynamic modeling, and techno-economic analysis is applied to determine the total revenues required and net present value, given a range of bio-SNG and electricity prices. The marginal cost of operation is then used to estimate the average operation time in each production mode. The results demonstrate that both electricity (46%) and bio-SNG (69%) production efficiencies are high. If district heating is coproduced, the total efficiencies increase to 85% and 90%, respectively. Furthermore, it was found that the annual operation time in each mode varies significantly depending on the future electricity price scenario and bio-SNG price. A system that can select the production or consumption of electricity depending on the market price enables constant operation all year round. This results in a higher net present value for the system and may lead to a positive return on investment, given the appropriate market price of electricity and bio-SNG. However, the techno-economic analysis revealed that the district heating product may be important for the economic feasibility of the polygeneration plant. This system may offer solutions in a smart energy system connecting electrofuel, heat, and power production, toward a 100% renewable system.
Spatiotemporal and economic analysis of industrial excess heat as a resource for district heating

Industrial excess heat may often be utilised for district heating and thus replace existing expensive or CO₂-emitting technologies. Previous works analysed the distribution of excess heat by temperature intervals and their geographical distribution relative to district heating areas. A more detailed analysis of the most suitable types of industries and the costs is required, allowing a targeted exploitation of this resource. This work extends the spatial and thermodynamic analysis, to account for the temporal match between industrial excess heat and district heating demands, as well as the costs for implementation and operation of the systems. This allows the determination of cost-effective district heating potentials, as well as the analysis of different industries and technological requirements. The results show that the temporal mismatch between excess heat and district heating demand and lack of demand, reduces the theoretical substitution potential by almost 30%. If heat storages are introduced, the total potential is reduced by only 10%. A majority of the excess heat can be utilised at socioeconomic heating costs lower than the average Danish district heating price and the cost of solar district heating. Excess heat from oil refineries, building material and food production can be utilised at the lowest specific costs.
Statistical investigations into the erosion of material from the tool in micro-electrical discharge machining

This paper presents a statistical study of the erosion of material from the tool electrode in a micro-electrical discharge machining process. The work involves analysis of variance and analysis of means approaches on the results of the tool electrode wear rate obtained based on design of experiments approach. The input factors used in the experiments are discharge current (Id), discharge frequency (fd), and pulse width (wp). The individual effects as well as interactions among the input factors have been considered for the analysis. The results of this investigation show that discharge current (Id) and discharge frequency (fd) control the erosion of material from the tool electrode. The material erosion from the tool electrode (Me) increases linearly with the discharge frequency. As the current index increases from 20 to 35, the Me decreases linearly by 29%, and then increases by of 36%. The current index of 35 gives the minimum material erosion from the tool. It is observed that none of the two-factor interactions are significant in controlling the erosion of the material from the tool.

Structural Stability and Vibration: An Integrated Introduction by Analytical and Numerical Methods

This book offers an integrated introduction to the topic of stability and vibration. Strikingly, it describes stability as a function of boundary conditions and eigenfrequency as a function of both boundary conditions and column force. Based on a post graduate course held by the author at the University of Southern Denmark, it reports on fundamental formulas and makes uses of graphical representation to promote understanding. Thanks to the emphasis put on analytical methods and numerical results, the book is meant to make students and engineers familiar with all fundamental equations and their derivation, thus stimulating them to write interactive and dynamic programs to analyze instability and vibrational modes.
Structure and strength of sub-100 nm lamellar structures in cold-drawn pearlitic steel wire

Pearlitic steel wire, with a representative sub-100 nm lamellar structure, is the strongest mass-produced steel with an excellent combination of formability and strength. This overview summarises investigations of cold-drawn pearlitic steel wire in the last decades, covering the microstructural evolution and strengthening mechanisms. Based on quantitative structural parameters, this overview covers a quantitative and extensive analysis of structure–strength relationships. By focusing on the structure, challenges and future strategy are outlined to further improve the mechanical behaviour and performance of pearlitic steel wire to widen its use in society.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials science and characterization, Department of Wind Energy, Materials and Surface Engineering, Tsinghua University
Authors: Zhang, X. (Intern), Hansen, N. (Intern), Godfrey, A. (Ekstern), Huang, X. (Intern)
Number of pages: 15
Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
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ISSN (Print): 0267-0836
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.43 SJR 0.814 SNIP 0.812
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.632 SNIP 0.764 CiteScore 1.1
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.788 SNIP 1.005 CiteScore 1.1
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.636 SNIP 0.868 CiteScore 0.92
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.683 SNIP 0.979 CiteScore 0.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.674 SNIP 1.059 CiteScore 0.94
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.638 SNIP 0.779
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.876 SNIP 1.08
Surface technology is essential for transition to a hydrogen-based energy system

The importance of advanced surface technology for the success of the ongoing energy turnaround in Germany has recently been discussed in this journal. The purpose of the present article is to add views based on the conditions valid for the Nordic region.

General information

State: Published
Organisations: Department of Mechanical Engineering, Danish Technological Institute, Jönköping University
Authors: Nielsen, L. P. (Ekstern), Leisner, P. (Ekstern), Møller, P. (Intern)
Pages: 8-10
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Publication information

Journal: Transactions of the Institute of Metal Finishing
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.7 SJR 0.289 SNIP 0.761
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.36 SNIP 0.653 CiteScore 0.71
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.354 SNIP 0.767 CiteScore 1.08
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.377 SNIP 0.368 CiteScore 0.87
ISI indexed (2013): ISI indexed yes
Swim and fly: escape strategy in neustonic and planktonic copepods

Copepods can respond to predators by powerful escape jumps that in some surface-dwelling forms may propel the copepod out of the water. We studied the kinematics and energetics of submerged and out-of-water jumps of two neustonic pontellid copepods, Anomalocera patersoni and Pontella mediterranea, and one pelagic calanoid copepod, Calanus helgolandicus (euxinus). We show that jumping out of the water does not happen just by inertia gained during the copepod's acceleration underwater, but also requires the force generated by the thoracic limbs when breaking through the water's surface to overcome surface tension, drag and gravity. The timing of this appears to be necessary for success. At the moment of breaking the water interface, the instantaneous velocity of the two pontellids reached 125 cm s⁻¹, while their maximum underwater speed (115 cm s⁻¹) was close to that of similarly sized C. helgolandicus (106 cm s⁻¹). The average specific power produced by the two pontellids during out-of-water jumps (1700-3300 W kg⁻¹ muscle mass) was close to that during submerged jumps (900-1600 W kg⁻¹ muscle mass) and, in turn, similar to that produced during submerged jumps of C. helgolandicus (1300 W kg⁻¹ muscle mass). The pontellids may shake off water adhering to their body by repeated strokes of the limbs during flight, which leads to a slight acceleration in the air. Our observations suggest that out-of-water jumps of pontellids are not dependent on any exceptional ability to perform this behavior but have the same energetic cost and are based on the same kinematic patterns and contractive capabilities of muscles as those of copepods swimming submerged.
Systematic design of 3D auxetic lattice materials with programmable Poisson’s ratio for finite strains

This paper presents a systematic approach for designing 3D auxetic lattice materials, which exhibit constant negative Poisson’s ratios over large strain intervals. A unit cell model mimicking tensile tests is established and based on the proposed model, the secant Poisson’s ratio is defined as the negative ratio between the lateral and the longitudinal engineering strains. The optimization problem for designing a material unit cell with a target Poisson’s ratio is formulated to minimize the average lateral engineering stresses under the prescribed deformations. Numerical results demonstrate that 3D auxetic lattice materials with constant Poisson’s ratios can be achieved by the proposed optimization formulation and that two sets of material architectures are obtained by imposing different symmetry on the unit cell. Moreover, inspired by the topology-optimized material architecture, a subsequent shape optimization is proposed by parametrizing material architectures using super-ellipsoids. By designing two geometrical parameters, simple optimized material microstructures with different target Poisson’s ratios are obtained. By interpolating these two parameters as polynomial functions of Poisson’s ratios, material architectures for any Poisson’s ratio in the interval of \( \nu \in [-0.78, 0.00] \) are explicitly presented. Numerical evaluations show that interpolated auxetic lattice materials exhibit constant Poisson’s ratios in the target strain interval of \([0.00, 0.20]\) and that 3D auxetic lattice material architectures with programmable Poisson’s ratio are achievable.
System evaluation of offshore platforms with gas liquefaction processes

Abstract Floating, production, storage and offloading plants are facilities used for offshore processing of hydrocarbons in remote locations. At present, the produced gas is injected back into the reservoir instead of being exported. The implementation of refrigeration processes offshore for liquefying natural gas provides the opportunity to monetize offshore gas resources. The present work analyzes the performance of offshore platforms, from the oil processing to the gas liquefaction system. Different feed compositions, system layouts and liquefaction processes are considered. Potential system improvements are discussed based on an energy and exergy analysis. Compared to a standard platform where gas is directly injected into the reservoir, the total power consumption increases by up to 50%, and the exergy destruction within the processing plant doubles when a liquefaction system is installed. It is therefore essential to conduct a careful analysis of the trade-off between the capital costs and operating revenues for such options.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, University of São Paulo
Authors: Nguyen, T. (Intern), de Oliveira Júnior, S. (Ekstern)
Pages: 594–606
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Main Research Area: Technical/natural sciences

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Journal: Energy
Volume: 144
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798
This paper focuses on the techno-economic feasibility of a grid-tied hybrid microgrid system for local inhabitants of Kallar Kahar near Chakwal city of Punjab province in Pakistan and investigates the potential for electricity generation through hybrid wind, photovoltaic and biomass system. The comprehensive resource assessment of wind, biomass and solar energy is carried out for grid integration. Homer Pro software is used to model a hybrid microgrid system. Optimization results and sensitivity analysis is carried out to ensure the robustness and cost-effectiveness of the proposed hybrid renewable energy system.
microgrid system. The total load has been optimally shared among generated power through wind, photovoltaic and biomass resources and surplus power is supplied to the national grid in case of low local demand of the load. The results of techno-economic feasibility study show that hybrid power system can generate more than 50 MW. The cost of energy based on peak load demand profiles are considered for both residential and commercial sectors. The cost of hybrid system for peak load of 73.6 MW is 180.2 million USD and levelized cost of energy is 0.05744 $/kWh.

**General information**

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Organisations: Department of Mechanical Engineering, Thermal Energy, University of Management & Technology, Lahore  
Pages: 208-234  
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Main Research Area: Technical/natural sciences  

**Publication information**

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Ratings:  
BFI (2018): BFI-level 2  
Web of Science (2018): Indexed yes  
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Web of Science (2017): Indexed yes  
BFI (2016): BFI-level 2  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 2  
Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798  
Web of Science (2016): Indexed yes  
BFI (2014): BFI-level 2  
Scopus rating (2014): SJR 2.647 SNIP 2.63 CiteScore 5.7  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 2  
Scopus rating (2013): SJR 2.54 SNIP 2.593 CiteScore 5.02  
ISI indexed (2013): ISI indexed yes  
Web of Science (2013): Indexed yes  
BFI (2012): BFI-level 2  
Scopus rating (2012): SJR 1.998 SNIP 2.25 CiteScore 4.25  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 2  
Scopus rating (2011): SJR 1.609 SNIP 2.043 CiteScore 4  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 2  
Scopus rating (2010): SJR 1.814 SNIP 2.725  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 2  
Scopus rating (2009): SJR 1.729 SNIP 2.313  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 2  
Scopus rating (2008): SJR 1.106 SNIP 1.444  
Scopus rating (2007): SJR 0.913 SNIP 1.481  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 0.875 SNIP 1.306  
Web of Science (2006): Indexed yes
The impact of applying product-modelling techniques in configurator projects

This paper aims to increase understanding of the impact of using product-modelling techniques to structure and formalise knowledge in configurator projects. Companies that provide customised products increasingly apply configurators in support of sales and design activities, reaping benefits that include shorter lead times, improved quality of specifications and products, and lower overall product costs. The design and implementation of configurators are a challenging task that calls for scientifically based modelling techniques to support the formal representation of configurator knowledge. Even though extant literature has shown the importance of formal modelling techniques, the impact of utilising these techniques remains relatively unknown. Therefore, this article studies three main areas: (1) the impact of using modelling techniques based on Unified Modelling Language (UML), in which the phenomenon model and information model are considered visually, (2) non-UML-based modelling techniques, in which only the phenomenon model is considered and (3) non-formal modelling techniques. This study analyses the impact to companies from increased availability of product knowledge and improved control of product variants. The methodology employed is an exploratory survey, followed by interviews with 18 manufacturing companies providing customised products. The results indicate that companies using UML-based modelling techniques tend to have improved documentation of their product knowledge and an improved ability to reduce the number of product variants. This paper contributes to an increased understanding of what companies can gain from using more formalised modelling techniques in configurator projects, and under what circumstances they should be used.

General information
State: Accepted/In press
Organisations: Department of Management Engineering, Management Science, Operations Management, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Hvam, L. (Intern), Kristjansdottir, K. (Intern), Shafiee, S. (Intern), Mortensen, N. H. (Intern), Herbert-Hansen, Z. N. L. (Intern)
Number of pages: 16
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Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.67 SJR 1.463 SNIP 1.416
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.286 SNIP 1.309 CiteScore 2.29
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
The importance of robust design methodology

While a systematic quality strategy is of crucial importance for the success of manufacturing companies, the universal applicability and effectiveness of implemented quality management practices were called into question by a number of major product recalls in recent years. This article seeks to illustrate how already simple analyses and early stage design methods can help to better understand one of the potential reasons for these failures, namely the variation inherent in manufacturing, assembly, and use processes. Usually thoroughly controlled in production, it seems as if particularly the risk of unanticipated variation effects remain largely underestimated and thus unaccounted for in design practice, sometimes with disastrous consequences. To foster the awareness of this variation and to illustrate the benefits of its early consideration in product development, this paper reviews one of the most infamous recalls in automotive history, that of the GM ignition switch, from the perspective of Robust Design. It is investigated if available Robust Design methods such as sensitivity analysis, tolerance stack-ups, design clarity, etc. would have been suitable to account for the performance variation, which has led to a number of fatal product defects and the recall of 30 million vehicles. Furthermore, the disclosed legal case files were examined, offering a unique opportunity to examine how technical malfunctioning of the ignition switch could stay undetected long enough to result in fatalities.
The influence of self-efficacy on entrepreneurial behavior among K-12 teachers

This study aimed to: (1) assess the unique contributions of self-efficacy to entrepreneurial behavior among teachers; (2) identify the best instrument(s) to measure such contributions by testing a domain-specific instrument (teacher self-efficacy) vs. a general (occupational self-efficacy) one; (3) identify the demographic characteristics associated with entrepreneurial behavior. A sample of 401 teachers from across the USA completed the online survey. The findings indicated that self-efficacy predicts entrepreneurial behavior and that occupational self-efficacy is a slightly better predictor of entrepreneurial behavior than teacher self-efficacy. The results also identified age and education as the demographic characteristics associated with entrepreneurial behavior.
Thermal behaviour of additively manufactured injection moulding inserts

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science
Authors: Hofstätter, T. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 2
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Main Research Area: Technical/natural sciences
Conference: euspen's 18th International Conference & Exhibition, Venice, Italy, 04/06/2018 - 04/06/2018
Additive Manufacturing, Injection Moulding, Micro Structures, Inserts, Simulation
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2018

The UV filtering potential of drop-casted layers of frustules of three diatom species

Diatoms are in focus as biological materials for a range of photonic applications. Many of these applications would require embedding a multitude of diatoms in a matrix (e.g. paint, crème or lacquer); however, most studies on the photonic and spectral properties of diatoms frustules (silica walls) have been carried out on single cells. In this study, for the first time, we test the spectral properties of layers of frustules of three diatom species (Coscinodiscus granii, Thalassiosira punctifera and Thalassiosira pseudonana), with special focus on transmission and reflectance in the UV range. The transmittance efficiency in the UV A and B range was: T. pseudonana (56–59%) > C. granii (53–54%) > T. punctifera (18–21%) for the rinsed frustules. To investigate the underlying cause of these differences, we performed X-ray scattering analysis, measurement of layer thickness and microscopic determination of frustule nanostructures. We further tested dried intact cells in the same experimental setup. Based on the sedata we discuss the relative importance of crystal structure properties, nanostructure and quantity of material on the spectral properties of diatom layers. Characterization of the UV protection performance of layers of diatom frustules is of central relevance for their potential use as innovative bio-based UV filters.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, National Institute of Aquatic Resources, Section for Oceans and Arctic, University of Copenhagen, International Iberian Nanotechnology Laboratory, Københavns Universitet
Authors: Su, Y. (Ekstern), Lenau, T. A. (Intern), Gundersen, E. (Ekstern), Kirkensgaard, J. J. K. (Ekstern), Maibohm, C. (Ekstern), Pinti, J. P. A. (Intern), Elleegaard, M. (Forskerdatabase)
Number of pages: 10
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Main Research Area: Technical/natural sciences

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Journal: Scientific Reports
Volume: 8
Article number: 959
ISSN (Print): 2045-2322
Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Tool design and materials for electro sinter forging (ESF)

A near net-shape forming process represents a suitable solution to obtain the final product by avoiding secondary machining processes. In this field, electro sinter forging is capable of accomplishing the advantages of sintering in a reduced amount of time. Classified as a high field mode (HFM) process, the main requirement is the electrical current passing through the electrical conducting powder. To obtain this, a closed-die setup with electrical insulating properties was used. Furthermore, the alignment between the compacting punch and die needed to be ensured by pre-aligning or alternatively by using an alignment system. The present work is focused on the designing phase of a tool for the electro sinter forging of a disc, made from titanium powder. By applying a pre-alignment system, the setup resulted suitable for this application. A tool design for sintering rings is also showed.

Too much food may cause reduced growth of blue mussels (Mytilus edulis) – Test of hypothesis and new ‘high Chl a BEG-model’

Growth of the blue mussel (Mytilus edulis) is closely related to the biomass of phytoplankton (expressed as concentration of chlorophyll a, Chl a), but the effect of too much food in eutrophicated areas has so far been overlooked. The hypothesis addressed in the present study suggests that high Chl a concentrations (> about 8μgChl al⁻¹) result in reduced growth because mussels are not evolutionarily adapted to utilize such high phytoplankton concentrations and to physiologically regulate the amount of ingested food in such a way that the growth rate remains high and constant. We first make a comparison of literature values for actually measured weight-specific growth rates (μ, %d⁻¹) of small (20 to 25mm) M. edulis, either grown in controlled laboratory experiments or in net bags in Danish waters, as a function of Chl a. A linear increase up to about μ=8.3%d⁻¹ at 8.1μgChl al⁻¹ fits the “standard BEG-model” after which a marked decrease takes place, and this supports the hypothesis. A “high Chl a BEG-model”, applicable to newly settled post-metamorphic and small juvenile (non-spawning) mussels in eutrophicated Danish and other temperate waters, is developed and tested, and
new data from a case study in which the growth of mussels in net bags was measured along a Chl a gradient are presented. Finally, we discuss the phenomenon of reduced growth of mussels in eutrophicated areas versus a possible impact of low salinity. It is concluded that it is difficult to separate the effect of salinity from the effect of Chl a, but the present study shows that too much food may cause reduced growth of mussels in eutrophicated marine areas regardless of high or moderate salinity above about 10psu.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Syddansk Universitet  
Authors: Larsen, P. S. (Intern), Lüskow, F. (Ekstern), Riisgård, H. U. (Ekstern)  
Pages: 299-306  
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Ratings:  
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Web of Science (2018): Indexed yes  
BFI (2017): BFI-level 1  
Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Web of Science (2016): Indexed yes  
Scopus rating (2016): CiteScore 2.61 SJR 1.403 SNIP 1.282  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 1.093 SNIP 1.033 CiteScore 2.19  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 1.231 SNIP 1.494 CiteScore 2.69  
Web of Science (2014): Indexed yes  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 1.609 SNIP 1.457 CiteScore 2.99  
ISI indexed (2013): ISI indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 1.534 SNIP 1.276 CiteScore 2.51  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 1.51 SNIP 1.289 CiteScore 2.43  
ISI indexed (2011): ISI indexed yes  
Web of Science (2011): Indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.43 SNIP 1.122  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.4 SNIP 1.097  
Web of Science (2009): Indexed yes  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 1.295 SNIP 1.289  
Web of Science (2008): Indexed yes  
Scopus rating (2007): SJR 1.164 SNIP 1.235  
Web of Science (2007): Indexed yes  
Scopus rating (2006): SJR 1.044 SNIP 1.31  
Web of Science (2006): Indexed yes  
Scopus rating (2005): SJR 1.372 SNIP 1.246
This paper investigates the application of density-based topology optimization to the design of air-cooled forced convection heat sinks. To reduce the computational burden that is associated with a full 3D optimization, a pseudo 3D optimization model comprising a 2D modeled conducting metal base layer and a thermally coupled 2D modeled thermofluid design layer is used. Symmetry conditions perpendicular to the flow direction are applied to generate periodic heat sink designs. The optimization objective is to minimize the heat sink heat transfer resistance for a fixed pressure drop over the heat sink and a fixed heat production rate in the base plate. Optimized designs are presented and the resulting fin geometry is discussed from a thermal engineering point of view and compared to fin shapes resulting from a pressure drop minimization objective. Parametric studies are conducted to analyze the influence of the pressure drop on the heat sink heat transfer resistance. To quantify the influence of the assumptions made in the pseudo 3D optimization model, validation simulations with a body-fitted mesh in 2D and 3D are conducted. A good agreement between optimization model and validation simulations is found, confirming the physical validity of the utilized optimization model. Two topology optimized designs are exemplarily benchmarked against a size optimized parallel fin heat sink and an up to 13.6% lower thermal resistance is found to be realized by the topology optimization.
Topology optimization of turbulent flows
The aim of this work is to present a fast and viable approach for taking into account turbulence in topology optimization of complex fluid flow systems, without resorting to any simplifying assumptions in the derivation of discrete adjoints. Topology optimization is an iterative gradient-based design process which minimizes an objective and satisfies a set of selected design constraints by distributing material in a design domain. The gradients are obtained using adjoint sensitivity analysis which requires solutions of a forward state problem and an additional adjoint problem. In the presented article the forward solver is based on finite volume discretized Reynolds-averaged Navier–Stokes equations coupled with either one- or two-equation turbulence closure models, and the adjoint solver is obtained via automatic differentiation. The presented approach is demonstrated on the optimization of several 2D and 3D examples including a detailed comparison to designs and sensitivities obtained with different turbulence models and under a frozen turbulence assumption. The results demonstrate the importance of exact sensitivity analysis and open new possibilities for the design of large scale multiphysics problems involving turbulent flows.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Dilgen, C. B. (Intern), Dilgen, S. B. (Intern), Fuhrman, D. R. (Intern), Sigmund, O. (Intern), Lazarov, B. S. (Intern)
Pages: 363–393
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Main Research Area: Technical/natural sciences
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Volume: 331
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Ratings:
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.31 SJR 2.743 SNIP 1.962
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.823 SNIP 2.126 CiteScore 3.91
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.418 SNIP 2.087 CiteScore 3.41
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.095 SNIP 2.252 CiteScore 3.5
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.543 SNIP 2.247 CiteScore 3.04
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.679 SNIP 1.959 CiteScore 3.03
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.463 SNIP 1.937
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.274 SNIP 1.73
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 2.184 SNIP 1.985
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 2.22 SNIP 1.863
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 2.109 SNIP 2.096
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 2.276 SNIP 1.881
Scopus rating (2004): SJR 1.641 SNIP 1.803
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.215 SNIP 1.629
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.094 SNIP 1.523
Scopus rating (2001): SJR 1.864 SNIP 1.502
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.899 SNIP 1.501
Scopus rating (1999): SJR 1.893 SNIP 1.212
Original language: English
Topology optimization, Automatic differentiation, Turbulent flow
DOIs:
10.1016/j.cma.2017.11.029
Transformation of iron containing constituent intermetallic particles during hydrothermal treatment

Aluminium alloys AA3102 and AA9108 were treated with high temperature steam, which resulted in the formation of an oxide layer of average thickness of 300–400 nm. Hydrothermal steam treatment resulted in the removal or oxidation of Al(Fe) Mn and Al(Fe-Si) Mn type intermetallic particles present in the alloys. Furthermore, electron energy loss spectroscopy analysis revealed that during the steam treatment, the Fe enriched areas of the Al(Fe-Si) Mn type intermetallic particles were transformed into Fe₂O₃ and Fe₃O₄ phases, while energy-dispersive X-ray spectroscopy line profile measurements by scanning transmission electron microscope showed that Mn and Si were leached out and incorporated into the surrounding oxide layer. Further, the part of intermetallic phase was transformed into polycrystalline material.

General information
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Organisations: Materials and Surface Engineering, Department of Mechanical Engineering, Center for Electron Nanoscopy
Authors: Borgaonkar, S. (Intern), Din, R. U. (Intern), Kasama, T. (Intern), Ambat, R. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.83 SJR 0.64 SNIP 0.897
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.705 SNIP 0.98 CiteScore 1.84
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.73 SNIP 1.115 CiteScore 1.94
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.818 SNIP 1.215 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.899 SNIP 1.162 CiteScore 1.86
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.995 SNIP 1.337 CiteScore 2.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.141 SNIP 1.235
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.142 SNIP 1.221
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.191 SNIP 1.282
Uncovering the local inelastic interactions during manufacture of ductile cast iron: How the substructure of the graphite particles can induce residual stress concentrations in the matrix

Recent X-ray diffraction (XRD) measurements have revealed that plastic deformation and a residual elastic strain field can be present around the graphite particles in ductile cast iron after manufacturing, probably due to some local mismatch in thermal contraction. However, as only one component of the elastic strain tensor could be obtained from the XRD data, the shape and magnitude of the associated residual stress field have remained unknown. To compensate for this and to provide theoretical insight into this unexplored topic, a combined experimental-numerical approach is presented in this paper. First, a material equivalent to the ductile cast iron matrix is manufactured and subjected to dilatometric and high-temperature tensile tests. Subsequently, a two-scale hierarchical top-down model is devised, calibrated on the basis of the collected data and used to simulate the interaction between the graphite particles and the matrix during manufacturing of the industrial part considered in the XRD study. The model indicates that, besides the viscoplastic deformation of the matrix, the effect of the inelastic deformation of the graphite has to be considered to explain the magnitude of the XRD strain. Moreover, the model shows that the large elastic strain perturbations recorded with XRD close to the graphite–matrix interface are not artifacts due to e.g. sharp gradients in chemical composition, but correspond to residual stress concentrations induced by the conical sectors forming the inter- ternal structure of the graphite particles. In contrast to common belief, these results thus suggest that ductile cast iron parts cannot be considered, in general, as stress-free at the microstructural scale.

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Publication date: 2018
Main Research Area: Technical/natural sciences

Publication information
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Web of Science (2017): Indexed yes
Thermophoresis is the phenomenon wherein particles experience a net drift induced by a thermal gradient. In this work, molecular dynamics simulations are conducted to study with atomistic detail the thermophoresis of water nanodroplets inside carbon nanotubes (CNTs) and its interplay with the retarding liquid-solid friction. Different applied temperatures,
thermal gradients, and droplet sizes are used to reveal the dynamics of the two kinetic regimes of the thermophoretic motion in CNTs. The results indicate that during the droplet motion, the thermophoretic force is independent of the velocity of the droplet, whereas the magnitude of the retarding friction force exhibits a linear dependence. In fact, in the initial regime the magnitude of the friction force increases linearly with the droplet velocity, until the thermophoretic force is balanced by the friction force as the droplet reaches its terminal velocity in the final regime. In addition, an increase in the magnitude of the thermophoretic force is found for longer water droplets. These findings provide a deeper understanding of liquid transport driven by temperature gradients in nanoconfined geometries where liquid-solid interfaces govern fluidics.

**General information**

- **State**: Published
- **Organisations**: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
- **Authors**: Oyarzua, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. A. (Ekstern)
- **Pages**: 3672-3677
- **Publication date**: 2018
- **Main Research Area**: Technical/natural sciences

**Publication information**

- **Journal**: Physical Chemistry Chemical Physics
- **Volume**: 20
- **ISSN (Print)**: 1463-9076
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  - BFI (2018): BFI-level 2
  - Web of Science (2018): Indexed yes
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  - BFI (2016): BFI-level 2
  - Scopus rating (2016): CiteScore 4.06 SJR 1.678 SNIP 1.117
  - Web of Science (2016): Indexed yes
  - BFI (2015): BFI-level 2
  - Scopus rating (2015): SJR 1.771 SNIP 1.244 CiteScore 4.45
  - Web of Science (2015): Indexed yes
  - BFI (2014): BFI-level 2
  - Scopus rating (2014): SJR 1.772 SNIP 1.253 CiteScore 4.29
  - Web of Science (2014): Indexed yes
  - BFI (2013): BFI-level 2
  - Scopus rating (2013): SJR 1.715 SNIP 1.216 CiteScore 4.05
  - ISI indexed (2013): ISI indexed yes
  - Web of Science (2013): Indexed yes
  - BFI (2012): BFI-level 2
  - Scopus rating (2012): SJR 1.916 SNIP 1.184 CiteScore 3.67
  - ISI indexed (2012): ISI indexed yes
  - Web of Science (2012): Indexed yes
  - BFI (2011): BFI-level 2
  - Scopus rating (2011): SJR 1.697 SNIP 1.203 CiteScore 3.6
  - ISI indexed (2011): ISI indexed yes
  - Web of Science (2011): Indexed yes
  - BFI (2010): BFI-level 2
  - Scopus rating (2010): SJR 1.802 SNIP 1.196
  - Web of Science (2010): Indexed yes
  - BFI (2009): BFI-level 2
  - Scopus rating (2009): SJR 2.127 SNIP 1.369
  - Web of Science (2009): Indexed yes
  - BFI (2008): BFI-level 2
  - Scopus rating (2008): SJR 2.158 SNIP 1.211
  - Web of Science (2008): Indexed yes
  - Scopus rating (2007): SJR 1.84 SNIP 1.138
GEOMETRICAL CALIBRATION OF X-RAY CT SCANNERS
A method of performing calibration scan and measurement scan in one and the same scanning operation with a calibration object having the fiducial marks arranged in positions spanning a volume enclosing at least a central portion of the measuring object. This avoids the need for one or more separate calibration scans to be performed in addition to the scanning of the measurement object. Considerable time is thereby saved. The fiducial objects are thus distributed, preferably evenly, around the measuring object, whereby homogeneous calibration is ensured. After having performed a scan of the measuring object together with the calibration object and thereby obtained scan data on the measuring object and corresponding scan data on the calibration object the scan data on the fiducial marks of the calibration object are used to calibrate the CT scanner, and the scan data on the measuring object are used to calculate geometric properties of the measuring object.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
Publication date: 26 Jul 2017

Publication information
IPC: G06T 7/ 60 A I
Patent number: EP3195802
Date: 26/07/2017
Priority date: 19/01/2016
Priority number: EP20160151878
Original language: English
Main Research Area: Technical/natural sciences
Source: espacenet
Source-ID: EP3195802
Publication: Research › Patent – Annual report year: 2017

A case hardened component of titanium
The present invention relates to a case hardened component of a titanium alloy, the component having a diffusion zone of a thickness of at least 50 μm, as calculated from the surface of the component, the diffusion zone comprising oxygen and carbon in solid solution and having a distinct phase of a carbo-oxide compound having the composition TiOxC1-x, wherein x is a number in the range of 0.01 to 0.99, which diffusion zone has a microhardness of at least 800 HV0.025 and which carbo-oxide compound has a microhardness of at least 1200 HV0.025. In another aspect the invention relates to a method
of producing the case hardened component. In a further aspect the invention relates to a method of oxidising a component of a Group IV metal.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Centre for oil and gas – DTU, Technical University of Denmark
Authors: Christiansen, T. L. (Intern), Jellesen, M. S. (Intern), Somers, M. A. J. (Intern), Gammeltoft-Hansen, N. B. (Ekstern)
Publication date: 2 Jun 2017

**Publication information**

IPC: C23C8/34
Patent number: WO2017207794
Date: 07/12/2017
Priority date: 02/06/2016
Priority number: EP20160172699
Original language: English
Main Research Area: Technical/natural sciences
Publication: Research › Patent – Annual report year: 2017

**Self-closing sheet for encapsulating and dumping a bulk of material**

The invention relates to a sheet (1) to be placed in relation to a split barge (100) for encapsulating a bulk of material (101) to be dumped when the bulk of material is released, the sheet comprising a material containing portion (4) and at least one material free portion (3) extending from at least two opposed sides of the material containing portion, wherein that the immersed sheet encapsulating the bulk of material comprises an encapsulated body (20) encapsulated by the material containing (4) portion and a self-closing portion (22) being at least a part of the material free portion (3) both extending from an assembly point (21), wherein a closing length of the self-closing portion (22) correspond to at least 5% of the circumventing length of the encapsulated body (20), the circumventing length extending from the assembly point (21) to the assembly point (21). The invention further relates to a method of encapsulating a bulk of material by means of a sheet.

**General information**

State: Published
Organisations: Department of Mechanical Engineering
Authors: Jensen, J. H. (Intern)
Publication date: 16 Feb 2017

**Publication information**

IPC: E02F 7/06 A1
Patent number: WO2017025262
Date: 16/02/2017
Priority date: 12/08/2015
Priority number: EP20150180716
Original language: English
Main Research Area: Technical/natural sciences
Source: espacenet
Source-ID: WO2017025262
Publication: Research › Patent – Annual report year: 2017

**2D Numerical Modelling of the Resin Injection Pultrusion Process Including Experimental Resin Kinetics and Temperature Validation**

In the present study, a two-dimensional (2D) transient Eulerian thermo-chemical analysis of a carbon fibre epoxy thermosetting Resin Injection Pultrusion (RIP) process is carried out. The numerical model is implemented using the well known unconditionally stable Alternating Direction Implicit (ADI) scheme. The total heat of reaction and the cure kinetics of the epoxy thermosetting are determined using Differential Scanning Calorimetry (DSC). A very good agreement is observed between the fitted cure kinetic model and the experimental measurements. The numerical steady state temperature predictions inside the composite profile are validated by comparison with experimental measurements and good agreement is found.

**General information**

State: Published
Drilling is an indispensable process for many manufacturing industries due to its importance for assembling components. This study presents a 3D finite element modeling (3D FEM) approach for drilling process of aluminum 2024-T3. The 3D model of drilling tools for two facet HSSCo and four facet HSS were generated base on the details geometry. The simulations were carried out for both drills in different cutting conditions. The numerically obtained thrust forces were compared against experimental results. The tool stress distribution, chip formation and temperature distribution in the chip area were determined numerically. The results confirm the ability and advantage of 3D FE model of the drilling process.
proposed model employs a Lagrangian explicit finite element formulation to perform coupled thermo-mechanical transient analyses. FE simulations were performed at different cutting conditions to obtain realistic numerical predictions of chip formation, temperature distribution, and cutting forces by considering the effect of tool run-out in the model. The radial run-out is a significant issue in micro milling processes and influences the cutting stability due to chip load and force variations. The Johnson–Cook (JC) material constitutive model was applied and its constants were determined by an inverse method based on the experimental cutting forces acquired during the micro end-milling tests. The FE model prediction capability was validated by comparing the numerical model results with experimental tests. The maximum tool temperature was predicted in a different angular position of the cutter which is difficult or impossible to obtain in experiments. The predicted results of the model, involving the run-out influence, showed a good correlation with experimental chip formation and the signal shape of cutting forces.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Milano  
Authors: Davoudinejad, A. (Intern), Tosello, G. (Intern), Parenti, P. (Ekstern), Annoni, M. (Ekstern)  
Number of pages: 20  
Publication date: 2017  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Micromachines  
Volume: 8  
Issue number: 6  
Article number: 187  
ISSN (Print): 2072-666X  
Ratings:  
- Web of Science (2018): Indexed yes  
- Web of Science (2017): Indexed yes  
- Scopus rating (2016): CiteScore 1.83 SJR 0.382 SNIP 0.766  
- Web of Science (2016): Indexed yes  
- Scopus rating (2015): SJR 0.438 SNIP 0.931 CiteScore 1.78  
- Web of Science (2015): Indexed yes  
- Scopus rating (2014): SJR 0.638 SNIP 1.384 CiteScore 2.1  
- Scopus rating (2013): SJR 0.479 SNIP 1.151 CiteScore 1.73  
- ISI indexed (2013): ISI indexed no  
- Scopus rating (2012): SJR 0.477 SNIP 1.34 CiteScore 1.28  
- ISI indexed (2012): ISI indexed no  
- Scopus rating (2011): SJR 0.226 SNIP 0.892  
- ISI indexed (2011): ISI indexed no  
Original language: English  
Micro milling, Finite element, Run-out, Chip formation, Cutting force, Cutting temperature, 3D simulation, Measurement  
Electronic versions: micromachines_08_00187.pdf  
DOIs: 10.3390/mi8060187  
Publication: Research - peer-review  
Journal article – Annual report year: 2017

**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**

State: Published  
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology  
Authors: Méndez Ribó, M. (Intern), Islam, A. (Intern)  
Number of pages: 1  
Publication date: 2017
A suitable piece of software is presented to connect Abaqus, a sophisticated finite element package, with Matlab, the most comprehensive program for mathematical analysis. This interface between these well-known codes not only benefits from the image processing and the integrated graph-plotting features of Matlab but also opens up new opportunities in results post-processing, statistical analysis and mathematical optimization, among many other possibilities. The software architecture and usage are appropriately described and two problems of particular engineering significance are addressed to demonstrate its capabilities. Firstly, the software is employed to assess cleavage fracture through a novel 3-parameter Weibull probabilistic framework. Then, its potential to create and train neural networks is used to identify damage parameters through a hybrid experimental–numerical scheme, and model crack propagation in structural materials by means of a cohesive zone approach. The source code, detailed documentation and a large number of tutorials can be freely downloaded from www.abaqus2matlab.com.
A brute-force spectral approach for wave estimation using measured vessel responses

The article introduces a spectral procedure for sea state estimation based on measurements of motion responses of a ship in a short-crested seaway. The procedure relies fundamentally on the wave buoy analogy, but the wave spectrum estimate is obtained in a direct - brute-force - approach, and the procedure is simple in its mathematical formulation. The actual formulation is extending another recent work by including vessel advance speed and short-crested seas. Due to its simplicity, the procedure is computationally efficient, providing wave spectrum estimates in the order of a few seconds, and the estimation procedure will therefore be appealing to applications related to real-time, onboard control and decision support systems for safe and efficient marine operations. The procedure's performance is evaluated by use of numerical simulation of motion measurements, and it is shown that accurate wave spectrum estimates can be obtained for all wave directions in short-crested waves, taking the wave system to be composed by both wind generated sea and swell.

**General information**

State: Submitted
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Norwegian University of Science and Technology
Authors: Nielsen, U. D. (Intern), H. Brodtkorb, A. (Ekstern), J. Sørensen, A. (Ekstern)
Number of pages: 37
Publication date: 2017
Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.49 SJR 1.655 SNIP 2.636
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.618 SNIP 2.602 CiteScore 2.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.431 SNIP 3.026 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.314 SNIP 2.871 CiteScore 2.42
ISI indexed (2013): ISI indexed yes
Accurate dimensional measurements in production environment using Dynamic Length Metrology

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Dalla Costa, G. (Intern), De Chiffre, L. (Intern), Hansen, H. N. (Intern)
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences

Relations
Projects:
Accurate dimensional measurements in production environment using Dynamic Length Metrology
Publication: Research › Ph.D. thesis – Annual report year: 2017
A CFD Investigation on the Effect of the Air Entrainment in Breaking Wave Impacts on a Mono-Pile

In impacts of breaking waves on offshore structures, it is still not well-known how the air entrainment phenomenon affects the exerted loads. In this paper, a developed CFD solver capable of simulating the air entrainment process was employed to reproduce an experimental investigation on the impact of a spilling wave against a circular cylinder. The exerted in-line force was computed with and without the inclusion of dispersed bubbles. Results showed that the magnitude of the computed force was affected when the entrainment of bubbles was simulated.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, DHI Denmark
Authors: Tomaselli, P. (Ekstern), Christensen, E. D. (Intern)
Number of pages: 10
Publication date: 2017

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Article number: OMAE2017-62445
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Main Research Area: Technical/natural sciences
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Waves, Computational fluid dynamics, Air entrainment
DOI: 10.1115/OMAE2017-62445
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

A cohesive zone framework for environmentally assisted fatigue

We present a compelling finite element framework to model hydrogen assisted fatigue by means of a hydrogen- and cycle-dependent cohesive zone formulation. The model builds upon: (i) appropriate environmental boundary conditions, (ii) a coupled mechanical and hydrogen diffusion response, driven by chemical potential gradients, (iii) a mechanical behavior characterized by finite deformation J2 plasticity, (iv) a phenomenological trapping model, (v) an irreversible cohesive zone formulation for fatigue, grounded on continuum damage mechanics, and (vi) a traction-separation law dependent on hydrogen coverage calculated from first principles. The computations show that the present scheme appropriately captures the main experimental trends; namely, the sensitivity of fatigue crack growth rates to the loading frequency and the environment. The role of yield strength, work hardening, and constraint conditions in enhancing crack growth rates as a function of the frequency is thoroughly investigated. The results reveal the need to incorporate additional sources of stress elevation, such as gradient-enhanced dislocation hardening, to attain a quantitative agreement with the experiments.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Universidad de Oviedo
Authors: del Busto, S. (Ekstern), Betegón, C. (Ekstern), Martínez Pañeda, E. (Intern)
Number of pages: 210-226
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: Engineering Fracture Mechanics
Volume: 185
ISSN (Print): 0013-7944
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 2.39 SJR 1.247 SNIP 1.676
Web of Science (2016): Indexed yes
A compact cyclic plasticity model with parameter evolution

The paper presents a compact model for cyclic plasticity based on energy in terms of external and internal variables, and plastic yielding described by kinematic hardening and a flow potential with an additive term controlling the nonlinear cyclic hardening. The model is basically described by five parameters: external and internal stiffness, a yield stress and a limiting ultimate stress, and finally a parameter controlling the gradual development of plastic deformation. Calibration against
numerous experimental results indicates that typically larger plastic strains develop than predicted by the
Armstrong–Frederick model, contained as a special case of the present model for a particular choice of the shape
parameter. In contrast to previous work, where shaping the stress-strain loops is derived from multiple internal stress
states, this effect is here represented by a single parameter, and it is demonstrated that this simple formulation enables
very accurate representation of experimental results. An extension of the theory to account for model parameter evolution
effects, e.g. in the form of changing yield level, is included in the form of extended evolution equations for the model
parameters. Finally, it is demonstrated that the model in combination with a simple parameter interpolation scheme
enables representation of ratcheting effects.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Authors: Krenk, S. (Intern), Tidemann, L. (Ekstern)
Pages: 57-68
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Main Research Area: Technical/natural sciences

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Volume: 113
ISSN (Print): 0167-6636
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.76 SJR 1.256 SNIP 1.546
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.224 SNIP 1.785 CiteScore 2.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.357 SNIP 1.838 CiteScore 2.56
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.204 SNIP 1.758 CiteScore 2.58
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.325 SNIP 1.909 CiteScore 2.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.488 SNIP 1.915 CiteScore 2.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.413 SNIP 1.846
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.905 SNIP 2.067
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.882 SNIP 2.112
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.87 SNIP 2.135
Scopus rating (2006): SJR 1.797 SNIP 2.136
A Comparison of Organic and Steam Rankine Cycle Power Systems for Waste Heat Recovery on Large Ships

This paper presents a comparison of the conventional dual pressure steam Rankine cycle process and the organic Rankine cycle process for marine engine waste heat recovery. The comparison was based on a container vessel, and results are presented for a high-sulfur (3 wt %) and low-sulfur (0.5 wt %) fuel case. The processes were compared based on their off-design performance for diesel engine loads in the range between 25% and 100%. The fluids considered in the organic Rankine cycle process were MM(hexamethyldisiloxane), toluene, n-pentane, i-pentane and c-pentane. The results of the comparison indicate that the net power output of the steam Rankine cycle process is higher at high engine loads, while the performance of the organic Rankine cycle units is higher at lower loads. Preliminary turbine design considerations suggest that higher turbine efficiencies can be obtained for the ORC unit turbines compared to the steam turbines. When the efficiency of the c-pentane turbine was allowed to be 10% points larger than the steam turbine efficiency, the organic Rankine cycle unit reaches higher net power outputs than the steam Rankine cycle unit at all engine loads for the low-sulfur fuel case. The net power production from the waste heat recovery units is generally higher for the low-sulfur fuel case. The steam Rankine cycle unit produces 18% more power at design compared to the high-sulfur fuel case, while the organic Rankine cycle unit using MM produces 33% more power.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Andreasen, J. G. (Intern), Meroni, A. (Intern), Haglind, F. (Intern)
Number of pages: 23
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Energies
Volume: 10
Issue number: 4
Article number: 547
ISSN (Print): 1996-1073
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.5 SJR 0.691 SNIP 1.053
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.804 SNIP 1.416 CiteScore 2.87
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 0.87 SNIP 1.601 CiteScore 2.66
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.632 SNIP 1.345 CiteScore 2.29
A comparison of reflectance properties on polymer micro-structured functional surface

In this study, a functional micro-structure surface [1] has been developed as a combination of arrays of micro ridges. The scope of the surface is to achieve specific directional optical properties: that is, under constrained lighting, maximizing the reflectance from a certain viewing direction, and minimizing it from the corresponding horizontally orthogonal position, i.e. maximize the contrast between two horizontally orthogonal view positions at the same inclination (Figure 1). The sample is composed of 12 different anisotropic surfaces, that are designed as a combination of ridges defined by their pitch distance and their angle in respect to the surface (Figure 2). The geometry was obtained by precision milling of a tool steel bar and replicated through silicone replica technology [2], and by hot embossing using Acrylonitrile Butadiene Styrene (ABS). A digital microscope has been used as a gonioreflectometer to determine the directional surface reflectance of each surface to varying light and camera positions. The presented results show that the replication processes and the polymeric material have a strong impact on the contrast under constrained lightening. More specifically, the reflectance properties are strongly influenced by the geometry of the structure and by the colour.

A concise account of techniques available for shipboard sea state estimation

This article gives a review of techniques applied to make sea state estimation on the basis of measured responses on a ship. The general concept of the procedures is similar to that of a classical wave buoy, which exploits a linear assumption between waves and the associated motions. In the frequency domain, this assumption yields the mathematical relation between the measured motion spectra and the directional wave spectrum. The analogy between a buoy and a ship is clear, and the author has worked on this wave buoy analogy for about fifteen years. In the article, available techniques for shipboard sea state estimation are addressed, but with a focus on only the wave buoy analogy. Most of the existing work is based on methods established in the frequency domain but, to counteract disadvantages of the frequency-domain procedures, newer studies are working also on procedures formulated directly in the time domain. Sample results from several studies are included, and the main findings from these are mentioned.
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<td>CiteScore 1.149 SJR 0.886 SNIP 1.149</td>
<td>yes</td>
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A Contribution to the Understanding of the Combined Effect of Nitrogen and Boron in Grey Cast Iron

Inoculation is an essential part of controlling material properties in grey cast iron. Inoculation practice has for decades been based on the addition to the melt of small amounts of elements with a strong affinity to O (and S) just before casting takes place. This method is proven—both in theory and in practice—to be effective in most cases. But it has the disadvantage that the nucleation effect fades away over time. In particular, in heavy castings (slow cooling) this effect may cause non-uniform and unacceptable material properties in some parts of the casting. Nitrogen is also known to influence grey iron microstructure. Both graphite flake formation and matrix formation are influenced. However, the obtained effects differ considerably between different reported investigations. This investigation deals with the combined effect of nitrogen and boron and how it is possible to utilize this effect to enhance material properties in heavy grey iron castings. It is shown that the controlled additions of nitrogen and boron can be used to control the microstructure of thick section grey iron castings. A plausible theory for the formation of boron nitride nuclei effective for graphite growth is presented.
Acoustic emission monitoring of the bending under tension test

Preliminary investigations have shown that acoustic emission has promising aspects as an online monitoring technique for assessment of tribological conditions during metal forming as regards to determination of the onset of galling. In the present study the acoustic emission measuring technique has been applied for online monitoring of the frictional conditions experienced during Bending Under Tension (BUT) testing. The BUT test emulates the forming conditions experienced when drawing sheet material over a die curvature as in deep drawing processes. Monitoring of the developed acoustic emission in BUT testing has been found to describe the frictional conditions during forming well and to allow for accurate assessment of the limits of lubrication.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Moghadam, M. (Intern), Sulaiman, M. H. B. (Intern), Christiansen, P. (Intern), Bay, N. O. (Intern)
Pages: 1421–1426
Publication date: 2017
Conference: International Conference on the Technology of Plasticity (ICTP 2017), Cambridge, United Kingdom, 17/09/2017 - 17/09/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Procedia Engineering
Volume: 207
ISSN (Print): 1877-7058
Ratings: Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.74
Scopus rating (2015): CiteScore 0.56
Scopus rating (2014): CiteScore 0.53
Scopus rating (2013): CiteScore 0.4
ISI indexed (2013): ISI indexed no
Scopus rating (2012): CiteScore 0.28
ISI indexed (2012): ISI indexed no
Scopus rating (2011): CiteScore 0.45
ISI indexed (2011): ISI indexed no
Web of Science (2010): Indexed yes
Original language: English
Acoustic emission monitoring, Tribology, Bending under tension testing
Electronic versions: 1_s2.0_S187770581735693X_main.pdf
Publication: Research - peer-review › Conference article – Annual report year: 2017

Active tilting-pad journal bearings supporting flexible rotors: Part II–The model-based feedback-controlled lubrication

This is part II of a twofold paper series dealing with the design and implementation of model-based controllers meant for assisting the hybrid and developing the feedback-controlled lubrication regimes in active tilting pad journal bearings (active TPJBs). In both papers theoretical and experimental analyses are presented with focus on the reduction of rotor lateral vibration. This part is devoted to synthesising model-based LQG optimal controllers (LQR regulator + Kalman Filter) for the feedback-controlled lubrication and is based upon the mathematical model of the rotor-bearing system derived in part I. Results show further suppression of resonant vibrations when using the feedback-controlled or active lubrication, overweighting the reduction already achieved with hybrid lubrication, thus improving the whole machine dynamic performance.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Salazar, J. A. G. (Intern), Santos, I. (Intern)
Pages: 106-115
Publication date: 2017
Main Research Area: Technical/natural sciences
Active tilting-pad journal bearings supporting flexible rotors: Part I – The hybrid lubrication

This is part I of a twofold paper series, of theoretical and experimental nature, presenting the design and implementation of model-based controllers meant for assisting the hybrid and developing the feedback-controlled lubrication regimes in active tilting-pad journal bearings (active TPJBs). In part I, the flexible rotor-active TPJB modelling is thoroughly covered by establishing the link between the mechanical and hydraulic systems for all regimes. The hybrid lubrication is herein covered in depth; from a control viewpoint, an integral controller to aid such a regime is designed using model-based standard tools. Results show slight improvement on the system dynamic performance by using the hybrid lubrication instead of the passive one. Further improvements are pursued with the active lubrication in part II.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Salazar, J. A. G. (Intern), Santos, I. (Intern)
Pages: 94-105
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Tribology International
Volume: 107
ISSN (Print): 0301-679X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.437 SNIP 2.04 CiteScore 2.61
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.545 SNIP 2.5 CiteScore 2.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.473 SNIP 2.793 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.406 SNIP 2.331 CiteScore 1.96
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.247 SNIP 2.209 CiteScore 1.89
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.394 SNIP 2.159
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.294 SNIP 2.09
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Active tuned mass damper for damping of offshore wind turbine vibrations

An active tuned mass damper (ATMD) is employed for damping of tower vibrations of fixed offshore wind turbines, where the additional actuator force is controlled using feedback from the tower displacement and the relative velocity of the damper mass. An optimum tuning procedure equivalent to the tuning procedure of the passive tuned mass damper combined with a simple procedure for minimizing the control force is employed for determination of optimum damper parameters and feedback gain values. By time domain simulations conducted in an aeroelastic code, it is demonstrated that the ATMD can be used to further reduce the structural response of the wind turbine compared with the passive tuned mass damper and this without an increase in damper mass. A limiting factor of the design of the ATMD is the displacement of the damper mass, which for the ATMD, increases to compensate for the reduction in mass.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, National Oilwell Varco Denmark I/S
Authors: Brodersen, M. L. (Intern), Bjørke, A. (Ekstern), Høgsberg, J. B. (Intern)
Pages: 783–796
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Wind Energy
Volume: 20
Issue number: 5
ISSN (Print): 1095-4244
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.104 SNIP 2.306
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.196 SNIP 2.086 CiteScore 3.06
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.272 SNIP 3.75 CiteScore 3.42
Additive manufacturing: state-of-the-art and application framework

Additive manufacturing encompasses a class of production processes with increasing applications indifferent areas and supply chains. Due to its flexibility for production in small batches and the versatility of materials and geometries, this technology is recognized as being capable of revolutionizing the production processes as well as changing production strategies that are currently employed. However, there are different technologies under the generic label of additive manufacturing, materials and application areas with different requirements. Given the growing importance of additive manufacturing as a production process, and also considering the need to have a better insight into the potential applications for driving research and development efforts, this article presents a proposal of organization for additive manufacturing applications in seven areas. Additionally, the article provides a panorama of the current development stage of this technology, with a review of its major technological variants. The results presented aim to serve as a basis to support driving initiatives in additive manufacturing in companies, development agencies and research institutions.

General information
State: Published
Addressing fuel recycling in solid oxide fuel cell systems fed by alternative fuels
An innovative study on anode recirculation in solid oxide fuel cell systems with alternative fuels is carried out and investigated. Alternative fuels under study are ammonia, pure hydrogen, methanol, ethanol, DME and biogas from biomass gasification. It is shown that the amount of anode off-fuel recirculation depends strongly on type of the fuel used in the system. Anode recycling combined with fuel cell utilization factors have an important impact on plant efficiency, which will be analysed here. The current study may provide an in-depth understanding of reasons for using anode off-fuel recycling and its effect on plant efficiency. For example, it is founded that anode recirculation is not needed when the plant is fed by ammonia. Further, it is founded that when the system is fed by pure hydrogen then anode recirculation should be about 20% of the off-fuel if fuel cell utilization factor is 80%. Furthermore, it is founded that for the case with methanol, ethanol and DME then at high utilization factors, low anode recirculation is recommended while at low utilization factors, high anode recirculation is recommended. If the plant is fed by biogas from biomass gasification then for each utilization factor, there exist an optimum anode recirculation at which plant efficiency maximizes.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Rokni, M. (Intern)
Pages: 1013-1025
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication Information
Journal: Energy
Volume: 137
ISSN (Print): 0360-5442
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.276 SNIP 2.046 CiteScore 5.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.647 SNIP 2.63 CiteScore 5.7
Web of Science (2014): Indexed yes
Adjoint Optimisation of the Turbulent Flow in an Annular Diffuser

In the present study, a numerical optimisation of guide vanes in an annular diffuser, is performed. The optimisation is preformed for the purpose of improving the following two parameters simultaneously; the first parameter is the uniformity perpendicular to the flow direction, a 1/3 diameter downstream of the expansion. The second parameter is the pressure loss introduced by these guide vanes. The optimisation yields an improvement of the uniformity of 1.5% and a 28% reduction in the over all pressure loss.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark, MAN Diesel and Turbo
Authors: Gotfredsen, E. (Intern), Agular Knudsen, C. (Ekstem), Kunoy, J. D. (Ekstem), Meyer, K. E. (Intern), Walther, J. H. (Intern)
Pages: 71-74
Publication date: 2017
A DSM-based framework for integrated function modelling: concept, application and evaluation

Function modelling is proposed in the literature from different disciplines, in interdisciplinary approaches, and used in practice with the intention of facilitating system conceptualisation. However, function models across disciplines are largely diverse addressing different function modelling perspectives and using different structures and forms for representing the contained information. This hampers the exchange of information between the models and poses particular challenges to joint modelling and shared comprehension between designers from different disciplines. This article proposes an integrated function modelling framework, which specifically aims at relating between the different function modelling perspectives prominently addressed in different disciplines. It uses interlinked matrices based on the concept of DSM and MDM in order to facilitate cross-disciplinary modelling and analysis of the functionality of a system. The article further presents the application of the framework based on a product example. Finally, an empirical study in industry is presented. Therein, feedback on the potential of the proposed framework to support interdisciplinary design practice as well as on areas of further improvement has been obtained from participants working in industry.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Delft University of Technology, University of Luxembourg, Singapore University of Technology and Design
Authors: Eisenbart, B. (Ekstern), Gericke, K. (Ekstern), Blessing, L. T. M. (Ekstern), McAloone, T. C. (Intern)
Number of pages: 27
Pages: 25–51
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Research in Engineering Design
Volume: 28
Issue number: 1
ISSN (Print): 0934-9839
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.78 SJR 1.224 SNIP 1.76
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.956 SNIP 1.827 CiteScore 1.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.259 SNIP 2.435 CiteScore 2.38
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.271 SNIP 2.588 CiteScore 2.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.825 SNIP 3.307 CiteScore 2.13
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.086 SNIP 2.739 CiteScore 2.37
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.222 SNIP 1.589
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.752 SNIP 1.269
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.901 SNIP 1.09
Scopus rating (2007): SJR 0.671 SNIP 1.387
Scopus rating (2006): SJR 0.764 SNIP 1.579
Scopus rating (2005): SJR 0.579 SNIP 1.718
Scopus rating (2004): SJR 3.038 SNIP 4.009
Scopus rating (2003): SJR 1.513 SNIP 1.422
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.878 SNIP 1.542
Scopus rating (2001): SJR 0.375 SNIP 0.808
Scopus rating (2000): SJR 0.366 SNIP 1.333
Scopus rating (1999): SJR 0.382 SNIP 1.398
Original language: English
Function modelling, DSM, Interdisciplinary product development, Conceptual design, Empirical study
Electronic versions:
A_DSM_based_framework_for_integrated_function_modelling_concept_application_and_evaluation.pdf
DOIs:
10.1007/s00163-016-0228-1

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Source: FindIt
Source-ID: 2303661371
Publication: Research - peer-review › Journal article – Annual report year: 2016

A Durability Study of High-temperature PEMFC. Effects of Operating Parameters and Thermal Curing

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Proton conductors, Department of Mechanical Engineering, Materials and Surface Engineering, Danish Power Systems ApS
Authors: Jensen, J. O. (Intern), Søndergaard, T. (Intern), Aili, D. (Intern), Steenberg, T. (Ekstern), Hjuler, H. A. (Ekstern), Becker, H. (Intern), Zhong, L. (Intern), Li, Q. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 5th International CARISMA Conference (2017), Newcastle, United Kingdom.
Main Research Area: Technical/natural sciences
Electronic versions:
Carisma_2017_Abstract_Jens_Oluf_Jensen_1.pdf
Source: PublicationPreSubmission
Source-ID: 141975367
Publication: Research › Conference abstract for conference – Annual report year: 2017

A Failure Locus for Hydrogen Assisted Failure
We investigate cracking in the presence of hydrogen by means of a hybrid experimental-numerical approach. Slow strain rate tests are conducted in a Nickel superalloy under different environmental conditions. Finite element analysis of crack initiation and subsequent growth is modeled by means of a hydrogen-dependent traction separation law. A special control algorithm is employed to overcome numerical instabilities intrinsically associated with cohesive zone formulations. The fracture energy is degraded by means of an experimentally-motivated hydrogen degradation relation. Numerical results
provide important insight into the failure process, enabling to identify critical values of hydrogen concentration and remote stresses that trigger cracking. The work builds upon previous works by the authors and brings important insight into the technologically important problem of hydrogen assisted cracking.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Universidad de Oviedo, University of Virginia
Authors: Fuentes-Alonso, S. (Ekstern), Harris, Z. D. (Ekstern), Burns, J. T. (Ekstern), Martínez Pañeda, E. (Intern)
Number of pages: 1
Pages: 225
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
Hydrogen embrittlement, Cohesive zone models, Fracture, Finite element analysis
Electronic versions:
Sider_fra_NSCM_proceedings_23102017_5.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

A FEM based methodology to simulate multiple crack propagation in friction stir welds

In this work a numerical procedure, based on a finite element approach, is proposed to simulate multiple three-dimensional crack propagation in a welded structure. Cracks are introduced in a friction stir welded AA2024-T3 butt joint, affected by a process-induced residual stress scenario. The residual stress field was inferred by a thermo-mechanical FEM simulation of the process, considering temperature dependent elastic-plastic material properties, material softening and isotropic hardening. Afterwards, cracks introduced in the selected location of FEM computational domain allow stress redistribution and fatigue crack growth. The proposed approach has been validated by comparison with numerical outcomes provided by a consolidated FEM-DBEM procedure, available in literature. The discussed procedures are substantially equivalent in terms of SIFs evaluation along the crack front at the cracks insertion, as well as with respect to crack sizes measured in three different points for each propagation step. This FEM-based approach simulates the fatigue crack propagation by considering accurately the residual stress field generated by plastic deformations imposed on a structural component and has general validity.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Salerno, Norwegian University of Science and Technology
Authors: Lepore, M. (Ekstern), Carlone, P. (Ekstern), Berto, F. (Ekstern), Sonne, M. R. (Intern)
Pages: 154-167
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Engineering Fracture Mechanics
ISSN (Print): 0013-7944
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.39 SJR 1.247 SNIP 1.676
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.362 SNIP 1.945 CiteScore 2.44
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.619 SNIP 2.214 CiteScore 2.28
Web of Science (2014): Indexed yes
A Framework for Determining Product Modularity Levels

The application of modular products is seen as an important enabler for delivering customized products competitively. However, many companies struggle to find ways to implement modular products in a manner that suits their particular business. The literature includes examples of how modular products have been implemented in specific types of companies (mostly mass producers), but little guidance exists on how to identify the right level of modularity for other types of companies (such as engineer-to-order companies). In this article, we address this gap by suggesting a framework that categorizes the different types of modularity, where the categories fit different types of companies. More specifically, we introduce The Modularity Application Matrix – a conceptual tool that leads to a better understanding of partial modularization in relation to products. Through four case studies its application in practice is illustrated. This paper thereby contributes with new theoretical developments as well as a practical tool for practitioners in industries using partial modularization, such as, for example, the construction and building industry.
A fully coupled air foil bearing model considering friction – Theory & experiment

The dynamics of air foil bearings (AFBs) are not yet fully captured by any model. The recent years have, however, seen promising results from nonlinear time domain models, and simultaneously coupled formulations are now available, avoiding the previous requirements for undesirably small time steps and temporal convergence studies.

In the present work, an alternative foil structure model is substituted for the simple elastic foundation model to avoid its inherent limitations. The new foil model is based on a truss representation from the literature, but incorporates the foil mass and a dynamic friction model. As a consequence of the friction model's velocity dependency, the foil mass is included to obtain a set of differential equations that can be coupled to the rotor and fluid domains while allowing a simultaneous solution.

Considerations leading to a practically applicable implementation are discussed and numerical results are compared with experimental data. The model predicts natural frequencies and mode shapes well, but it is not yet capturing the unbalance response when friction is considered. Possible causes for this discrepancy are discussed and it is suggested that sticking is a more prevalent state than previously assumed.
A guide for evaluating the environmental performance of Product/Service-Systems

Environmental issues, such as climate change, resource depletion and pollution are societal concerns, which are also increasingly affecting the way we do business. Concepts such as circular economy, sharing economy, and service economy, often highlight that more sustainable businesses can be created when focusing on product performance (e.g. by offering lighting as a service) rather than the physical products (e.g. by selling light bulbs).

Such strategies of integrating products and services to deliver required user functionality are often termed Product/Service-Systems (PSS). This guide is intended to support studies that aim to explore if or when a PSS is leading to environmental improvements. The guide consists of six steps, which will assist the user to evaluate the environmental performance of PSS using Life Cycle Assessment (LCA) methodology. Special attention is given to the scoping phase of the study. This section of the guide introduces PSS as a concept, explains the aim of the guide, and provides an overview of stakeholders with potential interest in the guide plus the set of competences needed to perform the study.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Kjær, L. L. (Intern), Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
Number of pages: 37
Publication date: 2017

A Guide for Evaluating the Environmental Performance of Product/Service-Systems

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Kjær, L. L. (Intern), Pigosso, D. C. A. (Intern), McAloone, T. 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: G-8
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
SustainAbstracts2017c.compressed_78.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

A layered shell containing patches of piezoelectric fibers and interdigitated electrodes: Finite element modeling and experimental validation

The work gives a theoretical and experimental contribution to the problem of smart materials connected to double curved flexible shells. In the theoretical part the finite element modeling of a double curved flexible shell with a piezoelectric fiber patch with interdigitated electrodes (IDEs) is presented. The developed element is based on a purely mechanical eight-
node isoparametric layered element for a double curved shell, utilizing first-order shear deformation theory. The
electromechanical coupling of piezoelectric material is added to all elements, but can also be excluded by setting the
piezoelectric material properties to zero. The electrical field applied via the IDEs is aligned with the piezoelectric fibers,
and hence the direct d33 piezoelectric constant is utilized for the electromechanical coupling. The dynamic performance of
a shell with a microfiber composite (MFC) patch is investigated using frequency response functions (FRFs) obtained via
external impact test as well as internal random signal excitation using the MCF patch as an actuator. The experiments are
used to validate the numerical results. Good agreement between theory and experiments is obtained in a large frequency
range. Discrepancies and insights into optimal modeling frequency range and non-linear behavior are discussed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Authors: Nielsen, B. B. (Intern), Nielsen, M. S. (Ekstern), Santos, I. (Intern)
Pages: 78-96
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Intelligent Material Systems and Structures
Volume: 28
Issue number: 1
ISSN (Print): 1045-389X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.02 SJR 0.707 SNIP 1.141
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.891 SNIP 1.584 CiteScore 2.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.045 SNIP 1.811 CiteScore 2.54
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.03 SNIP 1.981 CiteScore 2.84
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.025 SNIP 1.579 CiteScore 1.87
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.054 SNIP 1.743 CiteScore 2.06
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.864 SNIP 1.452
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.743 SNIP 1.291
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.114 SNIP 1.432
Scopus rating (2007): SJR 1.105 SNIP 1.62
Scopus rating (2006): SJR 0.674 SNIP 1.59
Scopus rating (2005): SJR 0.554 SNIP 1.537
Scopus rating (2004): SJR 0.578 SNIP 0.983
Scopus rating (2003): SJR 0.972 SNIP 1.09
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.585 SNIP 1.255
Allergic contact dermatitis caused by cobalt in leather – clinical cases

In 2013, we raised suspicion that cobalt in leather could be responsible for hitherto unrecognized cases of allergic contact dermatitis. We saw a patient sensitized only to cobalt with clear long-term exposure to cobalt from a leather sofa, and observed resolution of dermatitis following avoidance [1]. In 2014, we performed a questionnaire study, which showed a positive and significant association between cobalt allergy and a history of dermatitis caused by non-occupational exposure to leather articles [2]. Recently, we published an article showing high amounts of cobalt in selected leather swatches from furniture [3]. Here, we report 2 additional cases of allergic cobalt dermatitis caused by consumer leather exposure, to increase awareness about this topic.
A Method for Ship Collision Damage and Energy Absorption Analysis and Its Validation

For design evaluation, there is a need for a method which is fast, practical and yet accurate enough to determine the absorbed energy and collision damage extent in ship collision analysis. The most well-known simplified empirical approach to collision analysis was made probably by Minorsky, and its limitation is also well-recognised. The authors have previously developed simple expressions for the relation between the absorbed energy and the damaged material volume which take into account the structural arrangements, the material properties and the damage modes. The purpose of the present paper is to re-examine this method's validity and accuracy for ship collision damage analysis in ship design assessments by comprehensive validations with experimental results from the public domain. In total, 20 experimental tests have been selected, analysed and compared with the results calculated using the proposed method. It can be concluded that the proposed method has a good accuracy with the mean value of 0.988 and standard deviation of 0.042.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Lloyd's Register EMEA
Authors: Zhang, S. (Ekstern), Pedersen, P. T. (Intern)
Pages: 783–796
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Ships and Offshore Structures
Volume: 20
Issue number: 5
ISSN (Print): 1744-5302
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
A methodology for online visualization of the energy flow in a machine tool

The demand of energy efficient machine tools has increased recently due to the awareness for energy efficient production in precision manufacturing. A portion of the energy supplied to machine tools is transferred to thermal losses which influence also the thermal behavior of the precision related machine tools components. Machine cooling and process cooling can prevent thermal machine tool errors. However this further requires considerable amounts of energy. Hence there is a demand to monitor the electric, thermal, fluidic and mechanical energy flows in the machine tool in order to optimize the machining process and by this increasing its energy efficiency. This study intents to propose a method which has the capability of real-time monitoring of the entire energetic flows in a CNC machine tool including motors, pumps and cooling fluid. The structure of this approach is based on categorizing the machine into subsystems and measurements of the consumers (pump, motors, . . .) power, temperature at the inlet and outlet of the pumps and current as well as the speed of the motors. The visualization is carried out by a 2D Sankey diagram, which makes it easy to understand the energetic flows in the machine tool. The methodology is verified by the rule of energy conversion which confirms the capability of this method on real-time energy monitoring of a machine tool.
Energy flow model, Machine tools, Sankey diagram, Online monitoring, Energy efficiency

A model-based approach to associate complexity and robustness in engineering systems

Ever increasing functionality and complexity of products and systems challenge development companies in achieving high and consistent quality. A model-based approach is used to investigate the relationship between system complexity and system robustness. The measure for complexity is based on the degree of functional coupling and the level of contradiction in the couplings. Whilst Suh’s independence axiom states that functional independence (uncoupled designs) produces more robust designs, this study proves this not to be the case for max-/min-is-best requirements, and only to be true in the general sense for nominal-is-best requirements. In specific cases, the independence axiom has exceptions as illustrated with a machining example, showing how a coupled solution is more robust than its uncoupled counterpart. This study also shows with statistical significance, that for max- and min-is-best requirements, the robustness is most affected by the level of contradiction between coupled functional requirements (p = 1.4e−36). In practice, the results imply that if the main influencing factors for each function in a system are known in the concept phase, an evaluation of the contradiction level can be used to evaluate concept robustness.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Massachusetts Institute of Technology
Authors: Göhler, S. M. (Intern), D. Frey, D. (Ekstern), Howard, T. J. (Intern)
Pages: 223–234
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Research in Engineering Design
Volume: 28
ISSN (Print): 0934-9839
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
A multi-objective energy planning including system exergy efficiency and socio-economic costs

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Department of Mechanical Engineering, Thermal Energy
Authors: Dominkovic, D. F. (Intern), Pedersen, A. S. (Intern), Elmegaard, B. (Intern)
Number of pages: 1
Publication date: 2017

Electronic versions:
Post_print_A_model_based_approach_to_associate_Complexity_and_Robustness_in_Engineering_Systems.pdf. Embargo ended: 28/08/2017
DOIs:
10.1007/s00163-016-0236-1
Publication: Research - peer-review › Journal article – Annual report year: 2016
The demand for air conditioning has been consistently increasing worldwide in recent years, concomitantly to the introduction of ambitious energy and environmental targets. As a result, high efficiency air conditioners running on low polluting energy sources need to be developed. This thesis investigates the performance of a solid desiccant cooling system implementing indirect evaporative cooling processes. The aim is to quantify the system thermal and electrical performance for varying component dimensions and operating conditions, and to identify its range of applicability. This information serves to support the industrial development of the system. Ultimately, the aim is to understand if and to which extent the system is more efficient than electrically and thermally driven chiller-based systems.

The core system components are a silica gel desiccant wheel and a counter-flow indirect evaporative cooler. Detailed steady state numerical models are developed and implemented in MATLAB. The models need to be accurate and require low computational effort, for analysing the internal heat and mass transfer processes, as well as carrying out repetitive design and optimization simulations and seasonal simulations.

The desiccant wheel model is based on the parabolic moisture concentration profile assumption, which enables to consider the resistance to moisture diffusion in the desiccant pores while keeping a low computational effort. The comparison with a validated transient model indicates the parabolic profile assumption is very accurate for wheel rotational speeds up to 20 rph, considering silica gel properties and typical desiccant layer thickness.

The indirect evaporative cooler model is tuned to predict the performance of coolers manufactured by StatiqCooling, according to the manufacturer selection software. Different compositions of the secondary air stream are considered, including partial recirculation of the cooled primary air stream, i.e. dew point cooling, and use of air from a separate ambient. The desiccant cooling system combines the two components, including a compact air-to-air heat exchanger for enhancing cooling capacity and thermal performance. The system performance is investigated considering regeneration temperatures between 50 °C and 90 °C, which enable low temperature heat sources, such as solar energy or waste heat, to be used. The effects of several geometrical and operational parameters on the system thermal and electrical performance, supply conditions, and water consumption are investigated. The use of exhaust air from the conditioned space for indirect evaporative cooling provides the most promising results, with thermal COP above 1 and electrical COP above 20. These results indicate the system has a great potential for saving energy in respect to electrically and thermally driven chiller-based system.

An exergy analysis is carried out to identify the most important sources of irreversibility in the system, including the conversion of primary energy sources into heat and electricity. Results indicate that solar energy is utilized more efficiently than fossil fuels for supplying low regeneration temperatures.

In the end, a novel technical solution aiming to make desiccant cooling systems independent of external water sources is introduced. Water desorbed from the desiccant dehumidifier is condensed in a closed regeneration circuit and used to run evaporative coolers. This solution enables the system to run regardless of water availability, and avoids the use of water demineralization equipment, which consumes additional water and increases operational costs and maintenance. These benefits are significant for applications in regions with limited water resources.
benefits are achieved at the expense of higher electricity consumption, regeneration temperatures, space requirements and investment costs. The solution is analysed for the desiccant cooling system operating with dew point cooling. Mediterranean climatic conditions are considered for seasonal system simulations, with the possibility to store water recovered in excess for operating the system with open regeneration circuit in case of high loads. The system is found independent of external water sources.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Bellomo, L. (Intern), Elmegaard, B. (Intern), Kærn, M. R. (Intern), Markussen, W. B. (Intern), Lars Ove, R. (Ekstern)
Number of pages: 196
Publication date: 2017

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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:
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Relations
Projects:
Analysis of a solid desiccant cooling system with indirect evaporative cooling
Publication: Research › Ph.D. thesis – Annual report year: 2018

Analysis of bearing steel exposed to rolling contact fatigue
The objective of this work is to characterize fatigue damage in roller bearings under conditions of high load and slippage. A test rig constructed for rolling contact fatigue tests of rings is described, and test results are presented for rings taken from two spherical roller bearings. The preparation of the rings and the loading situation are explained. Test conditions are chosen with the aim of achieving pitting formation at the contacting surfaces. During testing the contact pressure, torque and the rotational speed are monitored and recorded. After testing the tested rings have been characterized using X-ray tomography and scanning electron microscopy. The observations confirm that rolling contact fatigue testing at high loads leads to pitting failure at the contacting surfaces. The pitting mostly appears on one side of the contact, attributed to a non-uniform contact pressure in the axial direction.

General information
State: Published
Organisations: Department of Wind Energy, Composites and Materials Mechanics, Materials science and characterization, Wind Turbine Structures and Component Design, Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Number of pages: 8
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Conference: 38th Risø International Symposium on Materials Science, Roskilde, Denmark, 04/09/2017 - 04/09/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: I O P Conference Series: Materials Science and Engineering
Volume: 219
Article number: 012024
ISSN (Print): 1757-8981
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.39 SJR 0.187 SNIP 0.499
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.172 SNIP 0.281 CiteScore 0.22
Scopus rating (2014): SJR 0.186 SNIP 0.306 CiteScore 0.18
Analysis of surface insulation resistance related failures in electronics by circuit simulation

Purpose-The purpose of this study is to show that the humidity levels for surface insulation resistance (SIR)-related failures are dependent on the type of activators used in no-clean flux systems and to demonstrate the possibility of simulating the effects of humidity and contamination on printed circuit board components and sensitive parts if typical SIR data connected to a particular climatic condition are available. This is shown on representative components and typical circuits. Design/methodology/approach-A range of SIR values obtained on SIR patterns with 1,476 squares was used as input data for the circuit analysis. The SIR data were compared to the surface resistance values observable on a real device printed circuit board assembly. SIR issues at the component and circuit levels were analysed on the basis of parasitic circuit effects owing to the formation of a water layer as an electrical conduction medium. Findings-This paper provides a summary of the effects of contamination with various weak organic acids representing the active components in no-clean solder flux residue, and demonstrates the effect of humidity and contamination on the possible malfunctions and errors in electronic circuits. The effect of contamination and humidity is expressed as drift from the nominal resistance values of the resistors, self-discharge of the capacitors and the errors in the circuits due to parasitic leakage currents (reduction of SIR). Practical/implications-The methodology of the analysis of the circuits using a range of empirical leakage resistance values combined with the knowledge of the humidity and contamination profile of the electronics can be used for the robust design of a device, which is also important for electronic products relying on low current consumption for long battery lifetime. Originality/value-Examples provide a basic link between the combined effect of humidity and contamination and the performance of electronic circuits. The methodology shown provides the possibility of addressing the climatic reliability of an electronic device at the early stage of device design by using typical SIR data representing the possible climate exposure.
Analysis of the equivalent indenter concept used to extract Young’s modulus from a nano-indentation test: some new insights into the Oliver–Pharr method

In this paper a thorough analysis of the equivalent indenter concept applied to nano-indentation is carried out, motivated by the fact that previous works in the field have not considered the requirement of a consistent relation between contact depth and projected contact area. Dimensional analysis is initially used to prove that the shape of the axisymmetric equivalent indenter can be regarded as a material property, provided that size-effects are negligible. Subsequently, it is shown that such shape can effectively be employed to describe the nano-indentation unloading stage by means of Sneddon’s elastic solution which is formally valid only for indentation into a flat surface. This allows for formulating the problem of extracting Young’s modulus from the unloading curve as an optimization problem. However, it is proved that the latter does not have a unique solution, due to the particular mathematical structure of the underlying equations; hence, additional constraints are needed to set restrictions on the admissible equivalent indenter shapes. An example of such constraint is hidden in some apparent inconsistencies of the well-known Oliver–Pharr method, which is demonstrated to be based on an equivalent conical indenter whose semi-apical angle depends on the ratio between residual and total penetration. Specifically, this angle tends to 90° when the material exhibits extensive inelastic deformation, whereas it reduces to the one characteristic of the real indenter for a perfectly elastic material. This provides a new physical explanation for the relatively good accuracy of the method even in presence of a non-negligible residual contact impression on the sample.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Andriollo, T. (Intern), Thorborg, J. (Intern), Hattel, J. H. (Intern)
Number of pages: 22
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Modelling and Simulation in Materials Science and Engineering
Volume: 25
Issue number: 4
ISSN (Print): 0965-0393
Ratings:
  BFI (2018): BFI-level 2
  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 2
  Web of Science (2017): Indexed yes
  BFI (2016): BFI-level 2
  Scopus rating (2016): CiteScore 1.82 SJR 0.932 SNIP 0.86
Analytic approximations for the elastic moduli of two-phase materials

Based on the models of series and parallel connections of the two phases in a composite, analytic approximations are derived for the elastic constants (Young's modulus, shear modulus, and Poisson's ratio) of elastically isotropic two-phase composites containing second phases of various volume fractions, shapes, and regular distributions. Comparison with a plentitude of finite element simulations and numerous previous experimental investigations shows a large consistency between the results and the analytic expressions derived, confirming the adequacy of the present approach. Compared with previous classical models, the present model has several advantages, including its simplicity, accuracy of prediction, and universal applicability.
An approach to the modeling study and analysis of tool electrode wear mechanisms in micro electrical discharge milling

**General information**
State: Submitted
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern)
Number of pages: 11
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Advanced Mechanical Engineering
ISSN (Print): 2162-9870
Original language: English
Source: PublicationPreSubmission
Source-ID: 127264150
Publication: Research - peer-review › Journal article – Annual report year: 2017

A New Volume-Of-Fluid Method in Openfoam
To realise the full potential of Computational Fluid Dynamics (CFD) within marine science and engineering, there is a need for continuous maturing as well as verification and validation of the numerical methods used for free surface and interfacial flows. One of the distinguishing features here is the existence of a water surface undergoing large deformations and topological changes during transient simulations e.g. of a breaking wave hitting an off-shore structure. To date, the most successful method for advecting the water surface in marine applications is the Volume-of-Fluid (VOF) method. While VOF methods have become quite advanced and accurate on structured meshes, there is still room for improvement when it comes to unstructured meshes of the type needed to simulate flows in and around complex geometrical structures. We have recently developed a new geometric VOF algorithm called isoAdvvector for general meshes and implemented it in the OpenFOAM interfacial flow solver called interFoam. We have previously shown the advantages of isoAdvvector for simple pure advection test cases on various mesh types. Here we test the effect of replacing the existing interface advection method in interFoam, based on MULES limited interface compression, with the new isoAdv-vector method. Our test case is a steady 2D stream function wave propagating in a periodic domain. Based on a series of simulations with different numerical settings, we conclude that the introduction of isoAdvvector has a significant effect on wave propagation with interFoam. There are several criteria of success: Preservation of water volume, of crest kinematics and celerity, not to mention computational efficiency. We demonstrate how isoAdvvector can improve on many of these parameters, but also that the success depends on the solver setup. Thus, we cautiously conclude that isoAdvvector is a viable alternative to MULES when set up correctly, especially when interface sharpness, interface smoothness and calculation times are important. There is, however, still potential for improvement in the coupling of isoAdvvector with interFoam’s PISO based pressure-velocity solution algorithm.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Department of Wind Energy, Fluid Mechanics, University of Zagreb
Authors: Pedersen, J. R. (Intern), Eltard-Larsen, B. (Intern), Bredmose, H. (Intern), Jasak, H. (Ekstern)
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences
CFD, Marine Engineering, Interfacial Flows, IsoAdvvector, VOF Methods, Surface Gravity Waves
Electronic versions: Roenbyetal2017.pdf
An experimental analysis of flow boiling and pressure drop in a brazed plate heat exchanger for organic Rankine cycle power systems

Organic Rankine cycle power systems for low quality waste heat recovery applications can play a major role in achieving targets of increasing industrial processes efficiency and thus reducing the emissions of greenhouse gases. Low capacity organic Rankine cycle systems are equipped with brazed plate heat exchangers which allows for efficient heat transfer with a compact design. Accurate heat transfer correlations characterizing these devices are required from the design phase to the development of model-based control strategies. In this paper, the experimental heat transfer coefficient and pressure drop during vaporization at typical temperatures for low quality waste heat recovery organic Rankine cycle systems are presented for the working fluids HFC-245fa and HFO-1233zd. The experiments were carried out at saturation temperatures of 100°C, 115°C and 130°C and inlet and outlet qualities ranging between 0.1–0.4 and 0.5–1 respectively. The experimental heat transfer coefficients and frictional pressure drop were compared with well-known correlations and new ones are developed. The results indicated weak sensitivity of the heat transfer coefficients to the saturation temperature and were characterized by similar values for the two fluids. The frictional pressure drop showed a linear dependence with mean quality and increased as the saturation temperature decreased.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, University of Liege, Institute for Product Development
Authors: Desideri, A. (Ekstern), Zhang, J. (Intern), Kærn, M. R. (Intern), Ommen, T. S. (Intern), Wronski, J. (Ekstern), Lemort, V. (Ekstern), Haglind, F. (Intern)
Pages: 6-21
Publication date: 2017
Main Research Area: Technical/natural sciences

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ISSN (Print): 0017-9310
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.75 SJR 1.623 SNIP 2.005
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.797 SNIP 1.941 CiteScore 3.09
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.624 SNIP 2.008 CiteScore 2.97
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.868 SNIP 2.164 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.688 SNIP 2.17 CiteScore 2.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.085 SNIP 1.978 CiteScore 3.04
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.647 SNIP 2.12
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
An experimental investigation of heat transfer enhancement in minichannel: Combination of nanofluid and micro fin structure techniques

This work experimentally studied the single-phase heat transfer and pressure drop characteristics by using two heat transfer enhancement techniques (micro fin structure and nanofluids) in multiport minichannel flat tube (MMFT). MMFT consisted of numerous parallel rectangular minichannels and is widely used in industry as the heat transfer unit of a heat exchanger. Firstly, the enhanced heat transfer performances by individually using one enhancement technique were investigated by testing Nusselt number, friction factor and performance evaluation criterion (PEC). In this section, five MMFTs with different micro fin numbers ($N = 0, 1, 2, 3$ and $4$) and nanofluids with three volume concentrations ($\phi = 0.005\%, 0.01\%$ and $0.1\%$) were used as test sections and working fluids respectively. Secondly, the experiments using two combined enhancement technique were performed. By using conjunctively two enhancement techniques, Nusselt number increases by up to $158\%$ at about $Re = 3600$ and the maximum PEC value can reach $2.0$ at $Re = 5150$. Finally, an optimal heat transfer scheme was proposed based on test data.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Beijing University of Technology
Authors: Zhang, J. (Intern), Diao, Y. (Ekstern), Zhao, Y. (Ekstern), Zhang, Y. (Ekstern)
Pages: 21-32
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Experimental Thermal and Fluid Science
Volume: 81
ISSN (Print): 0894-1777
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.14 SJR 1.398 SNIP 1.922
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.427 SNIP 1.847 CiteScore 2.58
BFI (2014): BFI-level 1
An exploration of the potential for re-distributed manufacturing to contribute to a sustainable, resilient city

Re-distributed manufacturing (RDM), broadly described as manufacturing done at a smaller-scale and locally, could be beneficial to business and urban society through creating jobs, reducing the environmental impacts of production, and improving resilience to future disturbances. Consideration of RDM within a city-region requires the consideration of a wide range of issues—societal, technical, economic and environmental. This paper presents the results of a study into the potential for RDM to contribute to a sustainable, resilient city in the face of a range of expected future disturbances on the city and on manufacturing sectors. The study took an integrated assessment approach which incorporated the development of a conceptual framework; a ‘strawman’ causal loop diagram which was reviewed by participants in a workshop; and a stock and flow system dynamics model that represents our understanding about the structure and behaviour of urban manufacturing. Several key themes emerged: similarities between RDM and traditional manufacturing, availability of physical space for RDM to be done, achieving urban resilience through RDM by enabling responsiveness to disturbances, changes in environmental impacts from production, additions or losses in jobs, the competitiveness of local manufacturing, and skills and innovation for RDM technologies. Further work is recommended.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, University of Manchester, University of Bristol
Authors: Freeman, R. (Ekstern), McMahon, C. A. (Intern), Godfrey, P. (Ekstern)
Pages: 260-271
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Sustainable Engineering

Scopus rating (2014): SJR 1.563 SNIP 2.04 CiteScore 2.57
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.321 SNIP 2.113 CiteScore 2.63
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.144 SNIP 1.916 CiteScore 2.09
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.969 SNIP 1.79 CiteScore 1.87
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1 SNIP 1.824
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.184 SNIP 1.571
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.753 SNIP 1.166
Scopus rating (2007): SJR 0.881 SNIP 1.335
Scopus rating (2006): SJR 1.126 SNIP 1.154
Scopus rating (2005): SJR 1.28 SNIP 1.309
Scopus rating (2004): SJR 0.936 SNIP 1.338
Scopus rating (2003): SJR 0.634 SNIP 0.798
Scopus rating (2002): SJR 0.741 SNIP 0.8
Scopus rating (2001): SJR 0.841 SNIP 1.066
Scopus rating (2000): SJR 0.959 SNIP 0.916
Scopus rating (1999): SJR 0.542 SNIP 0.632
Original language: English
Micro fin structure, Multiport minichannel flat tube, Nanofluid, PEC, Heat transfer enhancement
DOIs: 10.1016/j.expthermflusci.2016.10.001
Source: Findit
Source-ID: 2346860821
Publication: Research - peer-review › Journal article – Annual report year: 2016
An incremental flow theory for crystal plasticity incorporating strain gradient effects

The present work investigates a new approach to formulating a rate-independent strain gradient theory for crystal plasticity. The approach takes as offset recent discussions published in the literature for isotropic plasticity, and a key ingredient of the present work is the manner in which a gradient enhanced effective slip measure governs hardening evolution. The effect of both plastic strains and plastic strain gradients are combined into this scalar effective slip quantity, the energy associated with plastic strain is dissipative (unrecoverable), while the energy from plastic strain gradients is recoverable (free). The framework developed forms the basis of a finite element implementation and is demonstrated on benchmark problems designed to bring out effects such as strengthening and hardening. Monotonic loading and plane strain deformation is assumed throughout, but despite this, non-proportional straining is predicted in the plastic regime even under pure shear conditions. Results of single slip and symmetric double slip reveal that strengthening and hardening are governed by the slip system orientation and the material length parameter only.
An Influence of Parameters of Micro-Electrical Discharge Machining On Wear of Tool Electrode

To achieve better precision of features generated using the micro-electrical dischargemachining (micro-EDM), there is a necessity to minimize the wear of the tool electrode, because a change in the dimensions of the electrode is reflected directly or indirectly on the feature. This paper presents a novel modeling and analysis approach of the tool wear in micro-EDM using a systematic statistical method exemplifying the influences of capacitance, feed rate and voltage on the tool wear ratio. The association between tool wear ratio and the input factors is comprehended by using main effect plots, interaction effects and regression analysis. A maximum variation of four-fold in the tool wear ratio have been observed which indicated that the tool wear ratio varies significantly over the trials. As the capacitance increases from 1 to 10 nF, the increase in tool wear ratio is by 33%. An increase in voltage as well as capacitance would lead to an increase in the number of charged particles, the number of collisions among them, which further enhances the transfer of the proportion of heat.
energy to the toolsurface. Furthermore, to model the tool wear phenomenon, a regression relationship between tool wear ratio and the process inputs has been developed.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern)
Pages: 149-164
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Main Research Area: Technical/natural sciences

**Publication information**
Journal: Archive of Mechanical Engineering
Volume: LXIV
Issue number: 2
ISSN (Print): 2300-1895
Ratings:
Web of Science (2018): Indexed yes
Original language: English
Micro-EDM, Tool wear ratio, Process inputs, Statistical methods, Main effects, Interactions, Regression analysis
Electronic versions:
Govindan_Paper.pdf
DOIs:
10.1515/meceng-2017-0009

**An interaction of impacting droplets with superhydrophobic coatings**

**General information**
State: Published
Organisations: Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Department of Mechanical Engineering, Fluid Mechanics
Authors: Okulova, N. (Intern), Okulov, V. (Intern), Taboryski, R. J. (Intern)
Publication date: 2017
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Main Research Area: Technical/natural sciences
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Source-ID: 138355021
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**A Novel Integrated Approach for Analysis and Evaluation of Control Factor Effects on Volumetric Tool Wear Rate (Vtwr) in Micro-EDM**

**General information**
State: Submitted
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern)
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Main Research Area: Technical/natural sciences

**Publication information**
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Original language: English
Source: PublicationPreSubmission
A Numerical Framework for Self-Similar Problems in Plasticity: Indentation in Single Crystals

A new numerical framework specialized for analyzing self-similar problems in plasticity is developed. Self-similarity in plasticity is encountered in a number of different problems such as stationary cracks, void growth, indentation etc. To date, such problems are handled by traditional Lagrangian procedures that may be associated with severe numerical difficulties relating to sufficient discretization, moving contact points, etc. In the present work, self-similarity is exploited to construct the numerical framework that offers a simple and efficient method to handle self-similar problems in history dependent materials. The procedure allows for focusing the mesh only in regions of interest giving highly detailed results in fractions of the time compared to traditional frameworks. The framework is not limited to a specific constitutive law and may be applied to a wide range of material models. The technique is here applied to wedge indentation in elastic-viscoplastic single crystals.

The three most common metal structures are investigated, namely the FCC, BCC, and HCP crystal structures, where the slip rate fields and stress fields will be compared to analytical predictions [1][2] and traditional numerical simulations [3] when possible. To mimic the condition for the analytical predictions, the wedge indenter is considered nearly flat and the material is perfectly plastic with a very low yield strain. Under these conditions, [1][2] proved analytically the existence of discontinuities in the slip rate field. The numerical simulations reveal a striking match to the analytical prediction showing the expected discontinuities in the slip rate field. In addition, the current results provide much more detailed views of the stress and slip rate fields than previously obtained. The results are all obtained without encountering many of the issues related to the traditional procedures and guarantees that it is indeed the self-similar solution that has been found.

A numerical investigation of the effect of ambient conditions on natural convection cooling of electronics

Thermal management is a serious concern in electronic industry. It is important to understand the effects of ambient conditions on cooling of electronics. In this work, the effect of ambient conditions on the thermophysical properties of humid air is estimated in five cities (Copenhagen, Mashhad, Singapore, Las Vegas and Jakarta). Thereafter, the Nu number is calculated for cooling of an isothermal surface in horizontal and vertical orientations. Comparing the results, shows that Pr number is very slightly affected by ambient conditions; however, Gr is following the temperature changes. Among the investigated cities Singapore and Jakarta, the cities with the higher temperature and moisture concentration had the lowest heat transfer coefficients.
A performance assessment of a 2 axis scanning mirror galvanometer for powder bed fusion

Additive manufacturing by powder bed fusion allows production of high strength parts with complex features, not possible through conventional manufacturing. To experiment and test current theory within laser processing of metal powder, an open and customizable laser scanner platform is developed and constructed. The platform seeks to fully support and enable the laser driven process of selective consolidation metal powder, as most industrially available powder bed fusion machine tools are closed and proprietary systems. This allows the machine tool manufacturer to strictly control how the system is used and therefore maintain stability through limiting the operator to use proprietary software hardware and process materials but unfortunately limits to an equally wide extent how such machine tools can be applied for research purposes as it renders the scientist to become a mere operator of the machine tool. A galvanometer based laser scanning system is here presented. The system was designed to meet a theoretical resolution of 0.009 mm. From inspiration of the use of optomechanical hole plates as reference artefacts for coordinate metrology a test was conducted to verify the accuracy of the laser scanning system. The system was found to perform excellent for relative positioning. Absolute positioning of the laser beam did not conform with design specifications, as the test deviated by 0.12 mm with respect to the nominal test value, yet this is expected in the future to be met from the implementation of a better galvanometer control system.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
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Additive manufacturing, Powder Bed Fusion, Selective Laser Melting, Galvanometer, Laser Scanning
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Application of aluminum diffusion coatings to mitigate the KCl-induced high-temperature corrosion

Pack cementation was used to produce Fe1−xAl and Fe2Al5 diffusion coatings on ferritic-martensitic steel P91 and a Ni2Al3 diffusion coating on pure nickel. The performance of diffusion coatings against high-temperature corrosion induced by potassium chloride (KCl) was evaluated by exposing the samples at 600 °C for 168 h in static lab air under KCl deposit. In addition, a salt-free experiment was performed for comparison. Microstructure, chemical and phase composition of the samples were analyzed with scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS) and X-ray diffractometry (XRD) before and after the exposures. It was found that all the diffusion coatings formed protective oxides under salt-free exposure in air. Under the salt deposit, Fe1−xAl showed local failure while on large parts of the sample a protective layer had formed. Fe2Al5 was attacked over the entire surface and the dominant mode of attack was selective aluminum removal. Ni2Al3 showed excellent performance and no sign of attack was observed anywhere on the sample.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, FORCE Technology
Authors: Kiamehr, S. (Intern), Lomholt, T. N. (Ekstern), Dahl, K. V. (Intern), Christiansen, T. L. (Intern), Somers, M. A. J. (Intern)
Number of pages: 13
Pages: 82–94
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Main Research Area: Technical/natural sciences

Publication information
Journal: Materials and Corrosion
Volume: 68
Issue number: 1
Application of silicone based elastomers for manufacturing of Green Fiber Bottle

Due to ever-increasing demand of sustainable products, eco-friendly packaging solutions are finding their importance in the paper packaging industry [1]. Green Fiber Bottle (GFB) is an alternative to plastic, glass and metal based packaging for beverages. The manufacturing of paper bottle is a two-stage process, where the wood fibers are first thermoformed in the desired shape followed by drying of the formed geometry [2]. To ensure the robustness of the bottle and to avoid shrinkage of cellulose fibers, the wet-formed bottle is pressurized using a silicone core. The core is inserted inside the drying tooland inflated. This keeps the wet bottle under pressure thereby enhancing formation of good hydrogen bonds, and hence providing good strength. The feasibility of the tool design concept is supported with Finite Element Model. The hyperelastic behaviour of silicone is defined by the deformation energy function (W). To simulate the inflation action of the core, Yeoh’s model is used for modelling of W. The strength of the GFB is correlated with the pressure the bottle can hold and the cut off burst pressure from experiments is also reported in this work.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Saxena, P. (Intern), Bissacco, G. (Intern)
Number of pages: 1
Pages: 62
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Article number: P17
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Application of silicone based elastomers for manufacturing of Green Fiber Bottle

Due to ever-increasing demand of sustainable products, eco-friendly packaging solutions are finding their importance in the paper packaging industry. Green Fiber Bottle (GFB) is an alternative to plastic, glass and metal based packaging for beverages. The tool concept for manufacturing of paper bottle uses a silicone based elastomer as the core. The expansion of core in the tool resists shrinkage of paper during drying as well as helps in obtaining good fiber compaction. The feasibility of the tool concept in the production of GFB is discussed in this work.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Saxena, P. (Intern), Bissacco, G. (Intern)
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Applications of automatic differentiation in topology optimization

The goal of this article is to demonstrate the applicability and to discuss the advantages and disadvantages of automatic differentiation in topology optimization. The technique makes it possible to wholly or partially automate the evaluation of derivatives for optimization problems and is demonstrated on two separate, previously published types of problems in topology optimization. Two separate software packages for automatic differentiation, CoDiPack and Tapenade are considered, and their performance and usability trade-offs are discussed and compared to a hand coded adjoint gradient evaluation process. Finally, the resulting optimization framework is verified by applying it to a non-trivial unsteady flow topology optimization problem.
Applications of Fiber-Reinforced Polymers in Additive Manufacturing

Additive manufacturing technologies are these years entering the market of functional final parts. Initial research has been performed targeting the integration of fibers into additive manufactured plastic composites. Major advantages, among others, are for example increased tensile strength and Young's modulus. Key challenges in the field, as of now, are proper fiber placement, fiber seizing, an increased knowledge in the used materials and how they are applied into engineering solutions through proper control of the additive manufacturing process. The aim of this research is the improved understanding of fiber-reinforcement in additive manufacturing in terms of production and application. Vat polymerization and material extrusion techniques for composite additive manufacturing were investigated with respect of increasing adhesion between the matrix material and the fibers. Process optimization was performed in order to avoid matrix cracks and delamination.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Hofstätter, T. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
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Main Research Area: Technical/natural sciences

Applying Multi-Class Support Vector Machines for performance assessment of shipping operations: The case of tanker vessels

Energy efficient operations are a key competitive advantage for modern shipping companies. During the operation of the vessel, improvements in energy use can be achieved by not only by technical upgrades, but also through behavioural changes in the way the crew on board is operating the vessel. Identifying the potential of behavioural savings can be challenging, due to the inherent difficulty in analysing the data and operationalizing energy efficiency within the dynamic operating environment of the vessels. This article proposes a supervised learning model for identifying the presence of energy efficient operations. Positive and negative patterns of energy efficient operations were identified and verified through discussions with senior officers and technical superintendents. Based on this data, the high dimensional parameter space that describes vessel operations was first reduced by means of feature selection algorithms. Afterwards, a model based on Multi-Class Support Vector Machines (SVM) was constructed and the efficacy of the approach is shown through the application of a test set. The results demonstrate the importance and benefits of machine learning algorithms in driving energy efficiency on board, as well as the impact of power management on energy costs throughout the life cycle of the ships.
A preliminary study on replication and quality correlation of on-part and on-runner polymer injection moulded micro features

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Giannekas, N. (Intern), Tosello, G. (Intern), Zhang, Y. (Intern)
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Main Research Area: Technical/natural sciences
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Publication: Research - peer-review › Poster – Annual report year: 2017

Aqueous Lubrication with Polyelectrolytes: Toward Engineering Applications

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Lee, S. (Intern)
Pages: 39–60
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A regularized vortex-particle mesh method for large eddy simulation

We present recent developments of the remeshed vortex particle-mesh method for simulating incompressible fluid flow. The presented method relies on a parallel higher-order FFT based solver for the Poisson equation. Arbitrary high order is achieved through regularization of singular Green’s function solutions to the Poisson equation and recently we have derived novel high order solutions for a mixture of open and periodic domains. With this approach the simulated variables may formally be viewed as the approximate solution to the filtered Navier Stokes equations, hence we use the method for Large Eddy Simulation by including a dynamic subfilter-scale model based on test-filters compatible with the aforementioned regularization functions. Further the subfilter-scale model uses Lagrangian averaging, which is a natural candidate in light of the Lagrangian nature of vortex particle methods. A multiresolution variation of the method is applied to simulate the benchmark problem of the flow past a square cylinder at Re = 22000 and the obtained results are compared to results from the literature.
A review of recent research on the use of zeotropic mixtures in power generation systems

The use of zeotropic fluid mixtures in refrigeration cycles and heat pumps has been widely studied in the last three decades or so. However it is only in the past few years that the use of zeotropic mixtures in power generation applications has been analysed in a large number of studies, mostly with low grade heat as the energy source. This paper presents a review of the recent research on power cycles with zeotropic mixtures as the working fluid. The available literature primarily discusses the thermodynamic performance of the mixture power cycles through energy and exergy analyses but there are some studies which also consider the economic aspects through the investigation of capital investment costs or through a thermoeconomic analysis. The reviewed literature in this paper is divided based on the various applications such as solar energy based power systems, geothermal heat based power systems, waste heat recovery power systems, or generic studies. The fluid mixtures used in the various studies are listed along with the key operation parameters and the scale of the power plant. In order to limit the scope of the review, only the studies with system level analysis of various power cycles are considered. An overview of the key trends and general conclusions from the various studies and some possible directions for future research are also presented.
A review of solar energy based heat and power generation systems

The utilization of solar energy based technologies has attracted increased interest in recent times in order to satisfy the various energy demands of our society. This paper presents a thorough review of the open literature on solar energy based heat and power plants. In order to limit the scope of the review, only fully renewable plants with at least the production of electricity and heat/hot water for end use are considered. These include solar photovoltaic and solar thermal based plants with both concentrating and non-concentrating collectors in both solar-only and solar-hybrid configurations. The paper also presents a selection of case studies for the evaluation of solar energy based combined heat and power generation possibility in Denmark. The considered technologies for the case studies are (1) solar photovoltaic modules, (2) solar flat plate collectors, (3) a ground source heat pump, (4) a biomass burner, and (5) an organic Rankine cycle. The various cases are compared on the basis of economic profitability and environmental performance. The results from the case studies indicate that it is economically and environmentally beneficial to invest in both small and large capacity solar-biomass hybrid plants for combined heat and power production in the Nordic climatic conditions. The results also suggest that the configuration with an organic Rankine cycle with solar thermal collectors and a biomass burner is particularly attractive for large capacity plants.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Modi, A. (Intern), Bühler, F. (Intern), Andreasen, J. G. (Intern), Haglind, F. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 9.52 SJR 3.051 SNIP 3.454
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.999 SNIP 3.387 CiteScore 8.35
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.106 SNIP 3.761 CiteScore 7.79
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.072 SNIP 3.889 CiteScore 7.88
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.814 SNIP 3.915 CiteScore 7.24
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 2.787 SNIP 3.901 CiteScore 7.39
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.374 SNIP 3.112
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.494 SNIP 3.6
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 2.447 SNIP 3.127
Web of Science (2008): Indexed yes
Scopus rating (2006): SJR 0.889 SNIP 1.758
Scopus rating (2005): SJR 0.956 SNIP 2.649
Scopus rating (2004): SJR 1.152 SNIP 2.268
Scopus rating (2003): SJR 0.813 SNIP 2.492
Scopus rating (2002): SJR 0.72 SNIP 2.152
Scopus rating (2001): SJR 0.201 SNIP 1.035
Scopus rating (2000): SJR 0.267 SNIP 1.112
Scopus rating (1999): SJR 0.219 SNIP 1.351
Original language: English
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Publication: Research - peer-review › Review – Annual report year: 2016
A sheet metal necking formability diagram for nonlinear strain paths

A new procedure for drawing forming limit curves is suggested. The theoretical basis for computing the forming limit curve due to diffuse necking, for nonlinear strain paths, is derived. The theoretically determined forming limit curve is compared with experimentally determined forming limits for both linear and bilinear strain paths. Reasonable agreement is observed. The procedure can also be utilized for nonlinear strain paths in general.

General information

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials and Surface Engineering
Authors: Christiansen, P. (Intern), Jensen, M. R. B. (Intern), Winther, G. (Intern)
Number of pages: 8
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 0.89 SJR 0.344 SNIP 0.572
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.214 SNIP 0.501 CiteScore 0.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.374 SNIP 0.618 CiteScore 0.85
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.393 SNIP 0.94 CiteScore 0.91
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.405 SNIP 0.774 CiteScore 0.95
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.39 SNIP 0.525 CiteScore 0.72
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.352 SNIP 0.526
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.192 SNIP 0.51
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.21 SNIP 0.421
Scopus rating (2007): SJR 0.248 SNIP 0.55
Scopus rating (2006): SJR 0.258 SNIP 0.818
Scopus rating (2005): SJR 0.34 SNIP 0.563
Scopus rating (2004): SJR 0.137 SNIP 0.225
Scopus rating (2003): SJR 0.327 SNIP 0.577
Scopus rating (2002): SJR 0.158 SNIP 0.573
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Sheet metal forming, Formability diagram, Necking instability, Nonlinear strain path

DOIs:
A short numerical study on the optimization methods influence on topology optimization

Structural topology optimization problems are commonly defined using continuous design variables combined with material interpolation schemes. One of the challenges for density based topology optimization observed in the review article (Sigmund and Maute Struct Multidiscip Optim 48(6):1031–1055, 2013) is the slow convergence that is often encountered in practice, when an almost solid-and-void design is found. The purpose of this forum article is to present some preliminary observations on how designs evolve during the optimization process for different choices of optimization methods. Additionally, the authors want to open a discussion on how to properly define and identify the boundary translation that is often observed in practice. The authors hope that these preliminary observations can open for fruitful discussions and stimulate further investigations concerning slowly moving boundaries. Although the discussion is centered on density based methods it may be equally relevant to level-set and phase-field approaches.

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Organisations: Department of Wind Energy, Wind Turbine Structures and Component Design, Department of Mechanical Engineering, Solid Mechanics
Authors: Rojas Labanda, S. (Intern), Sigmund, O. (Intern), Stolpe, M. (Intern)
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Volume: 56
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.14
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 1.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
A Soft Tooling process chain employing Additive Manufacturing for injection molding of a 3D component with micro pillars

The purpose of the research presented in this paper is to investigate the capability of a soft tooling process chain employing Additive Manufacturing (AM) for preproduction of an insert with micro features by injection molding. The Soft Tooling insert was manufactured in a high temperature photopolymer by Digital Light Processing (vat photopolymerization). The mold cavity was formed by two insert halves, by design; both inserts have four angled tines, with micro holes (Ø200 μm, 200 μm deep) on the surface. Injection molding with polyethylene was used with the soft tool inserts to manufacture the final production components. The diameter and height of the pillars that were replicated on the molded components were characterized by means of a 3D profilometer. The influence of the injection molding parameters on the replication was evaluated using a 2-levels DOE of three factors. The uniformity of the pillars are also evaluated regarding the diameter and height.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Zhang, Y. (Intern), Pedersen, D. B. (Intern), Segebrecht Gøtje, A. (Ekstern), Mischkot, M. (Intern)
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Journal: Journal of Manufacturing Processes
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Scopus rating (2015): SJR 0.993 SNIP 1.91 CiteScore 2.26
Scopus rating (2014): SJR 1.021 SNIP 1.963 CiteScore 1.77
Scopus rating (2013): SJR 0.872 SNIP 1.521 CiteScore 1.74
Scopus rating (2012): SJR 0.978 SNIP 1.814 CiteScore 1.72
Scopus rating (2011): SJR 0.62 SNIP 2.288 CiteScore 1.2
Scopus rating (2010): SJR 0.834 SNIP 1.236
Scopus rating (2009): SJR 0.268 SNIP 0.412
Scopus rating (2008): SJR 0.191 SNIP 0.39
Scopus rating (2007): SJR 0.337 SNIP 0.74
Scopus rating (2006): SJR 0.285 SNIP 0.524
Scopus rating (2005): SJR 0.197 SNIP 0.277
Assessing the financial potential for modularization: A case study in a global OEM

Assessing the financial potential of implementing a strategy, based on sharing of key modules and interfaces across a portfolio is difficult. However, this is a critical input when deciding strategic direction in industrial organizations. Through a case study, this paper gives an example of how to map and evaluate the architectures in a portfolio to identify the financial potential for implanting a platform-based modularization strategy. The approach has been applied in a global world-leading OEM with 50,000+ product variants and a turnover of USD 3.5b (2015). The results show a potential for reducing the cost-base by up to 15% through systematically sharing of key design principles across 80% of the company’s portfolio. This has supported the discussion of adjusting innovation strategy in the organization. The core contribution of the paper is the operational application of the systematic Architecture Mapping and Evaluation approach (AME) and discussion of how it can support strategic decision-making related to modularization. The approach builds on the understanding that a top-down assessment can give a starting point for implementing a level of modularity across a portfolio.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Løkkegaard, M. (Intern), Mortensen, N. H. (Intern)
Pages: 021-030
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Assessing transformational change from institutionalising digital capabilities on implementation and development of Product-Service Systems: Learnings from the maritime industry

Digitization is rapidly reshaping industries and economic sectors. It enables novel Product-Service Systems (PSS) that transform customer/supplier relationships and introduces new value propositions. However, while opportunities for novel types of PSS arise, it is not clear how digitization and the institutionalisation of digital capabilities, particularly within the customer organisations, may affect implementation of PSS, potentially leading to transformational changes in the customer organisation. This paper examines one such potential transformational change from three complementary viewpoints – the resource based, the dynamic, and the relational viewpoint. It does so through action research study in the context of the maritime industry, which is particularly attractive for PSS offerings. The research methodology comprised a two-step action research process, focusing on both digitization and PSS development and implementation. The main findings are that rather than facilitating procurement to co-development of PSS, institutionalisation of digital capabilities facilitated development of PSS by stakeholders internal to the company, and strategic co-development with external stakeholders. The new digital capabilities circumvented cost barriers associated with the procurement of services from external stakeholders, supported process standardization - to the expense of process innovation-, and transformed the network that delivered PSS by closing opportunity gaps for externally procured services. Furthermore, the uptake of digital capabilities highlighted the importance of cost estimation in making the customer more responsive to threats and opportunities.

General information
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Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Department of Management Engineering, Engineering Systems
Assessment of the Contour Method for 2-D Cross Sectional Residual Stress Measurements of Friction Stir Welded Parts of AA2024-T3—Numerical and Experimental Comparison

The contour method is one of the newest techniques for obtaining residual stress fields from friction stir welded (FSW) parts, experimentally. This method has many advantages; however, edge effects coming from the process itself might introduce artifacts in the obtained results, and this was slightly touched upon in the very first paper on the method. This concern is further assessed in the present work, where the contour method is compared with the results that were obtained numerically via a thermomechanical model and experimentally via the cut-compliance method. For the two-dimensional (2-D) cross sectional map obtained by the method, peak stresses in tension are observed in the mid-section of the FSW butt-welded plates at the distance of the tool radius from the centerline. The corresponding numerical simulation indicates the same behavior because of the particular clamping conditions, and consequently this should not be interpreted as a misleading result of the contour method. Edge effects from the cutting process involved in the contour method should, however, be taken into consideration, most likely resulting in the residual stresses observed near the surfaces of the cross section being less extreme in reality than observed.
A study of DLC coatings for ironing of stainless steel

Stamping of sheet metal components without lubrication or using minimum amount of hazard free lubricant is a possible solution to diminish health hazards to personnel and environmental impact and to reduce production costs. This paper studies the application of diamond-like coating (DLC) under severe lubrication conditions by adopting strip reduction testing to replicate industrial ironing production of deep drawn, stainless steel cans. Three DLC coatings are investigated; multi-layer, double layer and single layer. Experiments revealed that the double layer coating worked successful, i.e. with no sign of galling using no lubrication even at elevated tool temperature, while the other two coatings peeled off and resulted in severe galling unless lubrication was applied.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Sulaiman, M. H. B. (Intern), Christiansen, P. (Intern), Bay, N. O. (Intern)
Number of pages: 7
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Conference: 36th IDDRG Conference on Materials Modelling and Testing for Sheet Metal Forming (IDDRG 2017), Munich, Germany, 02/07/2017 - 02/07/2017
Main Research Area: Technical/natural sciences

Publication information

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BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.39 SJR 0.187 SNIP 0.499
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.172 SNIP 0.281 CiteScore 0.22
Scopus rating (2014): SJR 0.186 SNIP 0.306 CiteScore 0.18
Scopus rating (2013): SJR 0.183 SNIP 0.256 CiteScore 0.16
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.161 SNIP 0.203 CiteScore 0.14
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.155 SNIP 0.149 CiteScore 0.1
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Source-ID: 134359148
Publication: Research - peer-review › Conference article – Annual report year: 2017
A study on replication and quality correlation of on-part and on-runner polymer injection molded micro features

Injection molding is increasingly gaining place in manufacturing of polymer components as it can ensure a cost efficient production with short cycle times. To ensure the quality of the produced parts and the stability of the process it is essential to perform frequent metrological inspections. In contrast to injection molding’s short cycle time, a metrological quality control can require a significant amount of time. The late detection of the problem can result to high losses and scrap rate. This paper presents an alternative approach to process monitoring and part quality control with fast off/in-line metrology of physical part quality indicators (“Product Fingerprint”). The proposed approach is based on the concept of metrology applied to dedicated micro features, positioned on the runners, similar or equal to those in the part in order to access the quality of the produced plastic parts. A designed experiment was employed to map the experimental space and quantify the pillars replication depending on position and processing parameter combinations. The pillars were assessed and the main effects of the processing parameters, were calculated to reveal that the effects of process parameter change were similar in all measurement positions. Results showed that the product fingerprints have a correlation to the quality of on-part micro features. The concept can support the creation of a fast part quality monitoring system that has the potential to decrease the use of off-line time-consuming detailed metrology for part approval.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Giannekas, N. (Intern), Tosello, G. (Intern), Zhang, Y. (Intern)
Number of pages: 4
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Main Research Area: Technical/natural sciences
Precision injection moulding, Quality Control, Process monitoring
Electronic versions:
A_study_on_replication_and_QC_of_on_part_and_on_runner_micro_features_POST_PRINT.pdf
Publication: Research - peer-review › Paper – Annual report year: 2017

Asymptotically Matched Layer (AML) for transient wave propagation in a moving frame of reference

The paper presents an Asymptotically Matched Layer (AML) formulation in a moving frame of reference for transient dynamic response of a multi-layer 2D half-space. A displacement based finite element formulation of the convected domain problem is presented together with the AML formulation in which the original convolution integrals are represented via two auxiliary displacement-like state-space variables. A parametric study of the AML parameters is conducted for optimizing the absorbing properties. The performance is demonstrated on a single- and a two-layered half-space for various velocities of an impulse Ricker load. Excellent absorbing properties are demonstrated in both half spaces.

General information
State: Published
Organisations: Department of Civil Engineering, Section for Geotechnics and Geology, Department of Mechanical Engineering, Solid Mechanics
Authors: Madsen, S. S. (Intern), Krenk, S. (Intern)
Pages: 124-133
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
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Scopus rating (2016): SJR 2.012 SNIP 2.371 CiteScore 3.11
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.959 SNIP 2.157 CiteScore 2.65
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.025 SNIP 2.649 CiteScore 2.83
A theoretical-experimental study of backup bearings: The pinned vs ball bearing

The backup bearing is a mechanical component designed to improve the safety and reliability of Active Magnetic Bearings (AMBs). Rotors levitated by AMBs can be subjected to delevitation and consequently to impacts if a power loss happens because real-time active control is necessary to keep them running. When impacting on a stator surface, the rotor can develop a dangerous behavior caused by the friction force known as the full annular backward whirl. In this situation, the rotor will describe a trajectory around the surface of the bearing at a dominant superharmonic frequency and with large radial forces. Remaining in this condition, it may lead to permanent damage or total failure of the machine. This is why the backup bearing design has to be carefully planned and investigated as to whether it helps to protect the integrity of the machine. This PhD thesis provides a comprehensive study of two types of backup bearings, which are investigated experimentally and theoretically. The first type is a conventional ball bearing commonly used in industrial applications. The second is an unconventional bearing that, which contains pins inside the clearance for the rotor to impact on. The main objective of this work is to investigate the rotor-to-stator contact dynamics under certain conditions and to explore dynamical phenomena that emerge, so advantages and drawbacks can be stated based on a solid theoretical model validated experimentally. The mathematical model is discontinuous since the contact forces exist only if the rotor surpasses the boundaries defined by the type of backup bearing. The compliance models proposed by Lankarani and Hunt and Crossley (H&C) are employed to represent this interaction between the rotor and the backup bearing. As a matter of comparison, plots of shaft orbits, of contact force values in time and double-sided frequency spectra are given. The test rig consists of a horizontal rotor and is able to exchange backup bearings. Thanks to the force transducers, displacement sensors, and an encoder, one is able to characterize the lateral vibration of the rotor, the impact forces and to ascertain that the same conditions are met for each test run. The parameters of the test rig were determined accordingly, so the tests match with the mentioned theoretical analysis. The problem of crossing the resonance frequency is undertaken. In this case, the magnetic forces are weakly damped. It means that they are unable to withstand the occurrence of high orbits close to the resonance frequency. The pinned bearing is introduced and the pins are made of POM (polymer), whose contact characteristics are investigated. The different behaviors of the center of the shaft for the two types of backup bearings are analyzed. One concludes that the pinned bearing reduces the interval of impact by
advancing the jump towards a safer contactless orbit while crossing the critical speed. The polymeric pins are softer than the rotor’s surface, so they wear from the impacts, saving the rotor. This is confirmed by a Finite-Element model of the contact case. For both types of bearings, the backward whirl could not be detected for the mentioned tests. Moreover, the H&C compliance model reproduced satisfactorily the changes in amplitude performed by the rotor and it is considered appropriate to represent both types of bearings for further investigation. Also, a full failure of the control and a rotor drop on the ball bearing as backup bearing is investigated by removing the magnetic forces. The nonlinear features of the dynamics of the rotor are assessed for different levels of unbalance. It has been shown that the proposed mechanical model for the rotor drop matches with the conducted experiments, as illustrated by the bifurcation diagrams, where three distinct behaviors are observed. The double-sided spectra demonstrate that higher unbalance values cause the rotor to perform a forward whirl trajectory.

General information
State: Published
Organisations: Solid Mechanics, Department of Mechanical Engineering
Authors: Lampe Linhares da Fonseca, C. A. (Intern), Santos, I. (Intern), Weber, H. I. (Ekstern)
Number of pages: 85
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Projects:
A theoretical-experimental study of backup bearings
Publication: Research › Ph.D. thesis – Annual report year: 2017

A third order accurate Lagrangian finite element scheme for the computation of generalized molecular stress function fluids
A third order accurate, in time and space, finite element scheme for the numerical simulation of three-dimensional time-dependent flow of the molecular stress function type of fluids in a generalized formulation is presented. The scheme is an extension of the K-BKZ Lagrangian finite element method presented by Marín and Rasmussen (2009).

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Fasano, A. (Intern), Rasmussen, H. K. (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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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.43 SJR 1.079 SNIP 1.555
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Augmented Reality Interfaces for Additive Manufacturing

This paper explores potential use cases for using augmented reality (AR) as a tool to operate industrial machines. As a baseline we use an additive manufacturing system, more commonly known as a 3D printer. We implement novel augmented interfaces and controls using readily available open source frameworks and low cost hardware. Our results show that the technology enables richer and more intuitive printer control and performance monitoring than currently available on the market. Therefore, there is a great deal of potential for these types of technologies in future digital factories.
Bayesian estimation of $P(X > x)$ from a small sample of Gaussian data

The classical statistical uncertainty problem of estimation of upper tail probabilities on the basis of a small sample of observations of a Gaussian random variable is considered. Predictive posterior estimation is discussed, adopting the standard statistical model with diffuse priors of the two normal distribution parameters. Rarely the uncertainty of the predictive estimate itself is quantified in practice. By considering the exceedance probability as a random variable over the posterior probability distribution of the parameters, an explicit expression for the distribution of this random variable is obtained. It is shown that the usual elementary estimate based on the normal distribution is very close to the median of this distribution. For increasing exceedance level the distribution skewness increases so that the predictive estimate, which is equal to the mean of the distribution, comes further and further out in the upper tail of the distribution. The dual frequentist's confidence interval approach is shown to have difficulties not present for the Bayesian approach. (C) 2017 Elsevier Ltd. All rights reserved.
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
State: Published
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), Merk, 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
Publication date: 2017

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Title of host publication: Proceedings of the 2017 International Conference on Numerical Simulation of Optoelectronic Devices (NUSOD)
Biological features produced by additive manufacturing processes using vat photopolymerization method

Bio inspired surfaces have attracted great interest due to their potential applications in different industries by using a variety of structures. The fabrication of microstructures having complex shapes have been developed within the recent decades. This work realizes the direct fabrication of micro biological features by Additive Manufacturing (AM) processes. The study characterizes the additive manufacturing processes for polymeric micro part productions using the vat photopolymerization method. A specifically designed vat photopolymerization AM machine suitable for precision printing at the micro dimensional scale has been developed, built and validated. In order to evaluate the AM machine capability a Tokay gecko test part that contains microscale pillars with widened tips was used as benchmark sample. Two main printing parameters were selected for the study: exposure time and layer thickness. In order to select the optimal range of printing parameters, a sensitivity analysis was carried out prior to the final experiment. The print quality was assessed in terms of features heights, tip heights and tip diameters.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology
Authors: Davoudinejad, A. (Intern), Mendez Ribo, M. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Islam, A. (Intern)
Number of pages: 3
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Additive manufacturing, Bioinspired surfaces, Biological Features, Micro manufacturing, Polymer components
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Book of presentations of the International Workshop on High Temperature Heat Pumps

Modern society moves towards an electrified energy system based on wind, solar and other renewable sources. Utilizing these sources efficiently by heat pumps is highly attractive and a significant potential for improving the energy system by extensive adaptation of heat pumping technology in all fields exists. However, challenges are present for heat pump technology. In particular for high temperature applications like industrial processes and to some extent district heating, heat pumps are not yet commercially available. In some countries the expansion already occurs, but other places the development is much more limited. Some obstacles relate to regulations and boundary conditions which may not be favorable for heat pumps and electrification. But, the level of the technology will probably also improve with regards to temperature limits, efficiency, capacity, and economy, and hence inherently become an attractive alternative to fossil fuels. The focus on developments for the future is apparent in both industrial and scientific research and development activities at all levels. DTU Technical University of Denmark, Danish Technological Institute and Norwegian SINTEF are all involved in these activities in collaboration with national and international partners. Based on these common interests and the many exciting activities we decided to invite for a workshop for a broad audience ranging from manufacturers, systems suppliers, industrial users, consultants, research institutes, and academia. The meeting attracted more than 60 participants attending the 18 talks and a final panel discussion on the 11. September 2017 in Copenhagen.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Danish Technological Institute, SINTEF Energi AS
Authors: Elmegaard, B. (ed.) (Intern), Zühlsdorf, B. (ed.) (Intern), Reinholdt, L. (ed.) (Ekstern), Bantle, M. (ed.) (Ekstern)
Number of pages: 176
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Publication information
Place of publication: Kgs. Lyngby
Building a Business Case for Eco-design Implementation: A System Dynamics Approach

Several potential business benefits obtained from ecodesign are consistently reported by academic studies and companies. These benefits comprise increased innovation potential, development of new markets and business models, reduction in risks and costs, improvement of organizational brand, among others. However, there are still significant challenges for adopting ecodesign, specially concerning the capture and measurement of the expected business benefits.

To address such gap, this paper proposes an exploratory concept of a simulation-based business case for ecodesign implementation, grounded on a System Dynamics approach. The study builds upon the Ecodesign Maturity Model (EcoM2) and the related capabilities of ecodesign management practices, offering an integrative outlook into how ecodesign capability building can potentially affect corporate performance outcomes over time. Preliminary results point towards the potential for managers and key organizational decision-makers to use the business case simulator to assessing ecodesign benefits and testing multiple implementation scenarios (e.g. what-if questions).

Calibration of piezoelectric RL shunts with explicit residual mode correction

Piezoelectric RL (resistive-inductive) shunts are passive resonant devices used for damping of dominant vibration modes of a flexible structure and their efficiency relies on the precise calibration of the shunt components. In the present paper improved calibration accuracy is attained by an extension of the local piezoelectric transducer displacement by two additional terms, representing the flexibility and inertia contributions from the residual vibration modes not directly addressed by the shunt damping. This results in an augmented dynamic model for the targeted resonant vibration mode, in which the residual contributions, represented by two correction factors, modify both the apparent transducer capacitance and the shunt circuit impedance. Explicit expressions for the correction of the shunt circuit inductance and resistance are presented in a form that is generally applicable to calibration formulae derived on the basis of an assumed single-mode structure, where modal interaction has been neglected. A design procedure is devised and subsequently verified by a numerical example, which demonstrates that effective mitigation can be obtained for an arbitrary vibration mode when the residual mode correction is included in the calibration of the RL shunt.
Capability Database of Injection Molding Process—Requirements Study for Wider Suitability and Higher Accuracy

Generally, there is little disagreement that an early consideration of dimensional accuracies achieved in production is conducive to the success of development of injection molding products. While different process capability databases (PCDBs) provide guidance for a meaningful estimation of the expected part variation, the adoption of corresponding guidelines and (proprietary) software tools seems to be, however, limited in industrial practice so far. This research paper addresses the gap between the available PCDBs and the requirement of designers in practice and investigates the key drivers for an improved applicability of corresponding database solutions in an industrial context. A survey of database users at all phases of product value chain in the plastic industry revealed that 59% of the participating companies use their own, internally created databases, although reported to be not fully adequate in most cases. Essential influences are the suitability of the provided data, defined by the content such as material, tolerance types, etc. covered, as well as its accuracy, largely influenced by the updating frequency. Forming a consortium with stakeholders, linking database update to technology changes and connecting dimensioning standards to database offerings are proposed solutions.

Carbon Nanotubes as Thermally Induced Water Pumps

Thermal Brownian motors (TBMs) are nanoscale machines that exploit thermal fluctuations to provide useful work. We introduce a TBM-based nanopump which enables continuous water flow through a carbon nanotube (CNT) by imposing an axial thermal gradient along its surface. We impose spatial asymmetry along the CNT by immobilizing certain points on its surface. We study the performance of this molecular motor using molecular dynamics (MD) simulations. From the MD trajectories, we compute the net water flow and the induced velocity profiles for various imposed thermal gradients. We find that spatial asymmetry modifies the vibrational modes of the CNT induced by the thermal gradient, resulting in a net water flow against the thermal gradient. Moreover, the kinetic energy associated with the thermal oscillations rectifies the Brownian motion of the water molecules, driving the flow in a preferred direction. For imposed thermal gradients of 0.5-3.3 K/nm, we observe continuous net flow with average velocities up to 5 m/s inside CNTs with diameters of 0.94, 1.4, and 2.0 nm. The results indicate that the CNT-based asymmetric thermal motor can provide a controllable and robust system for delivery of continuous water flow with potential applications in integrated nanofluidic devices.
Cavity prediction in sand mould production applying the DISAMATIC process
The sand shot in the DISAMATIC process is simulated by the discrete element method (DEM) taking into account the
influence and coupling of the airflow with computational fluid dynamics (CFD). The DEM model is calibrated by a ring
shear test, a sand pile experiment and a slump test. Subsequently, the DEM model is used to model the propagation of
the green sand inside the mold chamber and the results are compared to experimental video footage. The chamber
contains two cavities designed to quantify the deposited mass of green sand. The deposition of green sand in these two
cavities is investigated with three cases of different air vent settings which control the ventilation of the chamber. These
settings resulted in different air- and particle-velocities as well as different accumulated masses in the cavities, which were
successfully simulated by the model.

General information
CFD Analysis of Scale Effects on Conventional and Tip-Modified Propellers

Full-scale propeller performance is traditionally predicted by scaling model-scale test results, but the traditional scaling methods do not take into account hydrodynamic distinctions of tip-modified propellers in full-scale performance. An open-water CFD analysis is made on scale effects of tip-modified and conventional propellers, which are designed for the same operating condition with identical propeller diameter and expanded area ratio. While model-scale computations are made with a transition model, a fully turbulent flow is modeled in the full-scale computations. The investigation of the effects of the transition model shows that laminar and transitional flow modeling is crucial in model-scale computations. Grid-independent solutions at model and full scale are achieved by grid verification studies.

The CFD analysis of scale effects shows that the efficiency gain of the tip-modified propeller is increased at full scale. The difference of scale effects between the tip-modified and conventional propellers is related to alterations of tip vortex and sectional pressuredistributions by the bent tip and the higher spanwiseloading at the tip region of the tip-modified propeller.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, MAN Diesel & Turbo SE
Authors: Shin, K. W. (Ekstern), Andersen, P. (Intern)
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Scale effect, Unconventional propeller, CFD, RANS, Transition model
Electronic versions:
ScaleEffect_SMP17_Draft_Rev1.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

CFD modeling of condensation process of water vapor in supersonic flows

The condensation phenomenon of vapor plays an important role in various industries, such as the steam flow in turbines and refrigeration system. A mathematical model is developed to predict the spontaneous condensing phenomenon in the supersonic flows using the nucleation and droplet growth theories. The numerical approach is validated with the experimental data, which shows a good agreement between them. The condensation characteristics of water vapor in the Laval nozzle are described in detail. The results show that the condensation process is a rapid variation of the vapor-liquid phase change both in the space and in time. The spontaneous condensation of water vapor will not appear immediately when the steam reaches the saturation state. Instead, it occurs further downstream the nozzle throat, where the steam is in the state of supersaturation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Changzhou University, University of Nottingham
Authors: Yang, Y. (Ekstern), Walther, J. H. (Intern), Yan, Y. (Ekstern), Wen, C. (Intern)
Pages: 1357-1362
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Thermal Engineering
Volume: 115
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Ratings:
CFD modeling of particle behavior in supersonic flows with strong swirls for gas separation

The supersonic separator is a novel technique to remove the condensable components from gas mixtures. But the particle behavior is not well understood in this complex supersonic flow. The Discrete Particle Method was used here to study the particle motion in supersonic flows with a strong swirl. The results showed that the gas flow was accelerated to supersonic velocity, and created the low pressure and temperature conditions for gas removal. Most of the particles collided with the
walls or entered into the liquid-collection space directly, while only a few particles escaped together with the gas flow from the dry gas outlet. The separation efficiency reached over 80%, when the droplet diameter was more than 1.5 μm. The optimum length of the cyclonic separation section was approximate 16–20 times of the nozzle throat diameter to obtain higher collection efficiency for the supersonic separator with a delta wing.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Changzhou University
Authors: Yang, Y. (Ekstern), Wen, C. (Intern)
Pages: 22-28
Publication date: 2017
Main Research Area: Technical/natural sciences

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Volume: 174
ISSN (Print): 1383-5866
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.78 SJR 1.023 SNIP 1.394
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.078 SNIP 1.504 CiteScore 3.75
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.257 SNIP 1.54 CiteScore 3.5
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.325 SNIP 1.678 CiteScore 3.62
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.409 SNIP 1.732 CiteScore 3.2
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.35 SNIP 1.64 CiteScore 3.48
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.376 SNIP 1.586
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.388 SNIP 1.542
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.109 SNIP 1.433
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.015 SNIP 1.457
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.222 SNIP 1.628
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.012 SNIP 1.424
CFD simulation and statistical analysis of moisture transfer into an electronic enclosure

Condensation and moisture related problems are the cause of failures in many cases and consequently serious concerns for reliability in electronics industry. Thus, it is important to control the moisture content and the relative humidity inside electronic enclosures. In this work, a computational fluid dynamics (CFD) model is developed to simulate moisture transfer into a typical electronic enclosure. In the first attempt, an isothermal case is developed and compared against the well-known RC circuit analogy considering the behavior of an idealized electronic enclosure. It is shown that the RC method predicts a faster trend for the moisture transfer into the enclosure compared to the CFD. The effect of several important parameters, namely, position of the opening, initial relative humidity inside the enclosure, length and radius of the opening and temperature is studied using the developed CFD model for the isothermal case. The model is then combined with a two level factorial design to identify the significant factors as well as the potential interactions using the numerical simulation results. In the second part of this study, a non-isothermal case is studied, in which the enclosure is exposed to two different conditions, i.e., internal temperature oscillation only and combined cyclic changes of ambient relative humidity and temperature. The results are compared with experimental data from literature, and show that the local climate inside the enclosure responds faster to the temperature changes compared to the RH changes. The trends predicted by the CFD simulations can be used to decide for the right time and position of a commercial adsorbent and/or thermal mass inside the enclosure to control the local climate.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Shojaee Nasirabadi, P. (Intern), Jabbaribehnam, M. (Intern), Hattel, J. H. (Intern)
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 3.03 SJR 1.145 SNIP 1.748
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.212 SNIP 1.697 CiteScore 2.67
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.179 SNIP 1.923 CiteScore 2.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Challenges and opportunities of fibre-reinforced polymers in additive manufacturing with focus on industrial applications

Functional parts made by additive manufacturing of polymers have entered the area of industrial applications in recent years providing a wide range of materials with various mechanical, thermal, and electrical properties. These additive manufacturing processes can be combined with known fibre-reinforcements applying modified material parameters with the use of fibre-reinforced polymers.

An increase of tensile strength and Young’s modulus result from the application of short fibres in a polymer matrix opening up perspectives for a variety of industrial applications such as injection moulding, biomedical engineering, aerospace, racing, and train technology. A literature survey was conducted in order to identify challenges and opportunities in these fields.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Hofstätter, T. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 4
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Publisher: The European Society for Precision Engineering and Nanotechnology
Main Research Area: Technical/natural sciences
Conference: euspen and ASPE Special Interest Group Meeting: Additive Manufacturing, Leuven, Belgium, 10/10/2017 - 10/10/2017
Characterisation and full-scale production testing of multifunctional surfaces for deep drawing applications

Full-scale deep drawing tests using tools featuring multifunctional surfaces are carried out in a production environment. Multifunctional tools display regularly spaced, transversal grooves for lubricant retention obtained by hard-turning, separated by smooth bearing plateaus realized by robot assisted polishing. Advanced methods are employed to characterise the tools' surface topographies, detecting the surface features and analysing them separately according to their specific function. Four different multifunctional dies as well as two un-textured references are selected for testing. The tests are run using a non-hazardous, environmentally friendly lubricant, and the forming forces are constantly recorded. Multifunctional dies exhibit very good performances, with no galling occurrence and punch forces generally lower than the two references.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Strecon A/S
Authors: Godi, A. (Intern), Grønbæk, J. (Ekstern), De Chiffre, L. (Intern)
Number of pages: 8
Pages: 64–71
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.76 SJR 0.81 SNIP 1.991
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.953 SNIP 1.862 CiteScore 2.55
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.133 SNIP 1.777 CiteScore 2.46
Scopus rating (2013): SJR 0.95 SNIP 1.796 CiteScore 2.01
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.819 SNIP 1.822 CiteScore 1.69
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.946 SNIP 2.037 CiteScore 1.72
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 1.202 SNIP 2.299
Scopus rating (2009): SJR 0.837 SNIP 1.085
Original language: English
Functional surfaces, Metal forming, Production tests, Surface characterisation, Metal drawing, Deep drawing tests, Environmentally friendly lubricants
DOIs:
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Source: FindIt
Source-ID: 2319823705
Publication: Research - peer-review › Journal article – Annual report year: 2016

Characterization and Erosion Modeling of a Nozzle-Based Inflow-Control Device

In the petroleum industry, water-and-gas breakthrough in hydrocarbon reservoirs is a common issue that eventually leads to uneconomic production. To extend the economic production lifetime, inflow-control devices (ICDs) are designed to delay the water-and-gas breakthrough. Because the lifetime of a hydrocarbon reservoir commonly exceeds 20 years and it is a harsh environment, the reliability of the ICDs is vital.

General information
Characterization of additive manufacturing processes for polymer micro parts productions using direct light processing (DLP) method

The process capability of additive manufacturing (AM) for direct production of miniaturized polymer components with micro features is analyzed in this work. The consideration of the minimum printable feature size and obtainable tolerances of AM process is a critical step to establish a process chains for the production of parts with micro scale features. A specifically designed direct light processing (DLP) AM machine suitable for precision printing has been used. A test part is designed having features with different sizes and aspect ratios in order to evaluate the DLP AM machine capability to fabricate polymer micro scale features geometries. Four different factors are evaluated for the AM process analysis: printing layer thickness, exposure time, film thickness and geometry. The process optimization of the workpiece quality features is carried out to highlight potential and challenges of the micro AM process.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Davoudinejad, A. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern)
Number of pages: 5
Publication date: 2017
Event: Paper presented at 33rd Conference of the Polymer Processing Society (PPS-33), Cancun, Mexico.
Main Research Area: Technical/natural sciences
Electronic versions:
Publication: Research - peer-review › Paper – Annual report year: 2017

Characterization of clay-modified thermoset polymers under various environmental conditions for the use in high-voltage power pylons

The effect of nanoclay on various material properties like damping and strength of typical thermoset polymers, such as epoxy and vinyl ester, was investigated. Different environmental conditions typical for high-voltage transmission pylons made of composite materials were taken into account. Resin samples were prepared with various clay weight fractions ranging from 0% to 3%. Scanning electron microscopy, transmission electron microscopy, X-ray diffraction and rheological analysis were used to study the morphology and the structure of the nanocomposites. For all nanoclay-modified thermoset polymers, the morphology was found to be of exfoliated structure mainly. Static, uniaxial tensile tests showed that the addition of nanoclay to thermoset polymers led to a beneficial effect on the stiffness, whereas the tensile strength and ductility significantly decreased. When exposed to different environmental conditions, nanoclay was found to have a positive influence on the dynamic properties, analysed by a dynamic mechanical thermal analysis. The addition of nanoclay to the thermoset resin led to an increase of the damping properties by up to 28% for vinyl ester and up to 6% for epoxy at -20 degrees C. The dielectric properties were evaluated by electrical breakdown strength tests resulting in 11% better insulating behaviour for nanoclay-modified vinyl ester.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Aalborg University, Technische Universität Dresden
Authors: Kliem, M. (Intern), Høgsberg, J. B. (Intern), Wang, Q. (Ekstern), Dannemann, M. (Ekstern)
Pages: 1-16
Publication date: 2017
Main Research Area: Technical/natural sciences
Characterization of Thermochemically Surface-Hardened Titanium by Light Optical Microscopy

Thermochemically treated titanium grades 2 and 5 were investigated by light optical microscopy and hardness indentation. Gaseous oxidation in oxygen and N2O containing atmospheres resulted in a diffusion zone of oxygen in solid solution in titanium with a hardness up to 1000 HV. A surface scale consisting of oxide can be present depending on the treatment conditions. A new type of carbo-oxidation treatment was applied, where carbon and oxygen are simultaneously incorporated into the surface. This resulted in new microstructural features such as a deep zone of mixed interstitial solid solution, i.e., a diffusion zone, and surface regions consisting of a mixed interstitial compound (TiC$_{X}$O$_{1-X}$ structure).

Carbo-oxidation yields hardness values in excess of 2500 HV in the mixed interstitial compound and values up to 1500 HV in the diffusion zone. Simultaneously, with the surface hardening treatment, core hardening of the material can be obtained.
Characterizing Green Fiber Bottle Prototypes Using Computed Tomography
Due to ever increasing demand of sustainability and biodegradability, there arises a need to develop environmental friendly packaging products. Green fiber bottle is a packaging product for carbonated beverages, made out of cellulose fibers. The production process accounts for moulding paper pulp in the desired shape and structure. However, there are certain limitations associated to the product characterization using tactile measuring methods. In this work, a new approach has been applied for defect analysis and quality control of non-homogenous prototype paper products using computed tomography.

Chemically extracted nanocellulose from sisal fibres by a simple and industrially relevant process
A novel type of acetylated cellulose nanofibre (CNF) was extracted successfully from sisal fibres using chemical methods. Initially, a strong alkali treatment was used to swell the fibres, followed by a bleaching step to remove the residual lignin and finally an acetylation step to reduce the impact of the intermolecular hydrogen bonds in the nanocellulose. The result of this sequence of up-scalable chemical treatments was a pulp consisting mainly of micro-sized fibres, which allowed simpler handling through filtration and purification steps and permitted the isolation of an intermediate product with a high solids content. An aqueous dispersion of CNF could be obtained directly from this intermediate pulp by simple magnetic stirring. As a proof of concept, the dispersion was used directly for preparing a highly translucent CNF film, illustrating that there are no large aggregates in the prepared CNF dispersion. Finally, CNF films with alkali extracts were also prepared, resulting in flatter films with an increased mass yield and improved mechanical strength.
Collective design in 3D printing: A large scale empirical study of designs, designers and evolution

This paper provides an empirical study of a collective design platform (Thingiverse); with the aim of understanding the phenomenon and investigating how designs concurrently evolve through the large and complex network of designers. The case study is based on the meta-data collected from 158 489 designs and 247 768 users; and it reveals that (i) Designs can be shared and quickly evolved into other designs through a distributed network of designers, (ii) only a small portion of the users are designers and (iv) collective design has deep and strong evolutionary roots. Better understanding of collective design platforms can help design practitioners to identify lead users in their respective domains and to discover latent needs that stem from different sub-communities or geographic regions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Colorimetric visualization of tin corrosion: A method for early stage corrosion detection on printed circuit boards

A majority of printed circuit board surfaces are covered with tin, therefore tin corrosion under humid conditions and movement of tin ions under the influence of an electric field plays an important role in the corrosion failure development. Tracking tin corrosion products spread on the printed circuit board assembly (PCBA) provides a basis for the mechanistic understanding of PCBA corrosion failures and leak current tracks which eventually can lead to electrochemical migration. This paper presents a method for identification of such failures at the early stage of corrosion by using a colorimetric tin ion indicator applied as a gel. The examples provided in this paper include visualization of corrosion caused by weak organic acids found in solder fluxes, corrosion profiling on the PCBAs after climatic device level testing, and failure analysis of field returns.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Verdingovas, V. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Pages: 158-166
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Microelectronics Reliability
Volume: 73
ISSN (Print): 0026-2714
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.57 SJR 0.47 SNIP 0.976
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.618 SNIP 1.193 CiteScore 1.81
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.601 SNIP 1.432 CiteScore 1.9
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.594 SNIP 1.264 CiteScore 1.55
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.586 SNIP 1.414 CiteScore 1.6
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.621 SNIP 1.382 CiteScore 1.63
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.602 SNIP 1.114
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.736 SNIP 1.176
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.932 SNIP 1.235
Scopus rating (2007): SJR 0.743 SNIP 1.228
Scopus rating (2006): SJR 0.716 SNIP 1.153
Web of Science (2006): Indexed yes
Combined micro-cogeneration and electric vehicle system for household application: An energy and economic analysis in a Northern European climate

In recent years, Denmark boosted investments in renewable energy and electrification of transportation. The Danish Agenda proposed that all primary energy consumption will be covered by renewable sources such as wind, biomass and solar by 2050. These changes require significant investment and re-thinking of entire energy infrastructures and types of consumption. The Agenda also suggested, among other things, improving the efficiency of energy systems.

In this paper, the interactions between charging an electric car and an innovative cogeneration system for household application (micro-solid oxide fuel cell with an integrated heating system) are investigated. The charge of the electric car by the cogenerator produces waste heat that can be used to partially cover the heat demand of the house. In this way it may be possible to increase overall efficiency and decrease total energy costs. Different innovative strategies are proposed and analyzed to manage charging an electric car and efficiently using the waste heat available. The aims of this study are to make the system grid-independent, to decrease the thermal stress of SOFCs and to determine the nominal power of an integrated heating system. The results show energy efficiency and economic profitability of the system, even if subsidies are not included.
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.
Combined shape and topology optimization, Deformable simplicial complex method, Explicit surface representation, Stress minimization

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Source: FindIt
Source-ID: 2351625157

Publication: Research - peer-review › Journal article – Annual report year: 2017
Combining Gas Bearing and Smart Material Technologies for Improved Machine Performance Theory and Experiment

According to industry leaders, the world is on the verge of the fourth industrial revolution in which the Internet of Things and cyber-physical systems are central concepts. Where the previous industrial revolution evolved around electronics, IT and automated production on machine level, Industry 4.0 will enable a much stronger interaction between all of these technical achievements, from factory level all the way down to the individual machine elements. This can be exemplified by its the impact on machine maintenance. Nowadays, to avoid unwanted machine stops, maintenance cycles are scheduled based on the principle of the weakest link, e.g., the minimum expected lifetime of any machine element. In the future individual machine elements will not only send information about their performance, they will also be able to compensate for "wear and tear" or adapt to new operating conditions autonomously in coordination with adjacent machine elements. This requires mechatronic machine elements, which combine traditional passive mechanical components with sensors, actuators, electronics and computer algorithms, which thereby become "self-acting" machine elements, e.g. the piezoelectric air foil bearing (PAFB).

One way of supporting a rotor running at higher speed is by using air foil bearing (AFB). An AFB utilizes the aerodynamic pressure created by the relative velocity dif-ference between the rotor and the bearing surface. In an AFB the bearing surface is flexible and is made up by a thin top foil and a bump foil placed between the top foil and bearing housing. The PAFB combines the traditional AFB with piezoelectric material incorporated into the top foil. This creates a link between the mechanical domain of the traditional machine element and the electrical domain, i.e., ultimately a computer. The thesis deals with the development of the PAFB, and gives three main contributions: the design of a multifunctional test facility; the development of a state-of-the-art mathem-atical model of the PAFB and AFB; and interpretation of numerical results contributing to the understanding of both AFBs’ and PAFBs’ static and dynamic behaviours. The facility is designed to experimentally study the PAFB and its sub-systems. This allows for validation of mathematical models and gain of further knowledge of the PAFB’s static and dynamic behaviour. The mathematical models, based on the finite element method (FEM), are created as a combination of AFB models and models of piezoelectric material and their constitutive equations. The model includes journal, air film, piezoelectric top foil (PTF), bump foil and electrical circuit. It takes non-linear effects resulting from the aerodynamic pressure into account allowing for a separation of the top foil and bump foil. Numerical results obtained with a sub-model of the PTF shows good agreement with experiments, while simulations of a passive PAFB closely resembles results obtained with a non-linear AFB model known from literature.

A numerical investigation shows that rotor-bearing sub-harmonic vibrations associ-ated with large journal unbalance can be eliminated when the top foil is only partly supported by the bump foil, i.e., "shallow pocket" effect. The aerodynamic forces are significantly affected by the deformations of the PTF caused by the piezoelectric material due to an electrical potential difference (EPD) imposed between the electrodes. It is possible to increase the aerodynamic forces, and thereby the bearing load capacity, by a factor of two. The future steps in the development of PAFB are the design of feedback control laws and the experimental validation of a fully-controlled PAFB aided by the designed test facility and mathematical model derived in the thesis.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Nielsen, B. B. (Intern), Santos, I. (Intern)
Number of pages: 176
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Electronic versions:
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Relations
Projects:
Combining Gas Bearing and Smart Material Technologies for Improved Machine Performance Theory and Experiment
Publication: Research › Ph.D. thesis – Annual report year: 2017

Comparing novelty of designs from biological-inspiration with those from brainstorming
This research aims to understand the significance of biological-analogies in fostering novelty by comparing biological-analogies with other design methods for idea generation. Among other design methods, brainstorming was chosen here as benchmark. Four studies were conducted to compare: (i) the levels of abstraction at which concepts were ideated using biological inspiration (represented using biocards) with that using traditional brainstorming; and (ii) the novelty of concepts
produced by using these two design methods. Concepts produced in these studies were evaluated for levels of abstraction at which they were ideated, average novelty, and proportion of high-novelty concepts. Results suggest that concepts generated using biocards were ideated at higher abstraction levels than those using brainstorming, but neither were at the highest abstraction levels. The average novelty of concepts produced using biocards was found to be greater than that using brainstorming; however, no statistically significant difference was found in the proportion of high-novelty concepts. We suspect the lack of biological knowledge and cultural difference among the subjects involved in our studies as the two reasons behind the results. The results demonstrate that the design methods substantially influence the novelty of concepts generated, while indicating the need for better training in effective use of biological-analogies.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Indian Institute of Science, Imperial College London
Authors: Keshwani, S. (Ekstern), Lenau, T. A. (Intern), Ahmed-Kristensen, S. (Ekstern), Chakrabarti, A. (Ekstern)
Pages: 654–680
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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
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 2.19 SJR 0.64 SNIP 1.491
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.792 SNIP 1.607 CiteScore 2.12
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 1.172 SNIP 1.254 CiteScore 1.74
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 1.089 SNIP 1.64 CiteScore 2.06
- ISI indexed (2013): ISI indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 1.082 SNIP 2.059 CiteScore 1.54
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.528 SNIP 1.341 CiteScore 1.14
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.548 SNIP 1.022
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 0.687 SNIP 1.221
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.423 SNIP 0.929
- Scopus rating (2007): SJR 0.673 SNIP 1.429
- Scopus rating (2006): SJR 0.537 SNIP 1.482
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.

General information
State: Published
Organisations: Department of Photonics Engineering, Plasmonics and Metamaterials, Nanophotonic Devices, Department of Electrical Engineering, Electromagnetic Systems, Department of Mechanical Engineering, Solid Mechanics, Nanophotonics Theory and Signal Processing, Zuse Institute Berlin, St. Petersburg National Research University of Information Technologies, Mechanics and Optics (ITMO)
Number of pages: 2
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Conference: 19th International Conference on Transparent Optical Networks, Girona, Spain, 02/07/2017 - 02/07/2017
Photonic crystal, Microcavity, Line defect cavity, Quality factor, Numerical simulations
DOIs: 10.1109/ICTON.2017.8024813
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Comparison of Five Numerical Methods for Computing Quality Factors and Resonance Wavelengths in Photonic Crystal Membrane Cavities

General information
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Organisations: Department of Photonics Engineering, Nanophotonics Theory and Signal Processing, Nanophotonic Devices, 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)
Number of pages: 1
Publication date: 2017
Comparison of measured lattice rotations of individual grains with crystal plasticity simulations

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Xnovo Technology ApS
Authors: Juul, N. Y. (Intern), Oddershede, J. (Ekstern), Winther, G. (Intern)
Publication date: 2017
Event: Abstract from 18th International Conference on Textures of Materials (ICOTOM 18), St. George, Utah, United States.
Main Research Area: Technical/natural sciences
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Relations
Activities:
Comparison of measured lattice rotations of individual grains with crystal plasticity simulations
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Complementary Methods for the Characterization of Corrosion Products on a Plant-Exposed Superheater Tube
In this work, complex corrosion products on a superheater tube exposed to biomass firing were characterized by the complementary use of energy-dispersive synchrotron diffraction, electron microscopy, and energy-dispersive X-ray spectroscopy. Non-destructive synchrotron diffraction in transmission geometry measuring with a small gauge volume from the sample surface through the corrosion product allowed depth-resolved phase identification and revealed the presence of (Fe,Cr)2O3 and FeCr2O4. This was supplemented by microstructural and elemental analysis correlating the additional presence of a Ni-rich austenite phase to selective removal of Fe and Cr from the alloy, via a KCl-induced corrosion mechanism. Compositional variations were related to diffraction results and revealed a qualitative influence of the spinel cation concentration on the observed diffraction lines.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, Department of Mechanical Engineering, Materials and Surface Engineering, CHEC Research Centre, Centre for oil and gas – DTU, Helmholtz–Zentrum Berlin für Materialien und Energie
Number of pages: 14
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Main Research Area: Technical/natural sciences

Publication information
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Issue number: 1
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Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 0.67 SJR 0.357 SNIP 0.568
Scopus rating (2015): SJR 0.297 SNIP 0.513 CiteScore 0.54
Scopus rating (2014): SJR 0.415 SNIP 0.924 CiteScore 0.56
Lubrication of soft polydimethylsiloxane (PDMS) elastomer interfaces was studied in aqueous mixtures of porcine gastric mucin (PGM) and branched polyethyleneimine (b-PEI) at neutral pH and various ionic strengths (0.1–1.0 M). While neither PGM nor b-PEI improved lubrication compared to polymer-free buffer solution, their mixtures produced a synergistic lubricating effect by reducing friction coefficients by nearly two orders of magnitude, especially at slow sliding speed in the boundary lubrication regime. An array of spectroscopic studies revealed that small cationic b-PEI molecules were able to strongly bind and penetrate into large anionic PGM molecules, producing an overall contraction of the randomly coiled PGM conformation. The interaction also affected the structure of the folded PGM proteinterminals, decreased the surface potential and increased light absorbance in PGM:b-PEI mixtures. Adding an electrolyte (NaCl) weakened the aggregation between PGM and b-PEI, and degraded the lubrication synergy, indicating that electrostatic interactions drive PGM:b-PEI complexation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Università della Calabria
Authors: Patil, N. J. (Ekstern), Sankaranarayanan, R. (Intern), Nikogeorgos, N. (Intern), Guzzi, R. (Ekstern), Lee, S. (Intern), Zappone, B. (Ekstern)
Number of pages: 10
Pages: 590-599
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
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Volume: 13
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.7 SJR 1.573 SNIP 1.219
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.67 SNIP 1.33 CiteScore 3.97
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.751 SNIP 1.267 CiteScore 4.11
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.745 SNIP 1.208 CiteScore 4.2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.898 SNIP 1.155 CiteScore 3.96
ISI indexed (2012): ISI indexed yes
Complexity of Configurators Relative to Integrations and Field of Application

Configurators are applied widely to automate the specification processes at companies. The literature describes the industrial application of configurators supporting both sales and engineering processes, where configurators supporting the engineering processes are described more challenging. Moreover, configurators are commonly integrated to various IT systems within companies. The complexity of configurators is an important factor when it comes to performance, development and maintenance of the systems. A direct comparison of the complexity based on the different application and IT integrations is not addressed to a great extent in the literature. Thus, this paper aims to analyse the relationship of the complexity of the configurators, which is based on parameters (rules and attributes), in terms of first different applications of configurators (sales and engineering), and second integrations to other IT systems. The research method adopted in the paper is based on a survey followed with interviews where the unit of analysis is based on operating configurators within a company.

General information

State: Published
Organisations: Department of Management Engineering, Management Science, Operations Management, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Kristjansdottir, K. (Intern), Shafiee, S. (Intern), Battistello, L. (Intern), Hvam, L. (Intern), Forza, C. (Ekstern)
Number of pages: 5
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
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Source: PublicationPreSubmission
Source-ID: 139511349
**Composite Coiled Tubing for Extended Reach in Horizontal Oil Wells**

Conventional steel coiled tubing cannot reach along the entire length of very long horizontal oil wells. A lighter and more buoyant coiled tube is made possible using composite materials. The high stiffness to weight ratio of fiber reinforced polymers, coupled with a lower coefficient of friction, has the potential of greatly extending the reach in horizontal oil wells. This study shows how to design composite coiled tubing and gives a comprehensive discussion about the most influential parameters. Several solutions, using glass-fiber and carbon are considered. Finite element models are used to calculate the buckling loads and the corresponding interlaminar stresses. The very positive results obtained during this study show that composite coiled tubing systems are vastly superior to their steel counterparts, and that in the future, these will become the new industry standard.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Solid Mechanics  
Authors: Costache, A. (Intern), Berggreen, C. (Intern)  
Number of pages: 10  
Publication date: 2017

**Host publication information**

Title of host publication: ASME 2017 36th International Conference on Ocean, Offshore and Arctic Engineering  
Volume: 4  
Publisher: American Society of Mechanical Engineers  
Article number: OMAE2017-62579  
BFI conference series: International Conference on Ocean, Offshore and Arctic Engineering (5010067)  
Main Research Area: Technical/natural sciences  
Conference: 36th International Conference on Ocean, Offshore and Arctic Engineering, Trondheim, Norway, 25/06/2017 - 25/06/2017  
DOIs: 10.1115/OMAE2017-62579

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**Computational Fluid Dynamics of Choanoflagellate Filter-Feeding**

Choanoflagellates are unicellular aquatic organisms with a single flagellum that drives a feeding current through a funnel-shaped collar filter on which bacteria-sized prey are caught. Using computational fluid dynamics (CFD) we model the beating flagellum and the complex filter flow of the choanoflagellate Diaphanoeca grandis. Our CFD simulations based on the current understanding of the morphology underestimate the experimentally observed clearance rate by more than an order of magnitude: The beating flagellum is simply unable to draw enough water through the fine filter. Our observations motivate us to suggest a radically different filtration mechanism that requires a flagellar vane (sheet), and addition of a wide vane in our CFD model allows us to correctly predict the observed clearance rate.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, National Institute of Aquatic Resources, Centre for Ocean Life, Department of Physics, Biophysics and Fluids  
Number of pages: 1  
Publication date: 2017  
Event: Abstract from 70th Annual Meeting of the American Physical Society Division of Fluid Dynamics (DFD17), Denver, United States.  
Main Research Area: Technical/natural sciences  
Electronic versions: MWS_DFD17_2017_000131.pdf

**Computer Vision for Additive Manufacturing**

Ever since the commercialization of additive manufacturing in the late 80’s, it has been clear what enormous potential the technology could have, potentially disrupting several industries. However, we have yet to see the technology fully adopted by the manufacturing industry. One of the issues that has prevented widespread adoption of 3D printing for use within manufacturing is the apparent lack of quality control during and after the printing process. This thesis demonstrates how computer vision may be applied in beneficial ways within additive manufacturing. The main contributions aim at solving part of the challenges required for the technology to reach its full envisioned potential, and to reach widespread industry
adoption as a de-facto manufacturing modality. Quality control has been a major milestone to overcome in this regard. As a result, a core part of the contributions revolves around this central topic. The work is separated into three main categories: The first two concerning process and quality control of appearance and geometry. The third category concerns machine interaction paradigms within additive manufacturing. Here, challenges are addressed within the 3D ecosystem, aiming towards facilitating a fluid integration of additive manufacturing within the factory of tomorrow.

General information
State: Submitted
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Eiriksson, E. R. (Intern), Aanaes, H. (Intern), Pedersen, D. B. (Intern)
Number of pages: 157
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Publisher: DTU Compute
Original language: English
Series: DTU Compute PHD-2017
Volume: 447
ISSN: 0909-3192
Main Research Area: Technical/natural sciences

Relations
Projects:
Computer Vision for Additive Manufacturing.
Publication: Research › Ph.D. thesis – Annual report year: 2017

Conceptual Modelling for Product Configuration Systems
Individual customization of goods and processes in different industries leads to complexity due to a growing mix of products both regarding characteristics of products and support services. In order to eliminate complexity and challenges in product/process customizing, smart IT systems called Product Configuration Systems (PCS), have been proposed as the solution both by researchers and practitioners and various benefits are mentioned from utilizing PCSs. Based on the latest literature, there are challenges reported in all phases of PCS projects including planning, development, and documentation. Moreover, the challenges become more serious when it involves complicated products/processes in engineer-to-order (ETO) companies. The purpose of this thesis is to contribute to the existing knowledge of managing PCS projects by proposing frameworks and tools to address some of the main challenges.

First, this research focuses on the reported benefits and challenges in different phases of PCS projects aligned with the gaps in the current literature. Second, the study presents a survey in order to have a comprehensive overview to assess the most important challenges in the area. Third, in order to overcome different challenges in the PCS projects, the study contributes to the literature in forms of different frameworks, tools and IT solutions. Addressing the defined challenges, the following frameworks are proposed. 1) A framework is provided for business cases in PCS projects in order to estimate the needed investments and financial return-on-investment. 2) Furthermore, the research proposes a framework and different tools to scope the whole PCS project from planning to the maintenance phase. 3) Afterwards, the study suggests a framework to manage the knowledge in PCS projects due to reported challenges. 4) In order to make it possible to model, maintain, communicate, and document complicated products/process, a framework aligned with an IT tool is developed in close collaboration with industry. 5) Finally, the study contributes to the direction of integration of PCS and other IT systems by showing the automation impact of this alignment.

The tools and frameworks developed have been evaluated based on existing literature and by empirical tests in companies. Furthermore, areas for further investigation have been identified.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Operations Management, Department of Management Engineering, Management Science
Authors: Shafiee, S. (Intern), Hvam, L. (Intern), Mortensen, N. H. (Intern)
Number of pages: 129
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Considerations on the Construction of a Powder Bed Fusion Platform for Additive Manufacturing

As the demand for moulds and other tools becomes increasingly specific and complex, an additive manufacturing approach to production is making its way to the industry through laser-based consolidation of metal powder particles by a method known as powder bed fusion. This paper concerns a variety of design choices facilitating the development of an experimental powder bed fusion machine tool, capable of manufacturing metal parts with strength matching that of conventional manufactured parts and a complexity surpassing that of subtractive processes. To understand the different mechanisms acting within such an experimental machine tool, a fully open and customizable rig is constructed. Emphasizing modularity in the rig, allows alternation of lasers, scanner systems, optical elements, powder deposition, layer height, temperature, atmosphere, and powder type. Through a custom-made software platform, control of the process is achieved, which extends into a graphical user interface, easing adjustment of process parameters and the job file generation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Micro- and Nanotechnology
Authors: Andersen, S. A. (Intern), Nielsen, K. (Intern), Pedersen, D. B. (Intern), Nielsen, J. S. (Intern)
Pages: 3-10
Publication date: 2017
Conference: Nordic Laser Materials Processing Conference (NOLAMP16), Aalborg, Denmark, 22/08/2017 - 22/08/2017
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Publication information
Journal: Physics Procedia
Volume: 89
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Ratings:
Scopus rating (2016): CiteScore 0.65 SJR 0.343 SNIP 0.568
Scopus rating (2015): SJR 0.232 SNIP 0.557 CiteScore 0.61
Scopus rating (2014): SJR 0.363 SNIP 0.71 CiteScore 0.78
Scopus rating (2013): SJR 0.289 SNIP 0.664 CiteScore 0.72
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.293 SNIP 0.622 CiteScore 0.5
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 0.227 SNIP 0.477 CiteScore 0.45
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.219 SNIP 0.322
Scopus rating (2009): SJR 0.198 SNIP 0.43
Original language: English
Selective Laser Sintering, Selective Laser Melting, Additive Manufacturing, 3D-printing
Electronic versions:
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DOIs:
10.1016/j.phpro.2017.08.004
Source: FindIt
Source-ID: 2390499125
Publication: Research - peer-review » Conference article – Annual report year: 2017

Constant interchain pressure effect in extensional flows of oligomer diluted polystyrene and poly(methyl methacrylate) melts
The constant ‘interchain pressure’ idea has been addressed, to evaluate if it is an adequate quantitative assumption to describe the fluid mechanics of oligomer diluted entangled NMMD polymer systems. The molecular stress function
constitutive framework has been used with the constant interchain pressure assumption. Furthermore, the maximal extensibility based on the number of Kuhn steps in an entanglement has been used based on the relative Padé inverse Langevin function. The model predictions agree with the extensional measurements on all previously published poly(methyl methacrylate)s and almost all published oligomer diluted NMMD polystyrenes. The only deviation is on the most diluted and largest molecular weight case of an 18% 1880 kg/mol polystyrene in oligomer diluent. In this case, the maximal extensibility is not needed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Chemical and Biochemical Engineering, The Danish Polymer Centre
Authors: Rasmussen, H. K. (Intern), Huang, Q. (Intern)
Pages: 27–34
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: Rheologica Acta
Volume: 56
Issue number: 1
ISSN (Print): 0035-4511
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.9 SJR 0.61 SNIP 1.035
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.883 SNIP 1.307 CiteScore 2.09
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.725 SNIP 1.197 CiteScore 1.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.873 SNIP 1.397 CiteScore 2.09
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.909 SNIP 1.379 CiteScore 1.8
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.298 SNIP 1.428 CiteScore 2.22
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.272 SNIP 1.318
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.987 SNIP 1.236
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.898 SNIP 1.326
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.944 SNIP 1.307
Scopus rating (2006): SJR 0.899 SNIP 1.234
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.

General information
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
Authors: Juul-Nyholm, H. B. (Ekstern), Severinsen, J. C. (Intern), Schneider, H. (Intern), Mortensen, N. H. (Intern), Andersen, M. A. E. (Intern)
Number of pages: 9
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 142nd Audio Engineering Convention
Publisher: Audio Engineering Society
Article number: 9784
Main Research Area: Technical/natural sciences
Conference: 142nd Audio Engineering Society Convention, Berlin, Germany, 20/05/2017 - 20/05/2017
Electronic versions:
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Continuous Strip Reduction Test Simulating Tribological Conditions in Ironing

Laboratory testing of tribo-systems for sheet metal forming applications must ensure similar conditions with the tribo-parameters that are commonly utilized in real production in order to generate data that is meaningful for industry. The main parameters to consider are the tool and workpiece materials, surface roughnesses, normal pressure, sliding length, sliding speed, interface temperature and lubrication. This paper proposes a new Strip Reduction Test (SRT) for industrial ironing processes that is capable of replicating the highly severe tribological conditions that are experienced during both the forward stroke and the backward retraction of the punch. The new SRT tool design is implemented in a new Universal Sheet Tribo-Tester (UST), which can run multiple tests continuously from a coil. The test is capable of simulating various process parameters such as reduction, drawing speed, tool temperature, sliding length and quantifying the onset of breakdown of the lubricant film and subsequent galling after several strokes not only when emulating the forward strokes but also the backward strokes. Preliminary tests disclose promising results as regards the identification of lubricant film breakdown by detecting changes in measured force, surface roughness and/or torque values.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Lisbon
Authors: Üstünyagiz, E. (Intern), Nielsen, C. V. (Intern), Christiansen, P. (Intern), Martins, P. A. (Ekstern), Bay, N. O. (Intern)
Pages: 2286–2291
Continuous versus pulsating flow boiling. Experimental comparison, visualization, and statistical analysis

This experimental study investigates an active method for flow boiling heat transfer enhancement by means of fluid flow pulsation. The hypothesis is that pulsations increase the flow boiling heat transfer by means of better bulk fluid mixing, increased wall wetting, and flow-regime destabilization. The fluid pulsations are introduced by a flow modulating expansion device and are compared with continuous flow by a stepper-motor expansion valve in terms of time-averaged heat transfer coefficient. The cycle time ranges from 1 to 9 s for the pulsations. The time-averaged heat transfer coefficients are reduced from transient measurements immediately downstream of the expansion valves at low vapor qualities. The results show that the pulsations improve the time-averaged heat transfer coefficient by 3.2% on average at low cycle time (1 to 2 s), whereas the pulsations may reduce the time-averaged heat transfer coefficient by as much as 8% at high heat flux (q \geq 35 \text{ kW/m}^2) and cycle time (8 s). The latter reduction is attributed to a significant dry-out that occurs when the flow modulating expansion valve is closed. Additionally, the effect of fluid flow pulsations is found to be statistically significant, disregarding the lowest heat flux measurements.

General information

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Fluid Mechanics, Coastal and Maritime Engineering, Royal Institute of Technology, Danfoss Drives A/S
Authors: Kærn, M. R. (Intern), Elmegaard, B. (Intern), Meyer, K. E. (Intern), Palm, B. (Ekstern), Holst, J. (Ekstern)
Pages: 983-996
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information

Journal: Science and Technology for the Built Environment
Volume: 23
ISSN (Print): 2374-4731
Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Control Design of Active Magnetic Bearings for Rotors Subjected to Destabilising Seal Forces - Theory & Experiment

The use of Active Magnetic Bearings (AMBs) in industrial applications has increased over recent decades as the technology has grown more mature, further aided by advancements and decreasing prices of the electronic components. AMBs are well suited to turbo-machinery applications offering several advantages over traditional types of bearings, including: no mechanical contact, no lubrication, low maintenance, low vibration level, high rotational speed and low energy consumption. These advantages make AMBs especially useful in challenging environments, for instance in subsea turbomachinery applications for oil and gas production, where reliability, low maintenance and high speed are of great importance.
Annular seals are a key component in turbomachinery. They prevent internal flow leakage from high pressure to low pressure regions and improve the overall machine efficiency; in many applications, however, they also affect the system rotor-dynamic properties significantly. For this reason, the seal characteristics must be included in the rotor-dynamic stability analysis. Unfortunately, in many cases the seal forces are hard to model due to complex geometries of the seal and multiphase fluids. At present, there is no generally accepted method for determination of dynamic seal forces. Therefore, large uncertainties must be expected when modelling dynamic seal forces and consequently also in rotor-dynamic stability analysis.

This thesis focuses on i) closed loop identification of uncertain AMB parameters, ii) closed loop identification of unknown stiffness and damping coefficients of a dynamic seal model and iii) the design of AMB controllers to handle dynamic seal forces. Controllers that can guarantee stability and performance in the presence of uncertain seal forces are of special interest. The main original contribution of the thesis is the framework for design of model based controllers for AMB systems subjected to uncertain and changing dynamic seal forces. An identification method has been developed, and experimentally validated, to obtain precise models of Linear Fractional Transformation (LFT) form for synthesising H1, μ and Linear Parameter Varying (LPV) controllers. The seal parameters and AMB dynamics are identified on-site without any need of special equipment.

A perturbed model of the combined AMB, rotor and seal system is constructed using Finite Element Methods (FEM), modal reduction and LFT. It describes the dynamic behaviour due to parametric uncertainties/changes of the damping and stiffness coefficients of the seal and the uncertainties in the stiffness of the AMBs. Using different types of excitation signals, i.e. stepped sine, impulse and Pseudo Random Binary Sequence (PRBS), and optimisation in the time domain, the above mentioned parameters are identified. Inserting the identified parameters in the known model structure results in accurate models, which when simulated - fit experimental data well. The perturbed model is further used for the robust controller synthesis to describe the uncertainties in seal forces and for LPV control synthesis, to compensate for known changes in seal forces due to changes in operating conditions. A rotor dynamic test facility with a rigid rotor, two radial AMBs and one annular test seal is used for i) closed loop identification of parameters in the AMB-rotor model, ii) identification of dynamic seal forces, iii) implementation of AMB controllers to compensate for dynamic seal forces. The stability and performance of the designed controllers are examined and compared to a reference decentralised PID controller. Controllers based on identified nominal seal models are shown to provide good compensation for the destabilising dynamic seal forces. Furthermore, significant performance improvement is shown when using a robust controller, which can handle changes in operational pressures better, in comparison to a nominal model based controller. Simulations using both type of model based controllers match experiments well.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Lauridsen, J. S. (Intern), Santos, I. (Intern)
Number of pages: 82
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English

Series: DCAMM Special Report
Number: S225
ISSN: 0903-1685
Main Research Area: Technical/natural sciences
Electronic versions: PhD_Thesis_Jonas_Lauridsen.pdf

Relations
Projects:
Control Design of Active Magnetic Bearings for Rotors Subjected to Destabilising Seal Forces - Theory & Experiment
Publication: Research › Ph.D. thesis – Annual report year: 2017

Conversion of Measured Turbulence Spectra from Temporal to Spatial Domain
The spatial structure of a turbulent velocity field is of great theoretical interest as its kinematics describe the distribution of spatial scales and its dynamics describe their evolution from large energy carrying scales to smaller scales and finally to dissipation. However, the overwhelming number of turbulence measurements results in time records from stationary probes, either hot-wire probes (hot-wire anemometers, HWA) or laser beam probes (laser Doppler anemometers, LDA). The spatial structure of the turbulent velocity field is then inferred by “Taylor’s hypothesis,” as first presented in [1], assuming a “frozen” velocity field carried past the probe with the local mean velocity. However, Taylor’s hypothesis breaks down at higher turbulence intensities and can then only be applied with additional corrections, see, for example, [2–4].
Corrigendum to "Flow boiling heat transfer and pressure drop characteristics of R134a, R1234yf and R1234ze in a plate heat exchanger for organic Rankine cycle units". [Int. J. Heat Mass Transfer 108 (2017) 1787–1801]

The authors would like to inform you that on p. 1798 of their published article Eq. (29) was incorrect. It should read as: \[ v = \frac{G \Delta h}{\rho \sigma} \]
Corrosion failure analysis of hearing aid battery-spring contacts

Reliability of low power electrical contacts such as those in hearing aid battery-spring systems is a very critical aspect for the overall performance of the device. These systems are exposed to certain harsh environments like high humidity and elevated temperatures, and often in combination with high levels of salt from human perspiration and environmental pollutants. In addition, the design aspects of such systems often call for multi-material combinations of substrate and coatings for catering to various requirements such as electrical conductivity and wear resistance, which in turn enhance the susceptibility of these systems to galvanic corrosion. In this study, traditional behind the ear (BTE) hearing aid systems, which failed during service were analysed. Failure analysis was performed on the dome type battery-spring contact systems. The morphology of the contact areas was observed using scanning electron microscopy, and the compositional analysis of the corrosion products and contaminants was performed using energy dispersive X-ray spectroscopy. Wear track morphology was observed on the contact points, and the top coating on the dome was worn out exposing the substrate spring material. The obtained results were correlated to the underlying corrosion mechanism and the failure mode is presented.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Gudla, V. C. (Intern), Ambat, R. (Intern)
Pages: 980–987
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Engineering Failure Analysis
Volume: 79
ISSN (Print): 1350-6307
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
Electronic control units, power modules, and consumer electronics are used today in a wide variety of varying climatic conditions. Varying external climatic conditions of temperature and humidity can cause an uncontrolled local climate inside the device enclosure. Uncontrolled humidity together with a number of other factors including the presence of hygroscopic contamination resulting from the Printed Circuit Board Assembly (PCBA) manufacturing process can introduce deviation from desired functionality or even intermittent or permanent failure of the device. Additional factors are the miniaturization and high density packing combined with the use of several materials, which can undergo electrochemical corrosion in the presence of water film formed due to humidity exposure and bias conditions on the PCBA surface. This article provides a short review of the corrosion reliability issues of electronics due to the use of electronics under varying humidity conditions. Important PCBA aspects, which are fundamental to the corrosion cell formation under humid conditions, are discussed. Effect of hygroscopic residues from the process and service and their role in assisting water film build up and corrosion is presented. Various failure modes resulting from the corrosion and influence factors are discussed including humid and gaseous conditions.
Corrosion in the Flue Gas Cleaning System of a Biomass-Fired Power Plant

After only a few years operation, corrosion damage was observed in the flue gas cleaning system of a biomass power plant. The corrosion was on the lower part of the gas/gas heat exchanger fabricated from A242 weathering steel, where UNS S31600 bolts were used to attach sealing strips to the rotor. Thick iron oxides (up to 5 mm) had formed on the weathering steel, and these oxides also contained chlorine and sulfur. In this area of the heat exchanger, weathering steel has not had the optimal wet/dry cycles required to achieve a protective oxide. Due to the thick growing oxide on the rotor, the UNS S31600 bolts were under stress and this together with the presence of accumulated chlorine between the sealing strips and bolts resulted in stress corrosion cracking and rupture. In addition, Zn-K-Cl deposits were agglomerated in the duct after the DeNOx unit. Zn was also a constituent of corrosion products in various places in the ducts resulting in hygroscopic compounds. The presence of Zn in these cases was not from the fuel and is assumed to have originated from Zn containing primer (used to protect the plant during construction) reacting with flue gas constituents containing chlorine (KCl and HCl).
Corrosion failure analysis, Deposits, ilure analysis Deposits Flu

Electronic versions:

GAFO_low_temperature_corrosion_to_JFAP_2_.pdf. Embargo ended: 03/02/2018

DOIs:
10.1007/s11668-017-0238-y
Source: FindIt
Source-ID: 2352068949
Publication: Research - peer-review › Journal article – Annual report year: 2017

Corrosion reliability of lead-free solder systems used in electronics

Corrosion reliability of five Sn-Ag-Cu (SAC) based lead-free solder alloys under humid and corrosive conditions has been investigated to understand the microstructure effects on corrosion performance. Electrochemical experiments such as potentiodynamic and potentiostatic tests were conducted in 3.5 wt% sodium chloride electrolyte at room temperature. Microstructure of the solder alloys and corrosion surface morphology was evaluated using light optical microscope (LOM), scanning electron microscope (SEM), energy dispersive spectroscopy (EDS) and X-ray diffraction (XRD). During the potentiostatic tests, the cathodically active Bi phase in No. 5 alloy introduced pitting in the Sn phase nearby, whereas Ag3Sn phase prompted pitting on the adjacent to β-Sn phase in No. 1–4 solder alloys (Table 1.).

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Budapest University of Technology and Economics
Authors: Li, F. (Intern), Verdingovas, V. (Intern), Medgyes, B. (Ekstern), Ambat, R. (Intern)
Number of pages: 6
Publication date: 2017

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Publisher: IEEE
ISBN (Electronic): 978-1-5386-0582-0
Main Research Area: Technical/natural sciences
Conference: 40th International Spring Seminar on Electronics Technology, Sofia, Bulgaria, 10/05/2017 - 10/05/2017
Corrosion, Surface morphology, Microstructure, Reliability, Lead, X-ray scattering
DOIs:
10.1109/ISSE.2017.8000929
Source: FindIt
Source-ID: 2372913793
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Corrosion Reliability of Lead-free Solder Systems Used in Electronics

The present work investigated the corrosion reliability of Sn-Ag-Cu based five lead-free solder alloys. The corrosion and electrochemical migration (ECM) susceptibility study of the solder alloys has been carried out by water droplet (WD) tests on pure alloy ingot samples, and by accelerated humidity/temperature cycling tests on soldered surface insulation resistance (SIR) comb pattern. Complimentary microstructural and phase analysis of solder alloys has been carried out using the scanning electron microscope (SEM), energy dispersive spectroscopy (EDS), and X-ray diffraction (XRD) methods. The galvanic corrosion was found between cathodically active Bi phase and anodic (Sn, Sb) solid solution in InnoLot alloy, while the Ag3Sn phase was cathodically active in the other four alloys. The paper theoretically illustrated the reason for the differences in corrosion reliability in the five alloys based on the composition and distribution of intermetallic compounds (IMCs).

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Budapest University of Technology and Economics
Authors: Li, F. (Intern), Verdingovas, V. (Intern), Medgyes, B. (Ekstern), Ambat, R. (Intern)
Number of pages: 10
Publication date: 2017
Corrosion Resistance of AISI 316L Coated with an Air-Cured Hydrogen Silsesquioxane Based Spin-On-Glass Enamel in Chloride Environment

The efficiency of thin hydrogen silsesquioxane (HSQ) -based corrosion barrier coatings on 316 Lsubstrates after oxidative thermal curing at 400-550 °C in air was investigated. Infrared spectroscopy and electrochemical impedance spectroscopy showed that an increasing curing temperature leads to progressing coating densification, accompanied by decreasing barrier properties. Cyclic polarization measurements indicated that defects due to substrate oxidation are detrimental for the substrate passivity. Insufficiently polymerized coatings showed poor chemical stability in neutral salt spray testing and the chemical coating stability increased with curing temperature. Oxidative curing was found inadequate as polymerization treatment of HSQ-based corrosion barrier coatings on 316L substrate.
Cost estimation of a specifically designed direct light processing (DLP) additive manufacturing machine for precision printing

Additive Manufacturing (AM) refers to a portfolio of novel manufacturing technologies based on a layer-by-layer fabrication method. The market and industrial application of additive manufacturing technologies as an established manufacturing process have increased exponentially in the last years creating new opportunities for manufacturers in a variety of industrial sectors. AM is an essential prototyping technique for product design and development that is used in many different fields. However, the suitability of AM applications in actual production in an industrial context needs to be determined. This study presents a cost estimation model for precision printing with a specifically designed Digital Light Processing (DLP) AM machine built and validated at the Technical University of Denmark. The model presented in this study can be easily adapted and applied to estimate within a high level of confidence the cost of any part manufactured with the mentioned 3D printing technology.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Charalambis, A. (Intern), Davoudinejad, A. (Intern), Tosello, G. (Intern), Pedersen, D. B. (Intern)
Number of pages: 4
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 17th International Conference of the European Society for Precision Engineering and Nanotechnology
Publisher: The European Society for Precision Engineering and Nanotechnology
ISBN (Electronic): 978-0-9957751-0-7
Main Research Area: Technical/natural sciences
Conference: 17th euspen International Conference & Exhibition, Hannover, Germany, 29/05/2017 - 29/05/2017
Additive manufacturing, Cost estimation, Digital light processing, Precision printing
Electronic versions:
Cost estimation of a specifically designed direct light processing (DLP) additive manufacturing machine for precision printing - POST PRINT
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Crack Tip Flipping: A New Phenomenon yet to be Resolved in Ductile Plate Tearing

Conclusive insight to the mechanics that govern so-called “crack tip flipping” remains to be revealed, but details continue to fall into place as researcher dig deeper. The work presents an overview of the latest findings and the next steps to be made.
Crack Tip Flipping under Mode I Tearing: Investigated by X-Ray Tomography

The fracture surface morphology that results from mode I tearing of ductile plate metals depends heavily on both the elastic-plastic material properties and the microstructure. Severe tunneling of the advancing crack tip (resulting in cup-cup, or bath-tub-like fracture surfaces) can take place in a range of materials, often of low strength, while tearing of high strength metals typically progress by the shear band failure mechanism (slanting). In reality, however, most fracture surfaces display a mixture of morphologies. For example, slant crack propagation can be accompanied by large shear lips near the outer free plate surface or a complete shear band switch - seemingly distributed randomly on the fracture surface. The occasionally observed shear band switch of mode I slant cracks, related to ductile plate tearing, is far from random as the crack can flip systematically from one side to the other in roughly 45-degree shear bands. This "flipping" action of a slanted crack remains to be fully understood, and the present study serves to share details on the phenomenon by exploiting X-ray tomography scanning to access the plate interior and the very crack tip. Throughout, the focus is on a crack tip where the flip is underway. Extensive growth of single edge cracks under mode I loading is achieved in a purpose built test set-up. Here, considering a 4 mm plate of normal strength / high strain hardening steel which has been found to display successive flipping of the slant crack face. While undergoing a shear band switch, such that the flipping mechanism is active, the plate tearing test is interrupted and the crack tip extracted for further investigation. The conducted X-ray tomography scans reveal the failure process ahead of the advancing crack tip to resemble the ductile slant crack growth governed by local thinning and moderate crack tip tunneling. However, small shear lips form at the outer free plate surface, well behind the 45-degree slant (tunneling) crack tip, as the flipping action engages. Upon further loading, the shear lips subsequently grow to form a set of secondary crack fronts at an angle to the primary tunneling slant crack. Eventually, these secondary crack fronts catch up on the primary slant crack front and overtake the growth to complete the shear band switch. Once the crack slants, an out-of-plane action occurs due to the loss of symmetry in the system. It is this out-of-plane action which is believed to set-off the flipping mechanism.
Creating a Multi-material Probing Error Test for the Acceptance Testing of Dimensional Computed Tomography Systems

The requirement of quality assurance of inner and outer structures in complex multi-material assemblies is one important factor that has encouraged the use of industrial X-ray computed tomography (CT). The application of CT as a coordinate measurement system (CMS) has opened up new challenges, typically associated with performance verification,
specification definition and thus standardization. Especially when performing multi-material measurements, further, new, challenging effects are included in dimensional CT measurements, e.g. the influence of material A on material B in multi-material scenarios and the appropriate parameters for surface determination in a multi-surface setting. Thus, this paper presents – as part of a multi-material acceptance test and to create trust in multi-material CT measurement – a new concept for multi-material probing error testing (P-test) and discusses the test design and the first experimental results. This paper also attempts to perform a critical analysis of this new concept – featuring a compound sphere made of two half spheres of different materials - and tries to perform analyses of geometrical features of the new standard.

**Cross-flow heat exchanger design using thermofluid topology optimization**

**Cryogenic treatment of steel: from concept to metallurgical understanding**

Subjecting steel to cryogenic treatment to improve its properties was conceived in the 30ies of the previous century. The proof of concept that properties, in particular wear resistance, can indeed be improved importantly, was reported in the next decades. Despite many investigations, the metallurgical understanding of the microstructural changes involved in cryogenic treatment of steel has remained poor. It is believed that the improvement in wear resistance is promoted by an enhanced precipitation of carbides during tempering, but no explanation has been given as to how this enhanced precipitation can be obtained. In the last six years, the authors have applied in situ magnetometry, synchrotron X-Ray Diffraction and dilatometry to enlighten the phase transitions occurring in steels at cryogenic temperatures and to point out the connection between different treatment parameters and the response of the material to tempering. This activity is put into perspective in the present work. Experimental activity on 100Cr6, has shown that martensite forms during cryogenic treatment on cooling, isothermal holding as well as on re-heating to room temperature, and that the fraction of austenite that is transformed to martensite is maximal when cryogenic treatment is performed directly after quenching. Martensite formation evokes compressive stresses in austenite at temperatures higher than -140°C, whereas no compression builds up in austenite when martensite forms below this temperature. The isothermal formation of martensite at T<-140°C, promotes / modifies the precipitation of carbides during tempering. Additionally, cryogenic treatment facilitates the thermal decomposition of retained austenite. Furthermore, time dependent (i.e. isothermal) formation of martensite was investigated in numerous ferrous alloys. The activity was performed both applying isothermal treatments as well as following martensite formation during heating from boiling nitrogen temperature. These investigations showed that time-dependent, i.e. thermally activated, martensite formation is the rule rather than the exception. In systems forming martensite with blocky (lath) morphology the formation of martensite is purely time dependent and can be suppressed on fast cooling to cryogenic temperature. In systems forming plate martensite, martensite formation is only partially time-dependent and cannot be suppressed entirely during fast cooling to cryogenic temperature. Time-dependent martensite
formation proceeds very sluggishly at boiling nitrogen temperature (-196°C), but can be pronounced in the temperature range -180°C to -40°C. The improved understanding of the phenomena occurring during cryogenic treatment of steel can find application in the heat treatment of high carbon steels, of martensitic stainless steels and in case-hardened components. Maximum advantage can be obtained if the entire heat treatment cycle is optimized.

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Authors: Villa, M. (Intern), Somers, M. A. J. (Intern)
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**Current trends in micro electrical discharge machining (µEDM) for practical applications**
Micro electrical discharge machining is a novel non-traditional technique for machining of micro scale components and features on micro-components. There are a few remarkable developments in this area in the last two years, and the attempts are aiming at reducing the size of components. As the manufacturing necessities for practical applications upsurge, the demand for complex micro-features also increases. In addition, numerous research issues associated with the applications come up which remain unexplained. Considering these characteristics, this paper is divided into the following sections: i) fabrication of complex features and structures using µEDM, ii) analysis of tool electrode wear in µEDM, iii) condition monitoring in µEDM, iv) energy assessment in µEDM, and, v) analysis of machined surfaces in µEDM. The recent trends in µEDM are summarized and future research directions are evolved.

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**Cyclic plastic hinges with degradation effects for frame structures**
A model of cyclic plastic hinges in frame structures including degradation effects for stiffness and strength is developed. The model is formulated via potentials in terms of section forces. It consists of a yield surface, described in a generic format permitting representation of general convex shapes including corners, and a set of evolution equations based on an internal energy potential and a plastic flow potential. The form of these potentials is specified by five parameters for each generalized stress-strain component describing yield level, ultimate stress capacity, elastic and elastoplastic stiffnesses, and a shape parameter. The model permits gradual changes in stiffness and strength parameters via damage-based degradation. The degradation effects are introduced in the energy and flow potentials and result in additional evolution equations for the corresponding strength and stiffness parameters. The cyclic plastic hinges are introduced into a six-component equilibrium-based beam element, using additive element and hinge flexibilities. When converted to stiffness...
format the plastic hinges are incorporated into the element stiffness matrix. The cyclic plastic hinge model is implemented in a computer program and used for analysis of some simple structures, illustrating the characteristic features of the cyclic response and the accuracy of the proposed model.
Deformation Induced Martensitic Transformation and Its Initial Microstructure Dependence in a High Alloved Duplex Stainless Steel

Deformation induced martensitic transformation (DIMT) usually occurs in metastable austenitic stainless steels. Recent studies have shown that DIMT may occur in the austenite phase of low alloyed duplex stainless steels. The present study demonstrates that DIMT can also take place in a high alloyed Fe-23Cr-8.5Ni duplex stainless steel, which exhibits an unexpectedly rapid transformation from γ-austenite into α'-martensite. However, an inhibited martensitic transformation has been observed by varying the initial microstructure from a coarse alternating austenite and ferrite band structure to a fine equiaxed microduplex structure.

General information
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Organisations: Department of Mechanical Engineering, Department of Wind Energy, Materials and Surface Engineering, Materials science and characterization, Chongqing University, Yanshan University, Kyoto University
Authors: Xie, L. (Ekstern), Huang, T. L. (Ekstern), Wang, Y. H. (Ekstern), Wu, G. L. (Ekstern), Tsuji, N. (Ekstern), Huang, X. (Intern)
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BFI (2010): BFI-level 1
Derivation of guidelines for the design of plate evaporators in heat pumps using zeotropic mixtures

The present work derives design recommendations for plate heat exchangers used for evaporation of zeotropic mixtures in heat pumps. A parametric study is conducted on the geometry of the heat exchanger, and the analysis is carried out for four working fluids, based on a case study of heat pump integration in a spray drying facility. A numerical model of the evaporator is combined with cycle calculations, for estimating the impact of heat transfer area and pressure drop on the coefficient of performance and costs. Common trends are obtained as optimal configurations for the four considered fluids. It is recommended to minimize the hydraulic diameter by employing high corrugation height over low corrugation pitch. Moreover, an optimal range is found for the liquid Reynolds number at the evaporator inlet. The suggested values vary between 500 and 2000, depending on the fluid. Lastly, the trade-off between minimization of area and pressure drop is found by assessing the relative impact on costs of the heat exchanger area and pressure losses of both working fluid and heat source. The result shows that it is not always convenient to minimize the heat transfer area, since the mixture pressure drop negatively influences compressor investment and operating costs.
Design and Calibration of a Full-Scale Active Magnetic Bearing-Based Test Facility for Investigating Rotordynamic Properties of Turbomachinery Seals in Multiphase Flow

The recent move towards subsea oil and gas production brings about a requirement to locate process equipment in deepwater installations. Furthermore, there is a drive towards omitting well stream separation functionality, as this adds complexity and cost to the subsea installation. This in turn leads to technical challenges for the subsea installed pumps and compressors that are now required to handle multiphase flow of varying gas to liquid ratios. This highlights the necessity for a strong research focus on multiphase flow impact on rotordynamic properties and thereby operational stability of the subsea installed rotating machinery. It is well known that careful design of turbomachinery seals, such as interstage and balance piston seals, is pivotal for the performance of pumps and compressors. Consequently, the ability to predict the complex interaction between fluid dynamics and rotordynamics within these seals is key. Numerical tools offering predictive capabilities for turbomachinery seals in multiphase flow are currently being developed and refined, however the lack of experimental data for multiphase seals renders benchmarking and validation impossible. To this end, the Technical University of Denmark and Lloyd's Register Consulting are currently establishing a purpose built state of the art multiphase seal test facility. This paper provides details on the design of the novel test facility and the calibration of the Hall sensor system employed to measure AMB forces. Calibration and validation results are presented, along with an uncertainty analysis on the force quantification capabilities.
Design and prototyping of an ionic liquid piston compressor as a new generation of compressors for hydrogen refueling stations

The thesis presents design, modeling, and fabrication of a new compressor technology that involves an ionic liquid piston as a replacement for the solid piston in the conventional reciprocating compressors to compress hydrogen in hydrogen refueling stations. The motivation comes from the need to achieve more flexible and efficient compressors with longer life spans in hydrogen stations. This can eventually lead to a lower hydrogen delivery cost and faster penetration of hydrogen fuel cell vehicles into the market.

A thermodynamic model simulating a single-compression stroke is developed to investigate the heat transfer phenomena inside the compression chamber; the system performance is evaluated, followed by the design process. The model is developed based on the mass and energy balance of the hydrogen, and liquid bounded by the wall of the compression chamber. Therefore, at each time step and positional node, the model estimates the pressure and temperature of the hydrogen and liquid, the temperature of the compression chamber wall, and the amount of heat extracted from the hydrogen directly at the interface between the hydrogen and liquid, and through the wall. The results indicate that depending on the heat transfer correlation, the hydrogen temperature reduces slightly between 0.2 and 0.4% compared to the adiabatic case, at 500 bar. The main reasons for the small temperature reduction are the large wall resistance and the small contact area at the interface. Moreover, the results of the sensitivity analysis illustrate that increasing the total heat transfer coefficients at the interface and the wall, as well as compression time, play key roles in reducing the hydrogen temperature. Further optimization and increasing the total heat transfer coefficient at the interface (10000 times) or at the wall (200 times), leads to 22 % or 33% reduction of the hydrogen temperature, compared to the adiabatic case, at 500 bar, during 3.5 seconds compression, respectively.

A suitable ionic liquid is selected as the most reliable replacement for the solid piston in the conventional reciprocating compressors. Ionic liquids are room temperature salts which have very low vapor pressures. The ability to tune the physiochemical properties of ionic liquids by varying the cation-anion combinations is the feature of these liquids that
make them as promising candidates to replace the solid piston. However, due to a large number of available combinations for ionic liquids, it is essential to systematically investigate their performance for a particular application and narrow down the final choice. In this regard, certain criteria are determined for our specific application. The roles of the most commonly used cations and anions, as well as the effect of temperature are comprehensively reviewed to identify the most suitable ionic liquids that can fulfill our requirements. Hence, the options are narrowed down to five ionic liquids with triflate and bis(trifluoromethylsulfonyl)imide as the anion choices and three different cation types of imidazolium-, phosphonium-, and ammonium-based as the cation choices. Finally the ionic liquid: 1-ethyl-3-methylimidazolium bis(trifluoromethylsulfonyl)imide is recommended as the best candidate that can be safely used as a replacement for the solid piston in the conventional reciprocating compressors for compressing hydrogen in the hydrogen refueling stations.

In addition, the corrosion behavior of various commercially available stainless steels and nickel-based alloys as possible construction materials for the components which are in direct contact with the selected ionic liquids is evaluated. The results show a very high corrosion resistance and high stability for all of the alloys tested in any of the five selected ionic liquids. The stainless steel alloy, AISI 316L, with a high corrosion resistance and the lowest cost is selected as a material for all the components in direct contact with the ionic liquid, in the designed ionic liquid hydrogen compressor.

The new compressor consists of three main parts, namely pneumatic, hydraulic, and custom-designed hydraulic to pneumatic transformer, which work together to compress hydrogen. The proposed design addresses the limitations of the current technology and previously designed compressors using the liquid piston concept and ionic liquid, by introducing a custom-designed hydraulic to pneumatic transformer. As proof of concept, a prototype for compression of hydrogen from 100 to 300 bar is built, and a detailed procedure of the design, fabrication, and control of the prototype is described in the presented work.

The new compressor design has high potential to be used as an alternative to the conventional reciprocating compressors in hydrogen refueling stations, as it provides a simpler design with lower manufacturing costs, higher efficiency, much less sliding friction, possibility of internal cooling, higher functional reliability and less maintenance.
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 the 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
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Authors: Christiansen, R. E. (Intern), Sigmund, O. (Intern), Fernandez Grande, E. (Intern)
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Design of Robust AMB Controllers for Rotors Subjected to Varying and Uncertain Seal Forces
This paper demonstrates the design and simulation results of model based controllers for AMB systems, subjected to uncertain and changing dynamic seal forces. Specifically, a turbocharger with a hole-pattern seal mounted across the balance piston is considered. The dynamic forces of the seal, which are dependent on the operational conditions, have a significant effect on the overall system dynamics. Furthermore, these forces are considered uncertain. The nominal and the uncertainty representation of the seal model are established using results from conventional modelling approaches, i.e. CFD and Bulkflow, and experimental results. Three controllers are synthesized: I) An $H\infty$ controller based on nominal plant representation, II) A $\mu$ controller, designed to be robust against uncertainties in the dynamic seal model and III) a Linear Parameter Varying (LPV) controller, designed to provide a unified performance over a large operational speed range using the operational speed as the scheduling parameter.

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Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Lauridsen, J. S. (Intern), Santos, I. (Intern)
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Design of serially connected district heating heat pumps utilising a geothermal heat source
The design of two heat pumps (HP), connected in series, was investigated for operation in the district heating (DH) network of the Greater Copenhagen area, Denmark. The installation was dimensioned to supply 7.2 MW of heat at a temperature of 85 °C. The heat pumps utilise a geothermal heat source at 73 °C. Both heat source and sink experience a large temperature change, which may lead to decreased performance for single vapour compression HP. The performance may be increased by using HPs connected in series and by applying HPs with zeotropic mixtures. First a generic study with a simple representation of the HP was applied to investigate optimal system configurations. It was shown that using two heat pumps in series with direct heat exchange in parallel with the first heat pump could increase the performance compared to the HP performance. Detailed thermodynamic models of a zeotropic mixture HP predicted that an exergetic efficiency of the units between 50% and 65% is possible. The technical feasibility as well as the economic viability of this installation was investigated for a range of optimal configurations. The analysis recommends a heat pump configuration with a system exergetic efficiency of 63%.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Jensen, J. K. (Intern), Ommen, T. S. (Intern), Markussen, W. B. (Intern), Elmegaard, B. (Intern)
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Design of Waste Gasification Energy Systems with Solid Oxide Fuel Cells

Energy saving is an open point in most European countries where energy policies are oriented to reduce the use of fossil fuels, greenhouses emissions and energy independence, and to increase the use of renewable energies. In the last several years, new technologies have been developed and some of them received subsidies to increase installation and reduce cost. This article presents a new sustainable trigeneration system (power, heat and cool) based on a solid oxide fuel cell (SOFC) system integrated with an absorption chiller for special applications such as hotels, resorts, hospitals, etc. with a focus on plant design and performance. The proposal system is based on the idea of gasifying the municipal waste, producing syngas serving as fuel for the trigeneration system. Such advanced system when improved is thus self-sustainable without dependency on net grid, district heating and district cooling. Other advantage of such waste to energy system is waste management, less disposal to sanitary landfills, saving large municipal fields for other human activity and considerable less environmental impact. Although plant electrical efficiency of such system is not significant but fuel utilization factor along with free fuel, significant less pollutant emissions and self-sustainability are importance points of the proposed system. It is shown that the energy efficiency of the such small tri-geretaion system with 190 kW is more than 76%.

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Detection of the onset of galling in strip reduction testing using acoustic emission

Galling is an important issue in metal forming of tribologically severe materials such as high strength steel, stainless steel, Al- or Ti-alloys, since it leads to poor surface quality of the formed components, production stops and possibly deterioration of tools. The onset of galling is difficult to detect, since it is either based on the operator's personal judgement or indirect measuring techniques. The application of acoustic emission measuring technique for characterization of onset of galling in sheet metal forming is discussed in the presented paper. The strip reduction test, which emulates the ironing process, has been examined in order to evaluate onset of galling and how this is related to the generated acoustic emission parameters. Preliminary investigations have shown that differences can be found in the acoustic emission signal parameters depending on the frictional conditions between the tool and the workpiece surfaces. A correlation to the severity of galling is found. This is inspected through observations of tested workpiece surfaces in SEM and measurements of the surface roughness. The acoustic emission measuring technique is found to possess promising aspects for online monitoring of galling in metal forming processes.

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Authors: Moghadam, M. (Intern), Christiansen, P. (Intern), Bay, N. O. (Intern)
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Determination of the activation energy of Martensite formation in steel during heating from 77 K

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Authors: Villa, M. (Intern), Hansen, M. F. (Intern), Somers, M. A. J. (Intern)
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Deterministic Predictions of Vessel Responses Based on Past Measurements
The paper deals with a prediction procedure from which global wave-induced responses can be deterministically predicted a short time, 10-50 s, ahead of current time. The procedure relies on the autocorrelation function and takes into account prior measurements only; i.e. knowledge about wave conditions is not needed. In the present study, the procedure is examined on artificially simulated data that represents the measurements. It is shown that predictions, in most cases, can be made fairly accurate up to 20 s ahead of current time; for longer periods ahead the accuracy reduces somewhat. The sensitivity to the amount of prior data is investigated.

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Authors: Nielsen, U. D. (Intern), Jensen, J. J. (Intern)
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Development and Testing of Tailored Tool Surfaces for Sheet Metal Forming

This thesis describes measures taken to minimize or substitute environmentally hazardous lubricants applied in sheet metal forming processes by less harmful lubricants or not applying lubricant at all. The breakdown of lubricant film often leads to galling, and therefore application of the hazardous lubricants has spurred industrial interest. In order to face a serious challenge in trying to stimulate less consumptions of such hazardous lubricants, the PhD project was intended to lead to improvements in resistivity towards galling in sheet metal forming by studying three different subjects; compressibility of lubricants, application of structured tool surfaces and application of anti-seizure tool coatings.

In order to analyze the mechanisms of lubricant entrapment and escape, knowledge of the lubricant bulk modulus characterizing the compressibility of lubricant is required. Two methods were studied to achieve this purpose. A simple laboratory test consisting of upsetting a specially designed metal cylinder with a lubricant reservoir together with elastoplastic, numerical modelling of the metal cylinder is carried out in order to determine the bulk modulus at low pressure regimes of approximately 100 MPa. The above mentioned simple experimental procedure for determining lubricant bulk modulus gives a first rough estimate, and it is supplemented by a more advanced laboratory test based on a newly designed equipment. The lubricant compressibility experiment with a direct pressure measurement inside the high-pressure container allows for the direct determination of the bulk modulus at various pressure levels with no influence from friction in the sealing between punch and container. Using water as a reference, a good agreement between the experimental bulk modulus and values suggested in literature was found. Testing of liquid lubricants has revealed a nonlinear relationship between the bulk modulus and the pressure.

While texturing of workpiece surfaces to promote lubrication in sheet metal forming has been applied for several decades, tool surface texturing is rather new. A detailed background investigation and fundamental analysis of different textured tool surface arrangements have been carried out by Strip Reduction Test (SRT). Low as well as high viscosity oils were tested at varying sliding speeds. Micro-textured surfaces on the tool were made using an in-house micro-milling machine for the manufacturing. The SRT tools were manufactured with longitudinal, shallow pocket geometries oriented perpendicular to the sliding direction. The pockets have small angles to the workpiece surface and varying distance. The experiments show an optimum distance between the pockets to exist that creates a table mountain topography with flat plateaus and narrow pockets in between. If the flat plateaus are too narrow, an increase in drawing load and pick-up on the tool plateaus is observed. The same occurs for too wide plateaus. The tool textures were advantageous at larger sliding speeds when using higher viscosity oils, which facilitates the escape of trapped lubricant by micro-plasto-hydrodynamic lubrication. Large lubricant viscosity results in higher sheet plateau roughness and prevents pick-up and galling.

A theoretical friction model for a soft workpiece deforming against a textured tool surface was proposed. The friction model takes into account the plastic wave motion appearing, when the workpiece material flows into and out of local pockets between the flat plateaus of a table mountain tool surface topography. The friction model supports the experimental findings of an optimum distance between the pockets, where the contribution to friction by mechanical interlocking of the strip in the pockets is limited and lubrication of the plateaus is enhanced by micro-plasto-hydrodynamic lubrication. It was found that an optimum amount of tool texture exists which reduces friction and thus drawing load for the table-mountain tool surface topography.

Stamping of sheet metal components without lubrication or using minimum amount of hazard free lubricant is a possible solution to diminish health hazards to personnel and environmental impact and to reduce production costs. Adopting SRT, which emulates industrial ironing production of deep drawn, stainless steel cans, Diamond-Like Carbon (DLC) coating were deposited on SRT tools. The DLC coated tools with multi-, double- and single-layer coating structures were tested under severe tribological conditions, i.e., high normal pressure and temperature. A screening test campaign on a manually operated sheet tribo-tester is carried out to identify promising candidates. The screening tests revealed that the double-layer coating worked successfully, i.e., with no sign of galling using no lubrication even at elevated tool temperature, while the other coatings peeled off and resulted in severe galling unless lubrication was applied. The next test campaign on an automatic sheet tribo-tester examines the durability of the promising candidate as regards persistence towards pick-up. It is shown that the double-layer coating, DLC/Hyperlox®, can function effectively if a minimum quantity of hazard free lubricant is applied and hence, avoid peeling off of the coating leading to galling. Numerical simulation using a thermo-mechanical analysis supports the experimental findings, where lubrication lowers the temperature at the tool/workpiece interface by reducing the friction.

General information
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Mohd_Hafis_Bin_Sulaiman_PhD_Thesis.pdf
Development, modelling and evaluation of a small-scale gas liquefaction plant
A small-scale gas liquefaction plant was developed and analysed based on process simulation tools and pilot tests. It will be installed in harbours, easing the penetration of liquefied natural gas (LNG) as a maritime fuel, in a sector facing more stringent environmental regulations. The proposed plant uses a multi-component refrigerant together with a propane precooling cycle and plate heat exchangers, to achieve a higher performance. This LNG production concept was modelled based on the Danish natural gas composition. Firstly, the total power consumption and heat transfer conductance were minimised by optimising the operating conditions and the refrigerant composition. The effects of varying feed and refrigerant compositions were analysed. Secondly, the system layouts were evaluated by conducting an exergetic assessment. Finally, the most promising layouts were validated by pilot plant measurements, for a feed processing rate of 2160 kg/h. The results indicate that the specific power consumption can be reduced to the 1400-1800 kJ/kg range, for an exergetic efficiency of 25-30%. A good agreement between the simulation and experimental results was found, which justifies the use of the property database of the Groupe Européen de Recherches Gazières for system analyses.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Nguyen, T. (Intern), Rothuizen, E. D. (Intern), Markussen, W. B. (Intern), Elmegaard, B. (Intern)
Number of pages: 12
Publication date: 2017

Host publication information
Title of host publication: Proceedings of ECOS 2017: 30th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems
Main Research Area: Technical/natural sciences
Conference: 30th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems, San Diego, United States, 02/07/2017 - 02/07/2017
Energy, Gas liquefaction, Refrigeration, Process optimization, Exergy, Small-scale
Electronic versions:
ECOS_LNG_v6_r2.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Development of a numerical model for fluid-structure interaction analysis of flow through and around an aquaculture net cage
In the present work, we developed a numerical model for fluid-structure interaction analysis of flow through and around an aquaculture net cage. The numerical model is based on the coupling between the porous media model and the lumped mass structural model. A novel interface was implemented to ensure efficient data exchange and element mapping between the fluid and structural solver via random-access memory. The main idea is to apply a static mesh in the fluid model, in case that large deformation of the net structure reduces the quality of the mesh. Then the geometry of the net cage was approximated by a set of dynamic porous zones, where the grid cells were updated at every iteration based on the transferred nodal positions from the structural model. A time stepping procedure was introduced, so the solver is applicable in both steady and unsteady conditions. In order to reduce the computational effort, sub-cycling was applied for the structural solver within each time step, based on the quasi-steady state assumption. The numerical model was validated against experiments in both steady and unsteady conditions. In general, the agreement is satisfactory.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Chen, H. (Intern), Christensen, E. D. (Intern)
Pages: 597-615
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Ocean Engineering
Volume: 142
ISSN (Print): 0029-8018
Ratings:
Development of Large Scale Bed Forms in the Sea – 2DH Numerical Modeling

Large repetitive patterns on the sea bed are commonly observed in sandy areas. The formation of the bed forms have been studied extensively in literature using linear stability analyses, commonly conducted analytically and with simplifications in the governing equations. This work presents a shallow water equation model that is used to numerically simulate the morphodynamics of the water-bed system. The model includes separate formulations for bed load and suspended load, featuring bed load correction due to a sloping bed and modelled helical flow effects. Horizontal gradients are computed with spectral accuracy, which proves highly efficient for the analysis. Numerical linear stability analysis is used to identify the likely emergence of dominant finite sized bed forms, as a function of governing parameters. These are then used for interpretation of the results of a long time morphological simulation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Margalit, J. (Intern), Fuhrman, D. R. (Intern)
Number of pages: 11
Publication date: 2017
Main Research Area: Technical/natural sciences
Bed forms, Sediment transport, Morphodynamics, Linear stability analysis
Electronic versions: 178_margalit_jonatan.pdf

Diffuse back-illumination setup for high temporally resolved extinction imaging

This work presents the development of an optical setup for quantitative, high-temporal resolution line-of-sight extinction imaging in harsh optical environments. The application specifically targets measurements of automotive fuel sprays at high ambient temperature and pressure conditions where time scales are short and perceived attenuation by refractive index gradients along the optical path (i.e., beam steering) can be significant. The illumination and collection optics are optimized to abate beam steering, and the design criteria are supported by well-established theoretical relationships. The general effects of refractive steering are explained conceptually using simple ray tracing. Three isolated scenarios are analyzed to establish the lighting characteristics required to render the observed radiant flux unaffected by the steering effect. These criteria are used to optimize light throughput in the optical system, enabling minimal exposure times and high-temporal resolution capabilities. The setup uses a customized engineered diffuser to transmit a constant radiance within a limited angular range such that radiant intensity is maximized while fulfilling the lighting criteria for optimal beam-steering suppression. Methods for complete characterization of the optical system are detailed. Measurements of the liquid-vapor boundary and the soot volume fraction in an automotive spray are presented to demonstrate the resulting improved contrast and reduced uncertainty. The current optical setup reduces attenuation caused by refractive index gradients by an order of magnitude compared to previous high-temporal resolution setups.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Sandia National Laboratories
Authors: Westlye, F. R. (Intern), Penney, K. (Ekstern), Ivarsson, A. (Intern), Pickett, L. M. (Ekstern), Manin, J. (Ekstern), Skeen, S. A. (Ekstern)
Pages: 5028-5038
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Optics
Volume: 56
Issue number: 17
ISSN (Print): 1559-128X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.61 SJR 0.633 SNIP 1.095
Web of Science (2016): Indexed yes
Dimensional accuracy of Acrylonitrile Butadiene Styrene injection molded parts produced in a pilot produc
ing. Injection molding inserts manufactured additively by vat photopolymerization have become a serious option for
significantly faster and more economical prototyping and pilot production due to technological progress and advancements
in photopolymer materials in the recent years. 10 000 parts of a geometry including micro-features have been injection-
molded in Acrylonitrile Butadiene Styrene (ABS) with a single 20x20x2.5 mm^3 injection molding insert manufactured in a
photopolymer composite material. This research investigates the dimensional accuracy of the injection molded parts as a
function of inserts wearing and deformation with increasing shot number.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Mischkot, M. (Intern), Davoudinejad, A. (Intern), Charalambis, A. (Intern), Hofstätter, T. (Intern), Tosello, G.
(Intern), Pedersen, D. B. (Intern), Hansen, H. N. (Intern)
Number of pages: 5
Publication date: 2017
Event: Paper presented at 33rd Annual Meeting of the Polymer Processing Society (PPS33), Cancun, Mexico.
Main Research Area: Technical/natural sciences
Additive manufacturing, Micro injection molding, Soft tooling
Electronic versions:
PPS_33_Mischkot_Michael_DTU.pdf
Publication: Research - peer-review › Paper – Annual report year: 2017

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
Issue number: 1
ISSN (Print): 0007-8506
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.93 SJR 1.672 SNIP 3.072
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.839 SNIP 3.185 CiteScore 3.83
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.73 SNIP 3.99 CiteScore 4.39
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.455 SNIP 3.875 CiteScore 3.87
Discontinuous precipitation in a nickel-free high nitrogen austenitic stainless steel on solution nitriding

Chromium-rich nitride precipitates in production of nickel-free austenitic stainless steel plates via pressurised solution nitriding of Fe–22.7Cr–2.4Mo ferritic stainless steel at 1473 K (1200 °C) under a nitrogen gas atmosphere was investigated. The microstructure, chemical and phase composition, morphology and crystallographic orientation between the resulted austenite and precipitates were investigated using optical microscopy, X-ray Diffraction (XRD), Scanning and Transmission Electron Microscopy (TEM) and Electron Back Scatter Diffraction (EBSD). On prolonged nitriding, Chromium-rich nitride precipitates were formed firstly close to the surface and later throughout the sample with austenitic structure. Chromium-rich nitride precipitates with a rod or strip-like morphology was developed by a discontinuous cellular precipitation mechanism. STEM-EDS analysis demonstrated partitioning of metallic elements between austenite and nitrides, with chromium contents of about 80 wt.-% in the precipitates. XRD analysis indicated that the Chromium-rich nitride precipitates are hexagonal (Cr, Mo)2N. Based on the TEM studies, (Cr, Mo)2N precipitates presented a \( (1 1 1)_\gamma//[(0 0 2)_{(Cr, Mo)2N}] \) orientation relationship with respect to the austenite matrix. EBSD studies revealed that the austenite in the regions that have transformed into austenite and (Cr,
(Mo)₂N have no orientation relation to the untransformed austenite.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Azarbaijan Shahid Madani University, Sahand University of Technology
Authors: Mohammadzadeh, R. (Ekstern), Akbari, A. (Ekstern), Grumsen, F. B. (Intern), Somers, M. A. J. (Intern)
Pages: 2795-2814
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Philosophical Magazine
Volume: 97
Issue number: 30
ISSN (Print): 1478-6435
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.735 SNIP 0.714
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.888 SNIP 0.985 CiteScore 1.52
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.957 SNIP 1.11 CiteScore 1.56
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.902 SNIP 0.936 CiteScore 1.46
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.013 SNIP 0.953 CiteScore 1.45
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.933 SNIP 0.976 CiteScore 1.43
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.034 SNIP 0.959
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.06 SNIP 0.853
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.231 SNIP 0.996
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.113 SNIP 1.081
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.184 SNIP 1.152
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.063 SNIP 1.616
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.948 SNIP 1.565
Web of Science (2004): Indexed yes
Discussion on Problems in Buckling Analysis of a Continua

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, P. (Intern), Pedersen, N. L. (Intern)
Number of pages: 1
Pages: 231
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
Electronic versions:
DISCUSSION_ON_PROBLEMS_IN_BUCKLING_ANALYSIS.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Do Biomimetic Students Think Outside the Box?
Biomimetics is a recognized method in ideation for getting access to new and – for the designer – novel knowledge, which hopefully will result in more novel and useful products. But do designers actually find new knowledge, i.e. think outside the box or do they stick to well-known biological phenomena? If they concentrate on animals and plants, which they beforehand have knowledge about, it could be expected that solutions will remind of what they would have found without using biomimetics. To investigate this question, the empirical results from a university course in biomimetics have been analysed. The empirical material comprises 111 students working on 28 different functional design problems. On average teams identify 9.0 relevant biological phenomena and manage to produce a physical proof-of-principle for the selected biological analogy. 39% of the analogies can be characterised as well-known phenomena and 51% are from the animal kingdom. These numbers indicate a tendency of fixating on well-known knowledge. The authors propose that applying a simple constraint during the search process can counteract the tendency.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Lenau, T. A. (Intern)
Pages: 543-551
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 21st International Conference on Engineering Design (ICED17)
Publisher: Design Society
Main Research Area: Technical/natural sciences
Conference: 21st International Conference on Engineering Design, Vancouver, Canada, 21/08/2017 - 21/08/2017
Bio-inspired design, Biomimetics, Creativity, Early design phases
Electronic versions:
Contribution421_final_A_Lenau.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Drag reduction in silica nanochannels induced by graphitic wall coatings
Transport of water in hydrophilic nanochannels is of significant technological and scientific interest. Water flow through hydrophilic nanochannels is known to experience enormous hydraulic resistance. Therefore, drag reduction is essential for the development of highly efficient nanofluidic devices. In this work, we propose the use of graphitic materials as wall coatings in hydrophilic silica nanochannels. Specifically, by conducting atomistic simulations, we investigate the flow inside slit
and cylindrical silica channels with walls coated with graphene (GE) layers and carbon nanotubes (CNTs), respectively. We develop realistic force fields to simulate the systems of interest and systematically, compare flow rates in coated and uncoated nanochannels under different pressure gradients. Moreover, we assess the effect that GE and CNT translucencies to wettability have on water hydrodynamics in the nanochannels. The influence of channel size is investigated by systematically varying channel heights and nanopore diameters. In particular, we present the computed water density and velocity profiles, volumetric flow rates, slip lengths and flow enhancements, to clearly demonstrate the drag reduction capabilities of graphitic wall coatings.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepción
Authors: Wagemann, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. (Ekstern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 70th Annual Meeting of the American Physical Society Division of Fluid Dynamics (DFD17), Denver, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
MWS_DFD17_2017_000016.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

**Drying of a tape-cast layer: Numerical investigation of influencing parameters**

In this study, the evaporation of water from a ceramic-water mixture is investigated numerically with the purpose of understanding the drying process of the thin sheets produced by the tape casting process. In the scope of this work, a Representative Elementary Volume (REV) scale model concept for coupling non-isothermal multi-phase compositional porous-media flow and single-phase compositional laminar free-flow developed by Jabbari et al. (2016), is used for a thorough analysis of the influential parameters. Specifically, we investigate the influence of ventilation speed magnitude, $v_{\text{max}}$, the equivalent diameter of particles of the porous medium, $d_p$, the porosity of the porous medium, $\phi$, the initial temperature in the free-flow region, $T_{ff}$, and the initial temperature in the porous-medium region, $T_{pm}$, on the characteristic drying curves of a thin ceramic layer. We, moreover, conduct a statistical analysis based on numerical experiments in combination with a fractional factorial design of the aforementioned parameters. The analysis accounts for the effects of parameters on the characteristic drying curves of a thin ceramic layer. The effects of varying each of the parameters as well as their mutual interaction are shown with particular attention to the maximal drying rate as well as the final time for the drying process.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universität Stuttgart
Authors: Jabbaribechnam, M. (Intern), Shojaee Nasirabadi, P. (Intern), Jambhekar, V. A. (Ekstern), Hattel, J. H. (Intern), Helmig, R. (Ekstern)
Pages: 2229-2238
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Volume: 108
ISSN (Print): 0017-9310
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.75 SJR 1.623 SNIP 2.005
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.797 SNIP 1.941 CiteScore 3.09
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.624 SNIP 2.008 CiteScore 2.97
Web of Science (2014): Indexed yes
This paper focused attention to the falling weight deflectometer (FWD) load-time history. For a commonly used device, it studied the pulse generation mechanism and the influence of different load histories on backcalculation results. In this connection, a semi-analytic impact theory was first introduced for realistically simulating FWD pulse generation. Then a newly developed finite-element code was presented for FWD interpretation; the code is capable of addressing dynamics, time-dependent layer properties, and quasi-nonlinear behaviour. Both new developments were demonstrated for an experimental dataset that resulted from operating an FWD with different loading configurations. It was found that backcalculated parameters are sensitive to the FWD pulse features. Consequently, it is recommended that, whenever advanced pavement characterisation is sought, experimental attention should be placed on generating diverse FWD pulse histories. Collectively, the resulting deflection histories will contain pertinent constitutive information for supporting the calibration of more complex pavement models.
The purpose of this research is to analyze how additive manufacturing can create value when it is utilized as a supportive technology to injection molding by quantifying the cost advantages that can be obtained. Tooling for the product development phase is investigated as pilot integration area of additive manufacturing with injection molding. Cost considerations are discussed through the development of a cost estimation model. The study shows that integration of additive manufacturing in the product development phase for fabrication of soft tooling is economically convenient with a cost reduction of 79.8% and 89.9%. The cost models on additive manufacturing have been built so far on the idea of substituting injection molding with additive manufacturing. In response to this literature gap, this research addresses the advantages of additive manufacturing utilized in a synergistic rather than disruptive way to create value in the injection molding process chain.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, HEC Paris
Merchant vessels are equipped with antifouling systems to prevent accumulation of marine organisms on the hull—a phenomenon known as fouling. In many cases, however, fouling accumulates and in-water hull cleaning is required. Hull cleanings are part of a hull management scheme, and although they are an established practice, their associated environmental and economic trade-offs and conflicts have remained largely unexplored. The purpose of this article is to quantitatively assess both economic and environmental impacts of hull management schemes on the operation of tanker vessels. After identifying induced and avoided costs and environmental impacts from the hull management system, we used both temporally and spatially distributed models to capture the degradation of the antifouling system as well as the global sailing profile of the vessels. Last, we analyzed how each of the modeled impacts varied with the frequency of hull cleanings within the hull management scheme. Our analysis revealed a convex relationship between the frequency of hull cleanings and fuel savings. The higher the frequency of hull cleanings, the less fuel savings can be achieved per cleaning. In terms of costs, from some point on the costs of the service are likely to offset the savings—especially if fuel prices are low. In regards to climate change, avoided emissions due to fuel savings are likely to outweigh the limited impacts from the service itself. Last, while ecosystem impacts from marine, terrestrial, and freshwater eco-toxicity are likely to increase from hull cleanings, they are subject to high uncertainties.
Economic development as design: Insight and guidance through the PSI framework

Economic development is aimed at improving the lives of people in the developing world, and needs to be carried out with design at its heart, but this has often not been the case. This paper first reviews dominant approaches to economic development including the use of subsidies or the creation of markets and demand and the testing of initiatives using randomized control trials. It then introduces ‘development engineering’ as a representative engineering design approach to engineering and technology in development before presenting the view that successful development needs to involve continual learning through innovation in context. The PSI (problem social institutional) framework is presented as a basis for guiding such development as a design activity, and its application is illustrated using examples from India of the unsuccessful introduction of new cooking stoves and then both successful and unsuccessful approaches to rural electrification. A 2-level approach to PSI is taken, in which the lower level represents daily operation of communities and the 2nd level represents the development project including addressing misalignments between the different PSI spaces and levels.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Carnegie Mellon University, Tel Aviv University, The Open University
Authors: Subrahmanian, E. (Ekstern), Eckert, C. (Ekstern), McMahon, C. A. (Intern), Reich, Y. (Ekstern)
Pages: 229-238
Publication date: 2017

Host publication information
Volume: 1
Publisher: Design Society
Editors: Maier, A., Škec, S., Kim, H., Kokkolaras, M., Oehmen, J., Fadel, G., Salustri, F., Van der Loos, M.
ISBN (Electronic): 978-1-904670-89-6
Main Research Area: Technical/natural sciences
Conference: ICED17: 21st International Conference on Engineering Design, Vancouver, Canada, 21/08/2017 - 21/08/2017
Design theory, Social responsibility, Participatory design, Economic development
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Economic trade-offs of additive manufacturing integration in injection moulding process chain

Additive Manufacturing has emerged as an innovative set of novel technologies capable of replacing established manufacturing processes due to fabrication of highly complex parts and its continuous improvements of efficiency and cost effectiveness. This study is based on the idea that through the creation of synergies between additive and conventional manufacturing technologies it is possible to achieve greater cost advantages and operational benefits than by substituting injection moulding with additive manufacturing. The analysis presented explores the cost advantages that can be secured when additive manufacturing is used to support the fabrication of mould inserts for the product development phase of the injection moulding process chain. This study shows that fabrication of soft tooling by mean of AM is economically convenient with a cost reduction between 80% and 90%. Break-even points analysis based on the lot size of the product development phase is also investigated and it shows that the use of AM is cost effective up to 3400 units for the smaller geometry and up to 500 units for the larger insert geometry.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, HEC Paris
Authors: Charalambis, A. (Intern), Kerbache, L. (Ekstern), Tosello, G. (Intern), Pedersen, D. B. (Intern), Mischkot, M. (Intern), Hansen, H. N. (Intern)
Number of pages: 4
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the Joint Special Interest Group meeting between euspen and ASPE : Dimensional Accuracy and Surface Finish in Additive Manufacturing
Publisher: The European Society for Precision Engineering and Nanotechnology
Main Research Area: Technical/natural sciences
Conference: euspen and ASPE Special Interest Group Meeting: Additive Manufacturing, Leuven, Belgium, 10/10/2017 - 10/10/2017
Additive Manufacturing, Injection Moulding, Soft Tooling, Break-Even-Analysis, Cost Advantage
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Editorial: Special Issue: Selected conference papers from the Nord-Trib 2014 conference
This special issue of Journal of Engineering Tribology contains selected papers from the 16th Nordic symposiumon Tribology, NORDTRIB 2014, which was held in Denmark on 10–13 June 2014. The symposium was organised by Lars Pleth Nielsen, Lone Elly Larsen, Sascha Louring and Claus Mathiasen, Danish Technological Institute, Svend S. Eskildsen, MAN Diesel A/S and Ion M. Sivebaek, Technical University of Denmark and Novo Nordisk A/S. More than 140 delegates from 22 countries enjoyed 114 oral presentations at the symposium, which took place at the Scandinavian Congress Center, in the center of the second largest city in Denmark: Aarhus. NORDTRIB 2014 covered numerous aspects on friction, wear and lubrication, and their practical applications, with presentations on environmental aspects of tribology, tribotesting, tribology in metalworking, materials tribology, tribology of machine elements, contact mechanics, lubricants and lubrication, surface engineering, polymers and biotribology. The papers in this special issue of Journal of Engineering Tribology were selected from the symposium presentations by the Nordic Advisory Board of NORDTRIB and have subsequently undergone a normal peer review process. In addition to the papers presented in this journal, some papers were selected for publication in Wear and Tribology International. The organising committee wishes to express their appreciation to all the authors and delegates who made NORDTRIB 2014 a success. The guest editors also want to acknowledge all the reviewers.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Danish Technological Institute
Authors: Sivebaek, I. M. (Intern), Nielsen, L. P. (Ekstern)
Pages: 431-431
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 231
Issue number: 4
ISSN (Print): 1350-6501
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Editorial
In an ever-changing world, the roles of product development, business innovation, advanced manufacturing, service delivery and end-of-life management become increasingly important to enhance the competitiveness of industrial companies. The boundaries between disciplines soften and it is increasingly apparent that the scope for innovation and market disruption is to be found in the careful integration of numerous life cycle activities as the object of design. Industrial Product/Service-Systems (IPSS) are one answer to this development, offering solutions towards the conceptualisation, design, planning and deployment of new solutions and value propositions in fundamentally different ways than before. Implicit in the philosophy behind IPSS is to create customer-oriented solutions that function for longer and thus increase resource productivity, minimise resource consumption and enhance the ultimate value-add to the end user. In this context, PSS solutions have a great potential to enable the transition to a Circular Economy, where the goal is to think in circular product- and system life cycles, rather than our current linear “take-make-waste” paradigm.

This Procedia CIRP Special Issue collects manuscripts from the 9th CIRP IPSS Conference, IPSS2017, which focused its
theme on “Circular Perspectives on Product/Service-Systems”. With this theme, the conference, and therefore these manuscripts, have explored how the transition to a Circular Economy can be supported by PSS, in terms of life cycle, sustainability, optimisation, design and user satisfaction. The Special Issue is organised in five complementary and synergetic tracks, offering a holistic and systemic view on the circular perspectives of PSS.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Tokyo Metropolitan University
Authors: McAloone, T. C. (Intern), Pigosso, D. C. A. (Intern), Mortensen, N. H. (Intern), Shimomura, Y. (Ekstern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Procedia C I R P
Volume: 64
ISSN (Print): 2212-8271
Ratings:
Scopus rating (2016): CiteScore 1.6 SNIP 1.297
Scopus rating (2015): SJR 0.572 SNIP 1.012
Scopus rating (2014): SJR 0.736 SNIP 1.419
Scopus rating (2013): SJR 0.515 SNIP 1.163
ISI indexed (2013): ISI indexed no
Original language: English
Electronic versions:
1_s2.0_S2212827117302780_main.pdf
DOIs:
10.1016/j.procir.2017.03.129

**Bibliographical note**

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Source: PublicationPreSubmission
Source-ID: 137330173
Publication: Research › Editorial – Annual report year: 2017

**Effect of carbon on interstitial ordering and magnetic properties of ε-Fe2(N,C)1-z**

Hexagonal ε-iron nitride and ε-iron carbonitride phases are formed on nitriding and nitrocarburizing of iron and steel surfaces and can exist in broad compositional ranges. Long-range nitrogen ordering and magnetic properties for ε-iron nitrides and their dependence on composition have been the focus of several studies. So far, limited attention has been paid to the carbonitrides. In the current work, the effects of substitution of nitrogen by carbon on the interstitial ordering and magnetic properties in Fe2(C,N)1-z are explored using neutron diffraction, Mössbauer spectroscopy and vibrating sample magnetometry. Neutron diffraction patterns showed 001 and 301 superstructure reflections, confirming previously proposed structural model in space group P31m (compared to P6₃22 for the pure nitrides). On partial substitution of nitrogen by carbon in ε-iron nitride the Curie temperature, the saturation magnetization and the hyperfine fields of the iron atoms are increased, while isomer shifts are decreased. The effects on the a and c lattice parameters indicate a change in interstitial ordering, which is related to more favorable interactions between a nitrogen and carbon atom than among nitrogen atoms. This interaction leads to additional interstitial (short-range) ordering and a decrease in the c lattice parameter, while the a lattice parameter is largely unaffected.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Physics, Neutrons and X-rays for Materials Physics, Department of Chemistry, X-ray Crystallography, Department of Micro- and Nanotechnology, Magnetic Systems, Academy of Sciences of the Czech Republic
Authors: Brink, B. (Intern), Ståhl, K. (Intern), Christiansen, T. L. (Intern), Frandsen, C. (Intern), Hansen, M. F. (Intern), Beran, P. (Ekstern), Somers, M. A. J. (Intern)
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BFI (2015): BFI-level 1
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.135 SNIP 1.66 CiteScore 3.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
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ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.249 SNIP 1.584 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.166 SNIP 1.479 CiteScore 2.41
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.221
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.957 SNIP 1.367
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.899 SNIP 1.207
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.889 SNIP 1.216
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.897 SNIP 1.147
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.074 SNIP 1.212
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.903 SNIP 1.35
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.909 SNIP 1.04
Scopus rating (2002): SJR 0.797 SNIP 1.047
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.615 SNIP 0.967
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Scopus rating (1999): SJR 0.766 SNIP 0.927
Original language: English
Neutron diffraction, Vibrating sample magnetometry, Epsilon iron nitride, Thermal expansion, Interstitial order
DOI: 10.1016/j.jallcom.2016.09.317
Effect of Chemical Environment and pH on AC Corrosion of Cathodically Protected Structures

AC corrosion of structures under cathodic protection (CP) is a major concern for pipelines in case of even minor AC perturbations. There are indications that the specific chemical environment has a large influence on the AC mitigation current density criteria outlined in EN 15280:2013 [1]. This work investigates the effect of soil constituents, the earth alkali elements Ca and Mg, believed to have a large influence on the precipitation of hydroxides and carbonates in front of a coating damage. The formation of different polymorphous calcium carbonates, depending on the cathodic potential are observed as well as calcium hydroxides at high cathodic protection levels. This indicates a highly alkaline (pH > 11) environment locally. Corrosion rates at different cathodic potentials are measured using electrical resistance (ER) probes and a chemical and phase analysis of the calcareous deposits and corrosion products is made using scanning electron microscopy and energy dispersive x-ray spectroscopy (SEM/EDS) and x-ray diffraction (XRD). The findings suggest an AC corrosion mechanism highly dependent on the build-up and break-down of calcareous deposits at high CP, which is clearly reflected in variations in the spread resistance.

Effect of flue gas composition on deposit induced high temperature corrosion under laboratory conditions mimicking biomass firing. Part I: Exposures in oxidizing and chlorinating atmospheres

In biomass fired power plants, deposition of alkali chlorides on superheaters, as well as the presence of corrosive flue gas species, give rise to fast corrosion of superheaters. In order to understand the corrosion mechanism under this complex condition, the influence of the flue gas composition on high temperature corrosion of an austenitic superheater material under laboratory conditions mimicking biomass firing is investigated in this work. Exposures involving deposit (KCl)-coated and deposit-free austenitic stainless steel (TP347H FG) samples were conducted isothermally at 560 °C for 72 h, under both oxidizing and oxidizing-chlorinating atmospheres, and the resulting corrosion products were comprehensively studied with scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS), and X-ray diffraction (XRD) techniques. The results show that deposit-free samples suffer grain boundary attack only in an oxidizing-chlorinating atmosphere, otherwise corrosion results in formation of a duplex oxide. Corrosion attack on deposit-coated samples was higher than on deposit-free samples irrespective of the gaseous atmosphere. Specifically, severe volatilization of alloying elements occurred on deposit-coated samples under oxidizing-chlorinating atmosphere due to enhanced impact of KCl and HCl.
Effect of flue gas composition on deposit induced high temperature corrosion under laboratory conditions mimicking biomass firing. Part II: Exposures in SO2 containing atmospheres

In biomass fired power plants, the fast corrosion of superheaters is facilitated by the presence of corrosive flue gas species, for example, SO2, which are released during combustion. To understand the role of the gas species on the corrosion process, comparative laboratory exposures of deposit (KCl)-coated and deposit-free austenitic stainless steel (TP 347H FG) samples to gas mixtures containing SO2 was carried out, under conditions relevant to biomass-firing. Exposures were conducted isothermally at 560 °C for 72 h, in oxidizing-sulphidizing and oxidizing-sulphidizing-chlorinating gas mixtures containing 60 ppmv SO2. Scanning electron microscopy (SEM), energy dispersive X-rayspectroscopy (EDS) and X-ray diffraction (XRD) techniques were complementarily applied to characterize the resulting corrosion products. A partially molten K2SO4-layer formed on KCl coated specimens, and corrosion resulted in localized broad pits containing sulphides and oxides. The severe pitting attack was decreased by the presence of HCl in the gas mixture.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Chemical and Biochemical Engineering, CHEC Research Centre
Authors: Okoro, S. C. (Intern), Kiamehr, S. (Intern), Montgomery, M. (Intern), Jappe Frandsen, F. (Intern), Pantleon, K. (Intern)
Pages: 515-528
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.668 SNIP 1.033 CiteScore 1.53
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.76 SNIP 1.196 CiteScore 1.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.824 SNIP 1.434 CiteScore 1.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.669 SNIP 1.126 CiteScore 1.25
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.606 SNIP 1.124 CiteScore 1.13
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.572 SNIP 0.909
Web of Science (2010): Indexed yes
Effect of interior geometry on local climate inside an electronic device enclosure

Electronic enclosure design and the internal arrangement of PCBs and components influence microclimate inside the enclosure. This work features a general electronic unit with parallel PCBs. One of the PCB is considered to have heat generating components on it. The humidity and temperature profiles near the surface of PCBs depend on various factors like inter-PCB spacing, controlled opening size, and heat capacity of various parts. The effect of above mentioned factors on the humidity and temperature profiles are investigated for both transient and steady state operating conditions of the electronic device. The experiments are conducted for the case of condensed water present in the enclosure. A rectangular enclosure made of aluminium is used for the study. PCBs closer to heated surfaces are found to have lower relative humidity and less probability to failure. This is confirmed by impedance measurements on the PCBs. Enclosures with smaller opening sizes are observed to have lower relative humidity. Results also show possibility of using heat capacity of materials to store and release heat energy for control of humidity. This paper provides an improved understanding of the effect of internal geometry of the device and related enclosure design parameters on the humidity and temperature profiles inside the electronic device enclosure.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Joshy, S. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
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Main Research Area: Technical/natural sciences
Conference: 16th IEEE Intersociety Conference on Thermal and Thermomechanical Phenomena in Electronic Systems (ITherm 2017), Orlando, United States, 30/05/2017 - 30/05/2017
Humidity, Temperature, Thermal mass, Electronic enclosure, Microclimate
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Source-ID: 2372617654
Effect of shot peening on the residual stress and mechanical behaviour of low-temperature and high-temperature annealed martensitic gear steel 18CrNiMo7-6

A martensitic gear steel (18CrNiMo7-6) was annealed at 180 degrees C for 2h and at similar to 750 degrees C for 1h to design two different starting microstructures for shot peening. One maintains the original as-transformed martensite while the other contains irregular-shaped sorbite together with ferrite. These two materials were shot peened using two different peening conditions. The softer sorbite + ferrite microstructure was shot peened using 0.6 mm conditioned cut steel shots at an average speed of 25 m/s in a conventional shot peening machine, while the harder tempered martensite steel was shot peened using 1.5 mm steel shots at a speed of 50 m/s in an in-house developed shot peening machine. The shot speeds in the conventional shot peening machine were measured using an in-house lidar set-up. The microstructure of each sample was characterized by optical and scanning electron microscopy, and the mechanical properties examined by microhardness and tensile testing. The residual stresses were measured using an Xstress 3000 G2R diffractometer equipped with a Cr K alpha x-ray source. The correspondence between the residual stress profile and the gradient structure produced by shot peening, and the relationship between the microstructure and strength, are analyzed and discussed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Wind Energy, Manufacturing Engineering, Materials science and characterization, Meteorology & Remote Sensing, Composites and Materials Mechanics, Materials and Surface Engineering, Chongqing University, Chalmers University of Technology, Nanjing University of Science and Technology
Authors: Yang, R. (Ekstern), Zhang, X. (Intern), Mallipeddi, D. (Ekstern), Angelou, N. (Intern), Toftegaard, H. L. (Intern), Li, Y. (Ekstern), Ahlstrom, J. (Ekstern), Lorenzen, L. (Intern), Wu, G. (Ekstern), Huang, X. (Intern)
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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 0.172 SNIP 0.281 CiteScore 0.22
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Scopus rating (2013): SJR 0.183 SNIP 0.256 CiteScore 0.16
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.161 SNIP 0.203 CiteScore 0.14
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Scopus rating (2011): SJR 0.155 SNIP 0.149 CiteScore 0.1
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Publication: Research - peer-review › Journal article – Annual report year: 2017
Effect of thermal cycling on martensitic transformation and mechanical strengthening of stainless steels – A phase-field study

A 3D elastoplastic phase-field model is used to study the effect of thermal cycling on martensitic transformation as well as on mechanical strengthening of both austenite and martensite in stainless steel. The results show that with an increasing number of thermal cycles, martensite becomes more stable. Increase in strain, plastic strain and strain hardening lead to strengthening of austenite.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Newcastle University
Authors: Yeddu, H. K. (Ekstern), Shaw, B. A. (Ekstern), Somers, M. A. J. (Intern)
Pages: 1-5
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BFI (2017): BFI-level 2
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.39 SJR 1.666 SNIP 1.832
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.78 SNIP 1.849 CiteScore 3.01
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.285 SNIP 2.617 CiteScore 3.32
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.879 SNIP 2.231 CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.737 SNIP 2.351 CiteScore 2.5
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.741 SNIP 2.406 CiteScore 2.59
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.702 SNIP 2.086
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.551 SNIP 1.74
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.678 SNIP 1.847
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.32 SNIP 1.68
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.337 SNIP 1.748
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.163 SNIP 1.448
Effect of TWD estimation error on the depth of machined cavities in micro-EDM milling

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern), Bissacco, G. (Intern), Hansen, H. N. (Intern)
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EDM, Precision machining, Tool electrode wear
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Effects of carbon fibres on the life cycle assessment of additively manufactured injection moulding inserts for rapid prototyping

A life cycle assessment was conducted to evaluate the global warming potential and human toxicity of injection moulding processes applying newly developed tool inserts produced with vat polymerisation. The inserts were subject to increasing content of carbon fibres to improve their mechanical properties and lifetime. The additively manufactured inserts are compared to the standard materials steel, aluminium and brass. The investigated part of the production and prototyping phase considers the insert itself, the moulded part, and resulting waste material of the injection moulding process.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Hofstätter, T. (Intern), Bey, N. (Intern), Mischkot, M. (Intern), Stotz, P. M. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
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Effects of fast mold temperature evolution on micro features replication quality during injection molding

The growing demand to manufacture, with high accuracy, functional structures in the micro and sub-micrometer range polymer-based microsystem products calls for reliable mass production processes. Being injection molding (IM) the preferential technology employed for polymer mass fabrication and mold temperature one of the most relevant process parameter to enhance polymer replication at the micro-meter scale, the present study investigates effects of fast mold temperature evolution on final replication quality of produced injection molded parts. Micro features master geometries were produced by UV lithography and subsequent nickel electroplating. The mold temperature was controlled by a thin heating device (composed by polyimide as insulating layer and polyimide carbon black loaded as electrical conductive layer) able to increase the temperature on mold surface in a few seconds (40Â°C/s) by Joule effect and let the surface to cool down soon after. This heating device allowed to maintain mold temperature at a constant value for a time that could be equal to the filling time or longer. A fully characterized isotactic polypropylene was used as the polymer material during the injection molding experiments. The experiments revealed that the replication was mostly sensitive to cavity pressure and mold temperature. In particular, an increase of holding pressure and mold temperature enhanced the replication. Also, the heating time increased the replication quality.
Effects of Nozzle Diameter on Diesel Spray Flames: A numerical study using an Eulerian Stochastic Field Method

The present numerical study aims to assess the performance of an Eulerian Stochastic Field (ESF) model in simulating spray flames produced by three fuel injectors with different nozzle diameters of 100 μm, 180 μm and 363 μm. A comparison to the measurements shows that although the simulated ignition delay times are consistently overestimated, the relative differences remain below 28%. Furthermore, the change of the averaged pressure rise with respect to the variation of nozzle diameter is captured by the model. The simulated flame lift-off lengths also agree with the measurements, with a maximum relative difference of 13%. The spray flame produced by a larger nozzle diameter has a fuel-richer premixed core region despite the longer lift-off length, indicating that the higher fueling rate used with the larger nozzle diameter is a more dominating factor than the lift-off length is in influencing the air entrainment into the upstream of the spray flames. In addition, the simulated normalised flame lengths are found to decrease when the nozzle diameters increase. These predictions are in good qualitative agreement with the experimental observation. This work proves that the ESF model can serve as an important tool for the simulation of spray flames in marine diesel engines, where fuel injectors with different nozzle diameters are applied for pilot and main injections.
Effects of thickness reduction on recrystallization process of warm-rolled pure tungsten plates at 1350 °C

Investigations are conducted of the recrystallization behavior of pure tungsten through different thickness reductions by isothermal annealing at 1350 °C. Concise description is made of the recrystallization kinetics by the Johnson-Mehl-Avrami-Kolmogorov (JMAK) model in combination with hardness test results. The rate of the recrystallization process increases with the deformation ratio. For further investigations, three boundary maps of tungsten plates which are of different thickness reductions by rolling and in full recrystallization are obtained, each covering an area of 1.15 × 1.05 mm² on the transversal section comprising the rolling direction (RD) and the normal direction (ND). The average grain size and its distribution of pure tungsten can be easily calculated, and hence the grain aspect ratios of pure tungsten.

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Hefei University of Technology
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Scopus rating (2016): CiteScore 1.14 SJR 0.65 SNIP 0.904
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.76 SNIP 1.595 CiteScore 1.41
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.709 SNIP 1.26 CiteScore 1.2
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.619 SNIP 1.454 CiteScore 1.35
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.636 SNIP 1.078 CiteScore 0.99
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.664 SNIP 1.755 CiteScore 1.4
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.44 SNIP 1.111
Efficient preconditioning of hphp-FEM matrix sequences with slowly-varying coefficients: An application to topology optimization

We previously introduced a preconditioner that has proven effective for hphp-FEM discretizations of various challenging elliptic and hyperbolic problems. The construction is inspired by standard nested dissection, and relies on the assumption that the Schur complements can be approximated, to high precision, by Hierarchically-Semi-Separable matrices. The preconditioner is built as an approximate LDMₗLDMₗ factorization through a divide-and-conquer approach. This implies an enhanced flexibility which allows to handle unstructured geometric meshes, anisotropies, and discontinuities. We build on our previous numerical experiments and develop a preconditioner-update strategy that allows us handle matrix sequences arising from problems with slowly-varying coefficients. We investigate the performance of the preconditioner along with the update strategy in context of topology optimization of an acoustic cavity.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, RWTH Aachen University, Ecole Polytechnique Federale de Lausanne (EPFL)
Authors: Gatto, P. (Ekstern), Hesthaven, J. S. (Ekstern), Christiansen, R. E. (Intern)
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Scopus rating (2016): CiteScore 4.31 SJR 2.743 SNIP 1.962
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.823 SNIP 2.126 CiteScore 3.91
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Electrochemical migration of lead-free solder alloys in Na2SO4 environment

The effect of sulphate ion concentration on electrochemical migration of lead-free solder alloys was investigated with the use of water drop tests, by applying an in-situ optical and electrical inspection system. According to the Mean-Time-To-Failure (MTTF) values it was found that in the case of 0.1 and 1 mM Na2SO4 solutions X alloy (composition in wt%: Sn=90.95%, Ag=3.8%, Cu=0.7%, Bi=3%, Sb=1.4%, Ni=0.15%) has higher migration susceptibility than SAC305 alloy (composition in wt%: Sn=96.5%, Ag=3%, Cu=0.5%). However on higher concentration levels, MTTF decreased and the failures usually happened in the same time on each solder alloy type. Failures were not happened in the case of X covered boards in case of 10 mM concentration.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Budapest University of Technology and Economics
Authors: Medgyes, B. (Ekstern), Ádám, S. (Ekstern), Tar, L. (Ekstern), Verdingovas, V. (Intern), Ambat, R. (Intern), Harsányi, G. (Ekstern)
Electro sinter forging of titanium disks

Electro sinter forging (ESF) is a new sintering process based on the principle of electrical Joule heating. In the present work, middle frequency direct current (MFDC) was flowing through the powder compact, which was under mechanical pressure. The main parameters are the high electrical current, up to 10 kA, and the low voltage, 1-2 V, resulting in heat generation in the powder. Figure 1 shows the experimental setup. The punches were made of a conductive material; namely a copper alloy. The die, which has to be electrically insulating, was made of alumina. The ESF process takes 3-4s including the following phases: (i) feeding of powder (ii) pre-compaction (iii) heating by electrical current during 100-200ms (iv) cooling (v) ejection. Figure 2 shows an example of measured pressure and current during sintering of the sample shown in Figure 3. As compared to conventional sintering [1] and spark plasma sintering [2], the main advantages are the decreased sintering time and high relative density [3]. The short time at high temperature avoids grain growth and creep. The compacted particles are bonded together because of high temperature at the boundaries. A theoretical model for the bonding mechanisms is described by Al-Hassani [4]. Optimization of process parameters, i.e. pressure, time and current, is needed to obtain high densification without reaching the melting temperature. The main sample properties are density, geometry and strength. In-process monitoring of the density can be done by measuring the electrical resistance during the sintering process [5], since low electrical resistance corresponds to high density. It is, however, necessary to be aware that increased temperature, on the other hand, increases the resistance. SEM micrographs and Computed Tomography (CT) are carried out for off-line pore and porosity analysis, respectively.

Embracing Circular Economy: a journey seen through the perspective of Sustainability Maturity

Circular Economy has been progressively acknowledged as a promising and consistent approach to maximizing value by increasing resource productivity, while minimizing resource consumption and related waste. Manufacturing companies operating on a linear fashion are faced with a wealth of potential business benefits derived from a circular economy. However, this transition requires a systemic change mindset, encompassing a wide array of organizational processes and functions: from strategy and business models to take-back and end-of-life management. With a view to supporting the transition of manufacturing companies towards Circular Economy, this article presents a maturity-based approach that supports manufacturing companies to develop and implement strategic roadmaps and action plans for the transition. An analysis of twelve key management practices to manage the transition towards Circular Economy is presented and briefly discussed. Industrial applications of the proposed maturity approach indicate that the maturity approach can effectively strengthen companies’ abilities to embrace the beneficial prospects of the Circular Economy.
Empirical study of ill-supported activities in variation risk identification and assessment in early stage product development

The purpose of this paper is to present findings from an industrial case study about the support of activities related to identifying and assessing variation-related issues in the design during the concept- and embodiment design stages. The case study investigates a large world-leading mechanical medical device company by interviewing six key employees that work in the variation risk identification and assessment process. It is found that there are several ill-supported activities, and that the project teams rely heavily on tolerance experts’ assistance and experience in order to identify and assess the variation risk. Ill-supported activities are found to be: Balancing hardness of requirements and the screening; communicating mechanism understanding; predicting user input and internal component movement; documenting and communicating tolerance analysis; implementing robustness in the early definition of the projects; and implementing statistical information in the calculations. It is suggested these areas should be supported further.

Energirenovering af større bygninger - metode og proces

SBi-anvisning 269 omhandler metode og proces for gennemførelse af energirenoveringsprojekter for større bygninger fra idefase til driftsfase. Større bygninger omfatter etageboliger, bygninger til privat handel- og service samt offentlige institutioner.

Anvisningen giver vejledning for de involverede parter i et renoveringsprojekt om, hvordan energirenoveringsprojekter gennemføres i alle faser.

SBi-anvisning 269 kan bruges som styringsredskab for bygherrer og kravgrundlag for rådgivere, entreprenører og andre parter, der leverer ydelser til bygherrer. For institutioner, der stiller kapital til rådighed for energirenoveringsprojekter, kan anvisningen udgøre et grundlag til vurdering af kvaliteten af konkrete projektforslag.

Til anvisningen er knyttet en webside med links til specifikke værktyver, dokumenter, tjeklister, beregningsprogrammer m.m., der kan anvendes ved energirenovering af bygninger.
Energy efficient thermochemical conversion of very wet biomass to biofuels by integration of steam drying, steam electrolysis and gasification

A novel system concept is presented for the thermochemical conversion of very wet biomasses such as sewage sludge and manure. The system integrates steam drying, solid oxide electrolysis cells (SOEC) and gasification for the production of synthetic natural gas (SNG). The system is analyzed by thermodynamic modelling and the analysis shows that the system can handle mechanically dried biomasses with a water content of 70 wt% and an ash content of up to 50 wt% (dry basis). A high tolerable ash content is an advantage because very wet biomasses, such as sewage sludge and manure, have a high ash content. The analysis shows that the total efficiency of the novel system is 69–70% depending on the biomass ash content, while the biomass to SNG energy ratio is 165%, which is near the theoretical maximum because electrolytic hydrogen is supplied to the synthesis gas. It is proposed to combine the novel system with an anaerobic digester for conversion of biomasses with high nitrogen content, such as sewage sludge. The organic nitrogen in the sewage sludge will be mineralized in the digester instead of ending up as N₂ in the SNG product.

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Web of Science (2015): Indexed yes
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BFI (2013): BFI-level 2
In Germany, 19.6% of the industrial final energy consumption (FEC) can be allocated to the chemical industry. Energy efficiency measures with focus on the chemical industry could thus significantly contribute to reaching the German goal of reducing greenhouse gas emissions by 80% in 2050 compared to 1990. To achieve this ambitious goal, energy planners and industries alike require an overview of the existing energy efficiency measures, their technical potential as well as the costs for realizing this potential. Energy efficiency opportunities are commonly presented in marginal cost curves (MCCs), which rank these measures according to specific implementation costs. Existing analyses, however, often do not take uncertainties in costs and potentials into account. The aim of this paper is to create a MCC of energy efficiency measures for the chemical industry in Germany, while quantifying the uncertainties of the results and identifying the most influential input parameters. The identification of energy efficiency measures and the quantification of the associated technical potentials and costs are identified based on literature data and own assessments. Based on these findings, a cost curve is created for the current technical potential. To investigate the uncertainties of the model output, Monte Carlo (MC) simulations are performed to quantify the standard deviations of the implementation potential and costs. Furthermore, a sensitivity analysis, based on Morris Screening and a linear regression, is conducted in order to identify the most influential model input parameters.
Drones is a rapid developing technology that has been used for more than 170 years. In this time they have gone from merely military use to an important tool in the daily life. But one problem inhibits how modern drones can be used. They can only be in the air for a limited amount of time before the batteries are drained. This is an issue as batteries are important parts of all electronics sold today, but the current technology cannot follow the development that is seen in other fields. Lithium ion and polymer batteries are at their peak and the marked need battery solutions with a higher energy density. However they are far out in the future. The endurance problem is more profound for multi-rotor and fixed-wing hybrid drones as higher number of DC engines use more energy. Therefore this report tries to find a solution that can solve the endurance issue indirectly for these drone types, but with the possibility to use it for all designs.

In the process other technologies are analyzed as fuel cells, Internal Combustion (IC) engines, solar panels and turbines. After discussing the technologies they are evaluated individually with their pros and cons with respect to the operational environment that drones introduce. The system need to be able to operate at high altitudes, at low and high temperatures, in all weather, it may not introduce vibrations nor produce too much noise. Solar panels are a clean energy source that have a high lifetime and do not have any direct emissions. This sound perfect, but their disadvantages provide a hurdle that is not possible to overlook. They demand a high surface area and have a weather dependency that makes it difficult to stay in air during cloudy days. It may be possible to use them as a supplement on smaller hybrid fixed-wing drones, but not as a main power system. It is decided that solar panels would not be a sufficient solution.

Next was the jet turbine system. They pack a lot of power into a small amount of space and keep a high energy density from the liquid fuel. These two advantages are what is wanted from the solution, but with them come issues as complexity, price, noise and a high maintenance level. The P20-SX from JetCat is a small jet turbine which illustrate the problem. It costs 2,500 US dollars, has to go through maintenance every 25 hours, have an exhaust gas/thrust of 580-690 degrees Celsius and it is not possible to reduce the noise with a muffler. All this would introduce too many problems under operation, therefore were turbines left out as a solution.

Further there are fuel cells. They have a disadvantage of a low power to weight ratio and mostly use high pressurized cylinders filled with hydrogen. The cylinder can be seen as a small bomb flying around and can be dangerous to use in public areas, but some solutions are under development that contain solid capsules of hydrogen which is released when needed. Along with this fuel cells have already shown fine results for fixed-wing drones with several hours of flight time. Therefore with respect to development in technology and current proofs of usage fuel cells are seen as a possible solution.

This leaves the IC engines as the last system to be evaluated. This technology is still one of the best sources of energy today, thus there are some issues that need to be addressed before it can be used as a solution here. Piston driven engines introduce vibrations, but it is possible to reduce them with a proper design and engine control. If the IC engine is used as a generator with near constant RPM it is possible to design the crankshaft to counteract the unbalance made by the piston movement. By doing so the vibrations could be diminished. Noise would neither be a problem as a muffler could be designed to match the engine. But a problem that is introduced with constant RPM is that the maximum power output is affected. This effect is further enhanced with lower oxygen in higher altitudes. Therefore to address this it may be forced to use a 2-stroke engine to get more power, but this could introduce a problem with emissions. To solve this alternative fuels as ethanol and methanol are used as a substitution to gasoline. Further it is important to remember that an IC engine do not produce electrical energy. It need a converter that charge a small battery. This would create a hybrid IC engine system that could be used. Therefore to conclude it is possible that both fuel cells and a hybrid IC engine system could be used as a feasible solution. These two latter systems are therefore further used and implemented in a simulation study based on a multi-rotor drone to see how they perform compared to a battery powered drone. The hybrid IC engine is based on assumptions and knowledge from the DTU Roadrunners world record car Dynamo. With these assumptions there are tested three different
fuels; gasoline, ethanol and methanol. The fuel cells used in the simulation are 300 bar pressurized direct hydrogen systems based on fuel cells from HES energy systems. Here three sizes are used which produce 200W, 500W and 1000W of power.

From the simulation fuel cells showed fine results in the smaller drones, but lacked power when they reached a larger drone size and had to compete with the hybrid IC engine systems. The fuel cells cannot power multiple DC engines properly which is also seen when there is added payload to the drones. The fuel cells cannot get the drone off the ground within the assumed parameters or are only able to fly for the same amount of time as a battery powered drone. Therefore were all fuel cells discarded and not used further on. Better results were seen from the hybrid IC engines. They all outperformed the battery with a low amount of fuel and were therefore used further in the analyzation.

After the simulation model had been updated with other assumptions, it was clear that the hybrid IC engines are a solution to the problem addressed by the report. By using a fairly low amount of liquid fuels there were achieved a large increase in air time. Even though the gasoline show the largest gain, it is advised to use the CO2-neutral alternatives ethanol and methanol as they have some advantages as fuels including lower emissions. These advantages are not fully seen in the simulation and the difference in air time will in reality be less.

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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 parametervarying (LPV) controller and ∞ 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.

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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)
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Enhancing the antibacterial performance of orthopaedic implant materials by fibre laser surface engineering

Implant failure caused by bacterial infection is extremely difficult to treat and usually requires the removal of the infected components. Despite the severe consequence of bacterial infection, research into bacterial infection of orthopaedic implants is still at an early stage compared to the effort on enhancing osseointegration, wear and corrosion resistance of implant materials. In this study, the effects of laser surface treatment on enhancing the antibacterial properties of commercially pure (CP) Ti (Grade 2), Ti6Al4V (Grade 5) and CoCrMo alloy implant materials were studied and compared for the first time. Laser surface treatment was performed by a continuous wave (CW) fibre laser with a near-infrared wavelength of 1064 nm in a nitrogen-containing environment. Staphylococcus aureus, commonly implicated in infection associated with orthopaedic implants, was used to investigate the antibacterial properties of the laser-treated surfaces. The surface roughness and topography of the laser-treated materials were analysed by a 2D roughness testing and by AFM. The surface morphologies before and after 24 h of bacterial cell culture were captured by SEM, and bacterial viability was determined using live/dead staining. Surface chemistry was analysed by XPS and surface wettability was measured using the sessile drop method. The findings of this study indicated that the laser-treated CP Ti and Ti6Al4V surfaces exhibited a noticeable reduction in bacterial adhesion and possessed a bactericidal effect. Such properties were attributable to the combined effects of reduced hydrophobicity, thicker and stable oxide films and presence of laser-induced nano-features. No similar antibacterial effect was observed in the laser-treated CoCrMo.

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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Queen’s University Belfast, University of Chester
Authors: Chan, C. (Ekstern), Carson, L. (Ekstern), Smith, G. C. (Ekstern), Morelli, A. (Ekstern), Lee, S. (Intern)
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Equilibrium-Based Nonhomogeneous Anisotropic Beam Element
The stiffness matrix and the nodal forces associated with distributed loads are obtained for a nonhomogeneous anisotropic elastic beam element by the use of complementary energy. The element flexibility matrix is obtained by integrating the complementary-energy density corresponding to six beam equilibrium states, and then inverted and expanded to provide the element-stiffness matrix. Distributed element loads are represented via corresponding internal-force distributions in local equilibrium with the loads. The element formulation does not depend on assumed shape functions and can, in principle, include any variation of cross-sectional properties and load variation, provided that these are integrated with sufficient accuracy in the process. The ability to represent variable cross-sectional properties, coupling from anisotropic materials, and distributed element loads is illustrated by numerical examples.
This study presents the optimization of micro milling process for manufacturing injection moulding inserts with an optical functional surface. The objective is the optimal surface functionality. Micro ridges were used as the microstructures to realize the function to generate contrast between orthogonally textured areas by reflecting light in different directions. In order to maximize the contrast, a sample was machined with the same structures and dimensions, according to a Design
of Experiments (DOEs) to optimize the milling parameters by considering the contrast as a response. The contrast was evaluated based on the image processing method. The proper cutting condition was selected in order to obtain machined surface with the highest contrast and the results presented by DOE analysis. The correlations between the cutting parameters, the burrs height, and the function were determined. The contrast was found to be proportional to the spindle speed and feed rate and "oil+air" was considered as the preferred cooling method.

**General information**

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Li, D. (Intern), Davoudinejad, A. (Intern), Zhang, Y. (Intern), Regi, F. (Intern), Tosello, G. (Intern), Nielsen, J. B. (Intern), Aanaes, H. (Intern), Frisvad, J. R. (Intern)
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**Evaluation of polymer micro parts produced by additive manufacturing processes using vat photopolymerization method**

Micro manufacturing scale feature production by Additive Manufacturing (AM) processes for the direct production of miniaturized polymer components is analysed in this work. The study characterizes the AM processes for polymer micro parts productions using the vat photopolymerization method. A specifically designed vat photopolymerization AM machine suitable for precision printing has been developed, built and validated. In order to evaluate the AM machine capability a test part is designed having features with different sizes and aspect ratios. The printing parameters selected for the evaluation are considered as exposure time, light intensity and layer thickness. In order to have an initial optimal range of parameters values, a sensitivity analysis carried out prior to the final experimental plan. The print quality was assessed in terms of separation between the rows and columns of printed cubes, the number of printed features with square cross section and the surface roughness. The results declare the importance of different factors in micro AM processes.

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**Evaluation of surface roughness and geometrical characteristic of additive manufacturing inserts for precision injection moulding**

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**Exact Constraint Design and its potential for Robust Embodiment**

The design of exact, also referred to as minimal, constraints means applying just enough constraints between the various components of a mechanical assembly, in order to unambiguously define their positions in six degrees of freedom (3 translations, 3 rotations), their desired motions respectively. To ensure a predictable and reliable product performance, a systematic design of the corresponding elementary mechanical interfaces between components is of utmost importance. Over constraints, i.e., part-to-part connections with redundant interfaces which constrain one single degree of freedom, are largely susceptible to variation and therefore result in design solutions which frequently experience production/assembly issues, reduced performance, excessive and non-predictable wear-rates, etc.

Being a basic rule of embodiment design, literature provides various well-known and widely applied approaches for Exact Constraint Design. Examples are the calculation of a mechanism’s mobility using the Grübler-Kutzbach criterion, the analysis of statically determinate assemblies by means of the screw theory or so called Schlussartenmatrizen, as well as the analysis of engaging surfaces in terms of location schemes or interface ambiguity. However, despite the various existing approaches, workshops with practitioners and academics have shown that the systematic design of optimal constraints appears to be cumbersome for many engineers. Based on an overview of the most relevant approaches for Exact Constraint design, this contribution therefore reviews the challenges experienced by the workshop participants, discusses the necessity of kinematically correct constraints for robustness, and derives an initial prescriptive procedure for a coherent design of constraints throughout the embodiment design phase, which, despite a variety of available approaches, seems to be still missing.

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**Exercise in Configurable Products using Creo parametric**

Family tables is a long known method with ProEngineer/Creo parametric to make families of products – like families of bolts and roller bearings. Configurable Products expand these possibilities in two major ways: First it makes configurable assemblies possible where one topologically different component can replace another. Secondly it presents the configurable product in an interactive way which enable the user to experiment with product configurations and different variants in an easy way. In this exercise we will replace a circular axel with a hexagonal axel. (some of this functionality has been available as: configurable assemblies in earlier versions of Creo) An example of a practical application of configurable products is shown below where an outdoor Play/Exercise system is transferred from AutoCAD 2D to a 3D configurable product in Creo 3.0.

**General information**

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Exergy and economic analysis of organic rankine cycle hybrid system utilizing biogas and solar energy in rural area of China

Due to the existing huge biogas resource in the rural area of China, biogas is widely used for production and living. Cogeneration system provides an opportunity to realize the balanced utilization of the renewable energy such as biogas and solar energy. This paper presented a numerical investigation of a hybrid energy-driven organic Rankine cycle (ORC) cogeneration system, involving a solar organic Rankine cycle and a biogas boiler. The biogas boiler with a module of solar Parabolic-Trough Collectors (PTC) is employed to provide heat source to the ORC via two distinct intermediate pressurized circuits. The cogeneration supplied the power to the air-condition in summer condition and hot water, which is heated in the condenser, in winter condition. The system performance under the subcritical pressures has been assessed according to the energy-exergy and economic analysis with the organic working fluid R123. The effects of various parameters such as the evaporation and condensation temperatures on system performance were investigated. The net power generation efficiency of the cogeneration system is 11.17%, which is 25.8% higher than that of the base system at an evaporation temperature 110°C. The exergy efficiency of organic Rankine cycle (ORC) system increases from 35.2% to 38.2%. Moreover, an economic analysis of the system is carried out. The results demonstrate that the profits generated from the reduction of biogas fuel and electricity consumption can lead to a significant saving, resulting in an approximate annual saving from $1,700 to $3,000. Finally, a case study based on the consideration of typical rural residence was performed, which needs a payback period of 7.8 years under the best case.
Electricity and power produced from waste heat is particularly relevant in shipping because fuel expenses constitute the majority of the cost of operating the ships; however, the cost-benefit aspect limits the widespread implementation of waste heat recovery power units on ships. This paper presents the thermodynamic analysis of a concept that aims at reducing the cost of an organic Rankine cycle unit by using one of the cylinders in a large diesel engine as expansion device. Numerical models were used to optimise the process parameters and thereby determine the power potential for this concept. The evaluation of 104 working fluids points to cyclopropane, R245fa and R1234ze(z) as the most promising. The results suggest that the power produced by the organic Rankine cycle cylinder is at least equivalent to that of the cylinders operating with the diesel process. This enables potential fuel savings and emissions reductions of about 8.3% in the studied scenario.
Experimental analysis of solar thermal integrated MD system for cogeneration of drinking water and hot water for single family villa in Dubai using flat plate and evacuated tube solar collectors

This paper presents the experimental analysis performed on solar thermal integrated membrane distillation (MD) system using flat plate and evacuated tube collectors. The system will be utilized for cogeneration of drinking water and domestic hot water for single family in Dubai comprising of four to five members. Experiments have been performed in Ras Al Khaimah Research and Innovation Centre (RAKRIC) facility. The experimental setup has been installed to achieve the required production of 15–25 L/d of drinking water and 250 L/d of hot water for domestic purposes. Experiments have been performed on MD setup at optimized flow rates of 6 L/min on hot side and 3 L/min on cold side for producing the desired distillate. The hot side and cold side MD temperature has been maintained between 60°C and 70°C, and 20°C and 30°C. The total annual energy demand comes out to be 8,223 kWh (6,000 kWh is for pure water and 2,223 kWh for hot water). The optimum aperture areas for flat plate and evacuated tube collector field have been identified as 8.5 and 7.5 m², respectively. Annual energy consumption per liter for pure water production is 1, 0.85 and 0.7 kWh/L for different MD.
Experimental approach for the uncertainty assessment of 3D complex geometry dimensional measurements using computed tomography at the mm and sub-mm scales

The dimensional verification of miniaturized components with 3D complex geometries is particularly challenging. Computed Tomography (CT) can represent a suitable alternative solution to micro metrology tools based on optical and tactile techniques. However, the establishment of CT systems’ traceability when measuring 3D complex geometries is still an open issue. In this work, an alternative method for the measurement uncertainty assessment of 3D complex geometries by using CT is presented. The method is based on the micro-CT system Maximum Permissible Error (MPE) estimation, determined experimentally by using several calibrated reference artefacts. The main advantage of the presented method is that a previous calibration of the component by a more accurate Coordinate Measuring System (CMS) is not needed. In fact, such CMS would still hold all the typical limitations of optical and tactile techniques, particularly when measuring miniaturized components with complex 3D geometries and their inability to measure inner parts. To validate the presented method, the most accepted standard currently available for CT sensors, the Verein Deutscher Ingenieure/Verband Deutscher Elektrotechniker (VDI/VDE) guideline 2630-2.1 is applied. Considering the high number of influence factors in CT and their impact on the measuring result, two different techniques for surface extraction are also considered to obtain a realistic determination of the influence of data processing on uncertainty. The uncertainty assessment of a workpiece used for micro mechanical material testing is firstly used to confirm the method, due to its feasible calibration by an optical CMS. Secondly, the measurement of a miniaturized dental file with 3D complex geometry is carried out. The estimated uncertainties are eventually compared with the component’s calibration and the micro manufacturing tolerances to demonstrate the suitability of the presented CT calibration procedure. The 2U/T ratios resulting from the validation workpiece are, respectively, 0.27 (VDI) and 0.35 (MPE), by assuring tolerances in the range of ± 20–30 µm. For the dental file, the EN <1 value analysis is favorable in the majority of the cases (70.4%) and 2U/T is equal to 0.31 for sub-mm measurands (L <1 mm and tolerance intervals of ± 40–80 µm).
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.

General information
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Authors: Fernandez Grande, E. (Intern), Christiansen, R. E. (Intern)
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BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.788 SNIP 1.423 CiteScore 1.8
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.705 SNIP 1.966 CiteScore 2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.763 SNIP 1.622 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Experimental investigation of interfacial crack arrest in sandwich beams subjected to fatigue loading using a novel crack arresting device

A recently proposed face-sheet–core interface crack arresting device is implemented in sandwich beams and tested using the Sandwich Tear Test configuration. Fatigue loading conditions are applied to propagate the crack and determine the effect of the crack stopper on the fatigue growth rate and arrest of the crack. Digital image correlation is used through the duration of the fatigue experiment to track the strain evolution as the crack tip advances. The measured strains are related to crack tip propagation, arrest, and re-initiation of the crack. A finite element model is used to calculate the energy release rate, mode mixity and to simulate crack propagation and arrest of the crack. Finally, the effectiveness of the crack arresting device is demonstrated on composite sandwich beams subjected to fatigue loading conditions.

General information
State: Published
Organisations: Centre for oil and gas – DTU, Department of Mechanical Engineering, Solid Mechanics, Aalborg University
Authors: Martakos, G. (Ekstern), Andreasen, J. (Ekstern), Berggreen, C. (Intern), Thomsen, O. (Ekstern)
Number of pages: 21
Pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Sandwich Structures and Materials
Experimental Investigation of Sulfuric Acid Condensation and Corrosion Rate in Motored Bukh DV24 Diesel Engine

The work conducted in this paper presents a novel experimental setup to study sulfuric acid cold corrosion of cylinder liners in large two-stroke marine diesel engines. The process is simulated in a motored light duty BUKH DV24 diesel engine where the charge air contain known amounts of $\text{H}_2\text{SO}_4$ and $\text{H}_2\text{O}$ vapor. Liner corrosion is measured as iron accumulation in the lubeoil. Similarly sulfuric acid condensation is assessed by measuring the accumulation of sulfur in the
lube oil. To clarify the corrosive effect of sulfuric acid the lube oil utilized for experiments is a sulfur free neutral oil without alkaline additives (Chevron Neutral Oil 600R). Iron and sulfur accumulation in the lube oil is analyzed with an Energy Dispersive X-Ray Fluorescence (ED-XRF) apparatus. Three test cases with different H₂SO₄ concentrations are run. Results reveal good agreement between sulfuric acid injection flow and the accumulation of both iron and sulfur in the oil.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Technical University of Denmark
Authors: Kjemtrup, L. (Intern), Cordtz, R. F. (Intern), Meyer, M. (Ekstern), Schramm, J. (Intern)
Number of pages: 8
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of the ASME 2017 Internal Combustion Engine Division Fall Technical Conference
Publisher: American Society of Mechanical Engineers
Article number: ICEF2017-3652
ISBN (Electronic): 978-0-7918-5831-8
Main Research Area: Technical/natural sciences
Conference: Internal Combustion Engine Fall Technical Conference (ICEF 2017), Seattle, United States, 15/10/2017 - 15/10/2017
DOIs: 10.1115/ICEF2017-3652
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Experimental Investigation of the Performance of Tilt Current Meters in Wave-Dominated Flows**

In recent years, tilt current meters (TCMs) have received renewed attention as they provide an inexpensive method for measuring currents in the coastal zone. However, previous studies focused mainly on current dominated flows or the current component of the flow. This study investigates the performance of tilt current meters in wave-dominated flows and capturing the wave orbital velocities. A series of laboratory experiments were performed in which tilt current meters were used to measure flow velocities in pure current, pure wave and combined wave-current flows. Both spherical and cylindrical TCMs were investigated in order to assess the effect of TCM shape on its performance. The measured TCM tilt is compared with the flow velocity measured by conventional methods. Furthermore, the ability of a TCM to measure wave orbital and wave-averaged velocities is discussed.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Hansen, A. B. (Intern), Carstensen, S. (Intern)
Pages: 5473-5481
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of the 37th IAHR World Congress
Publisher: International Association for Hydro-Environment Engineering and Research (IAHR)
Main Research Area: Technical/natural sciences
Conference: 37th IAHR World Congress, Kuala Lumpur, Malaysia, 13/08/2017 - 13/08/2017
Tilt current meter, Observational techniques, Surf zone, Coastal hydrodynamics
Electronic versions: post_print_07_34_0255_.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Experimental patch testing with chromium-coated materials**

Chromium coatings on metal alloys can be decorative, and prevent corrosion and metal ion release. We recently showed that handling of a chromium-containing disc resulted in chromium deposition on the skin. To examine patch test reactivity to chromium-coated discs. We included 15 patients: 10 chromium-allergic patients, and 5 patients without chromium allergy. All were patch tested with potassium dichromate, cobalt chloride, nickel sulfate, and nine different metallic discs. The chromium-allergic patients were also patch tested with serial dilutions of potassium dichromate. Positive/weaker reactions were observed to disc B (1 of 10), disc C (1 of 10), and disc D, disc E, and disc I (4 of 10 each). As no controls reacted to any of the discs, the weak reactions indicate allergic reactions. Positive patch test reactions to 1770 ppm chromium(VI) in the serial dilutions of potassium dichromate were observed in 7 of 10 patients. When the case group was narrowed down to include only the patients with a current positive patch test reaction to potassium dichromate, elicitation of dermatitis by both chromium(III) and chromium(VI) discs was observed in 4 of 7 of patients. Many of the patients reacted to both chromium(III) and chromium(VI) surfaces. Our results indicate that both chromium(VI) and chromium(III) pose a risk to chromium-allergic patients.
Experimental validation of vibro-impact force models using numeric simulation and perturbation methods

The frequency response of a single-degree of freedom vibro-impact oscillator is analysed using Harmonic Linearization, Averaging and Numeric Simulations considering two different impact force models, one given by a piecewise-linear function and other by a high-order polynomial. Experimental validation is carried out using control-based continuation to obtain the experimental frequency response, including its unstable branch.

Exploring Teachers’ Thinking about Teaching and Learning

Professional practice in general is to a large extent based on tacit knowledge (Schön 1983). For university teachers, tacit knowledge includes knowledge about what works – and what does not work – when teaching a specific group of students a specific subject matter in a specific context.

Making tacit knowledge explicit is important for at least two reasons: For the individual it may facilitate a more conscious linking of loose impressions and observations from own teaching practice to general principles of teaching and learning, thus enabling a more systematic interpretation and development of own teaching (Mcalpine and Weston 2002). It is also useful – if not necessary - for communication with others about teaching and learning, e.g. when peer coaching less experienced colleagues, or sharing experience and collaborating on teaching development with colleagues. Teaching Portfolios are a well-known means for the individual teacher to develop a reflective approach to own teaching practice and the underlying values and presumptions, including a process of making tacit knowledge explicit (Smith and Tillema 2006). However, we see a need for methods for sharing, discussing and developing teaching philosophies in a collective process. The perspectives of introducing such methods are to support a team-oriented approach to teaching and to strengthen communities of practice (Wenger 2008) / communities of learning among teachers.

So how can we do this? The authors have conceived and designed a game to identify and clarify teachers’ values, attitudes and preferences related to their teaching. The core element of the game is a deck of cards each with a statement about teaching and/or learning, e.g. “Students must learn to dare to fail and learn from their mistakes”, “What I teach is what students learn”, and “Blackboards are an overlooked method of teaching”. While the statements do not give the "solution" to what good teaching practice is, their purpose is to start a personal reflection. During the game, the players go through an individual reflection process leading to the selection of a number of cards with statements each player find relevant and important in relation to the question “What is good teaching?” These are then ranked and discussed in a group of players who are asked see if some consensus can be reached and explore if they can identify common approaches to teaching and learning. This consensus may different from the individual player’s choices.

We have facilitated game sessions at several occasions, among others: at an international engineering education conference, at an annual education day at a university abroad, and at a meeting for study leaders of Bachelor of Engineering programmes. We have collected documentation of the selection and ranking of cards in these sessions, and
analysed the data. These data represent the involved teachers’ individual preferences, and consensus reached within
groups of players - preferences which may influence their teaching practice, consciously or unconsciously.

The data analysis has raised questions like:
• What patterns can be identified based on the cards that were selected, and the cards that were not?
• What kinds of attitudes towards teaching and learning do the selected cards represent?
• Which selections reflect teaching practices that support active learning?
• What types of statements have participants filled in on blank cards?

The active poster will present data collected and conclusions of the analysis. This will supplement the workshop at the
ETALEE 2017 conference (Jensen, Christiansen and Hansen 2017) – that gives conference participants a chance to get a
first-hand experience with the game – with giving an opportunity to discuss the outcome of having played the game and
help us with input to the further development.

General information
State: Published
Organisations: National Food Institute, Research Group for Microbial Food Safety, Office for Study Programmes and
Student Affairs, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Jensen, L. B. (Intern), Christiansen, B. L. (Intern), Hansen, C. T. (Intern)
Number of pages: 2
Publication date: 2017
Event: Abstract from ETALEE 2017, Odense, Denmark.
Main Research Area: Technical/natural sciences
Teaching philosophy, Teaching and learning, Communities of practice, Gamification
Electronic versions:
ETALEE2017_paper_37.pdf
Source: PublicationPreSubmission
Source-ID: 132616185
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Exploring the relationship between entrepreneurial behavior and teachers’ job satisfaction
This exploratory study has two goals: exploring the relationship between entrepreneurial behavior and job satisfaction
among teachers, and identifying the demographic characteristics associated with both variables. Using a snowball
technique, a sample of 385 K-12 Brazilian teachers from public and private schools responded to the survey. Statistical
analysis revealed a moderate correlation between entrepreneurial behavior and job satisfaction. Results also show that
gender and educational level are associated with entrepreneurial behavior. The discussion includes theoretical and
practical implications.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Davenport
University
Authors: do Carmo Amorim Neto, R. (Ekstern), Rodrigues, V. P. (Intern), Panzer, S. (Ekstern)
Pages: 254–262
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Teaching and Teacher Education
Volume: 63
ISSN (Print): 0742-051X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.12 SJR 1.59 SNIP 2.505
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.945 SNIP 2.558 CiteScore 2.97
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.058 SNIP 2.219 CiteScore 2.48
BFI (2013): BFI-level 2
Fabrication of Large Area Broadband and Omnidirectional Antireflective Transparent Foils by Roll-to-Roll Extrusion Coating

This study investigates the fabrication and performance of broadband and omnidirectional antireflective polymer foils, in the visible spectrum (400–800 nm), consisting of subwavelength inverted moth-eye structures. The foils are fabricated by a high throughput roll-to-roll extrusion coating process allowing structuring on both sides at a rate of 60 m min⁻¹, with web width 45 cm. The highest average transmittance obtained in the visible spectrum is (98 ± 1) %; compared with (92 ± 1) % for the unstructured foil. The antireflective foil shows no significant difference in transmittance between normal incidence and incidence up to at least 60°. The foil performance is also investigated for different depths (Dp) and shapes of structures. The transmittance initially increases with Dp and reaches a maximum at Dp ≈ 120 nm. For process parameters yielding greater depths, other shape factors also play a critical role in the foil's antireflective properties.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Department of Photonics Engineering, Optical Microsensors and Micromaterials, Danish Fundamental Metrology, Heliac ApS
Number of pages: 7
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Macromolecular Materials & Engineering
Article number: 1700027
ISSN (Print): 1438-7492
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.01 SJR 0.894 SNIP 0.971
Factors affecting the thermophysical properties of nanofluids

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Montagud, M. E. M. (Intern), Haglind, F. (Intern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 4th Marie Curie Alumni Association Annual Meeting, Salamanca, Spain.
Main Research Area: Technical/natural sciences

Relations
Activities:
Factors affecting the thermophysical properties of nanofluids
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017
Fe-Modeling Of Starved Hydrodynamic Lubrication With Free Surface Effects
This work concerns a new finite-element formulation for solving hydrodynamic lubrication problems that include partially flooded regions, where the lubricant film behavior is governed by free surface flow.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, MAN Diesel & Turbo SE
Authors: Poulios, K. (Intern), Vølund, A. (Ekstern), Klit, P. (Intern)
Number of pages: 1
Pages: 166
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
Hydrodynamic Lubrication, Thin Film Flow, Free Surface Flow, Finite-Element, Stabilization
Electronic versions: FE_MODELING_OF_STARVED_HYDRODYNAMIC.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Fibre laser nitriding of titanium and its alloy in open atmosphere for orthopaedic implant applications: Investigations on surface quality, microstructure and tribological properties
Laser nitriding is known to be an effective method to improve the surface hardness and wear resistance of titanium and its alloys. However, the process requires a gas chamber and this greatly limits the practicability for treating orthopaedic implants which involve complex-shaped parts or curved surfaces, such as the tapered surface in a femoral stem or the ball-shaped surface in a femoral head. To tackle this problem, a direct laser nitriding process in open atmosphere was performed on commercially pure titanium (grade 2, TiG2) and Ti6Al4V alloy (grade 5, TiG5) using a continuous-wave (CW) fibre laser. The effects of varying process parameters, for instance laser power and nitrogen pressure on the surface quality, namely discoloration were quantified using ImageJ analysis. The optimised process parameters to produce the gold-coloured nitride surfaces were also identified: 40W (laser power), 25mm/s (scanning speed), 1.5mm (standoff distance) and 5 bar (N2 pressure). Particularly, N2 pressure at 5 bar was found to be the threshold above which significant discoloration will occur. The surfacemorphology, composition, microstructure, micro-hardness, and tribological properties, particularly hydrodynamicsize distribution of wear debris, were carefully characterized and compared. The experimental resultsshowed that TiG2 and TiG5 reacted differently with the laser radiation at 1.06 μm wavelength in laser nitriding as evidenced by substantial differences in the microstructure, and surface colour and morphology. Furthermore, both friction and wear properties were strongly affected by the hardness and microstructure of titanium samples and direct laser nitriding led to substantial improvements in their wear resistant properties. Between the two types of titanium samples, bare TiG2 showed higher friction forces and wear rates, but this trend was reversed after laser nitriding treatments.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Queen's University Belfast, University of Chester
Authors: Chan, C. (Ekstern), Lee, S. (Intern), Smith, G. C. (Ekstern), Donaghy, C. (Ekstern)
Pages: 628-640
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Surface and Coatings Technology
Volume: 309
ISSN (Print): 0257-8972
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Filter-Feeding Zoobenthos and Hydrodynamics

This chapter summarizes recent years' studies on zoobenthic filter feeding in the sea. General principles are extracted based on experiments and mathematical modeling, mainly from own studies in shallow temperate Danish waters, in order to present primary characteristics of the sophisticated interplay between benthic filter feeders and hydrodynamics. Starting from the general concept of grazing potential and typical data on benthic population densities its realization is considered, first at the level of the individual organism through the processes of pumping and trapping of food particles for ingestion which relies on hydrodynamics. Studies have shown the importance of biomixing giving increased vertical seston flux due to mixing induced by exhalant jets of filter feeders, particularly in stagnant water but likely also in benthic boundary layers over mussel beds at moderate flow velocities. Mathematical models for such flows are discussed. At the scale of benthic boundary layers, mussels experience flows that are usually turbulent, but at the smaller scale of sublayers, colonies of bryozoans experience viscous-dominated flow that needs modeling. Finally, a case study from a particular shallow water area illustrates the effects of tide, current, and wind on vertical mixing, growth rates, and ecological implications. The main biophysical processes that may allow or prevent dense populations of filter feeders to control the phytoplankton biomass in shallow waters are presented along with remaining challenges for development of improved models for the benthic boundary layers, including effects of wall roughness, biomixing, and oscillating flows caused by waves.


This study investigates the micro end-milling process by using a 3D finite element modeling (3D FEM) approach. The FE model is developed for contouring up-milling operation to predict chip flow, burr formation and cutting forces. Different cutting conditions were simulated in order to investigate the influence of process variables that might be difficult or even impossible to follow in the physical experiments, particularly at this scale. 3D simulations of chip flow and temperature distribution are compared in various cutting conditions. The results of the burr formation and cutting forces predictions are compared against the experiments. The correlations were observed in terms of burr dimension trends and force profile shapes and magnitude.
Flow boiling heat transfer and pressure drop characteristics of R134a, R1234yf and R1234ze in a plate heat exchanger for organic Rankine cycle units

The optimal design of the evaporator is one of the key issues to improve the efficiency and economics of organic Rankine cycle units. The first step in studying the evaporator design is to understand the thermal-hydraulic performance of the working fluid in the evaporator of organic Rankine cycles. This paper is aimed at obtaining flow boiling heat transfer and pressure drop characteristics in a plate heat exchanger under the working conditions prevailing in the evaporator of organic Rankine cycle units. Two hydrofluoroolefins R1234yf and R1234ze, and one hydrofluorocarbon R134a, were selected as the working fluids. The heat transfer coefficients and pressure drops of the three working fluids were measured with varying saturation temperatures, mass fluxes, heat fluxes and outlet vapour qualities, which range from 60°C to 80°C, 86 kg/m²s to 137 kg/m²s, 9.8 kW/m² to 36.8 kW/m² and 0.5 to 1, respectively. The working conditions covered relatively high saturation temperatures (corresponding reduced pressures of 0.35-0.74), which are prevailing in organic Rankine cycles yet absent in the open literature. The experimental data were compared with existing correlations, and new correlations were developed that are more suitable for evaporation in organic Rankine cycles. The experimental results indicate that heat transfer coefficients are strongly dependent upon the heat flux and saturation temperature. Moreover, the results suggest better thermal-hydraulic performance for R1234yf than the other two working fluids at the same saturation temperatures. With the new heat transfer and pressure drop correlations, agreements within ±25% were obtained for experimental data in similar experiments with high saturation temperatures.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Institute for Product Development, University of Liege
Authors: Zhang, J. (Intern), Desideri, A. (Ekstern), Kærn, M. R. (Intern), Ommen, T. S. (Intern), Wronski, J. (Intern), Haglind, F. (Intern)
Pages: 1787-1801
Publication date: 2017
Main Research Area: Technical/natural sciences

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Volume: 108
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.75 SJR 1.623 SNIP 2.005
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.797 SNIP 1.941 CiteScore 3.09
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.624 SNIP 2.008 CiteScore 2.97
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.868 SNIP 2.164 CiteScore 3.38
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.688 SNIP 2.17 CiteScore 2.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.085 SNIP 1.978 CiteScore 3.04
FlowCyl: one-parameter characterisation of matrix rheology

The FlowCyl is a simple flow viscometer—a modification of the Marsh Cone test apparatus developed to characterize cement pastes and grouts. The FlowCyl gives a one parameter characterisation of rheology called the flow resistance ratio or $\lambda Q$ for use in the Particle-Matrix concrete proportioning Model (PMM) as a description of the viscous phase of the concrete, while another parameter related to packing density is used to describe the particle phase. There have been numerous studies which have shown how the matrix $\lambda Q$ values affect the rheological parameters of concretes with a given particle system. Recent studies have shown that the FlowCyl test, which has previously proven acceptable for the one-parameter characterisation of matrix phase rheology, is probably not suitable for matrices with high powder content and a superplasticiser dosage below the surface adsorption saturation. This paper reviews current studies that compare the measurements of the FlowCyl with the results obtained using a rheometer and presents initial results from a series of simulations of the FlowCyl test conducted to analyse the effect of yield shear stress (according to the Bingham model) on the measured flow resistance ratio $\lambda Q$.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Norwegian University of Science and Technology
Authors: Cepuritis, R. (Ekstern), Ramenskiy, E. (Ekstern), Mørtsell, E. (Ekstern), Smepllass, S. (Ekstern), Kjos-Hanssen, H. S. (Ekstern), Li, S. (Intern), Jacobsen, S. (Ekstern), Spangenberg, J. (Intern)
Number of pages: 10
Publication date: 2017
Event: Paper presented at Second Concrete Innovation Conference (2nd CIC) , Tromsø, Norway.
Main Research Area: Technical/natural sciences
Rheology, Matrix, FlowCyl, Yield stress, Plastic viscosity
Electronic versions:
11_10_17_CIC_2017_FlowCyl_CIC_in_Troms_.pdf
Source: PublicationPreSubmission
Source-ID: 140799910
Publication: Research - peer-review › Paper – Annual report year: 2017
Flow in axisymmetric expansion in a catalytic converter
The flow in an axisymmetric expansion (circular diffusor) is used in many different engineering applications, such as heat exchangers, catalytic converters and filters. These applications require a relatively uniform flow at the inlet. To minimise the pressure loss, an ideal solution would be to use a quite long expansion, but this is often not possible due to space restrictions. Therefore a short expansion combined with e.g. guide vanes is often used. The present study will use a Selective Catalytic Reduction (SCR) system for large marine diesel engines as a case. The catalyst is designed for a specific local flow rate and a non-uniform inflow to the catalyst will severely reduce the efficiency of the process. Since each ship will have a unique design the flow system, it is desirable to be able to design the system using Computational Fluid Dynamics (CFD). However, CFD fails to predict flow separation in many cases and cannot be used as the only design tool [1]. Typically CFD has to be validated against experimental data from representative designs under varying conditions to find trustworthy turbulence modelling, sufficient grid resolution and suitable boundary conditions. Here Particle Image Velocimetry (PIV) is a unique method that resolve the entire cross flow. This type of flow is expected to have a fluctuating ‘jet’-like structure from the smaller inlet pipe into the larger converter. The fluctuations of the jet are difficult, if not impossible, to capture with standard time averaged models, and more expensive methods like Large Eddy Simulation (LES) could be needed. Here PIV has an advantage compared with other measurement methods, because it captures instantaneous flow fields that are relevant for the catalyst efficiency and thus also for CFD validation.

The aim of the present study is to investigate flow phenomena in sudden pipe expansions similar to design used for catalytic converters with different upstream conditions and flow conditioning devices like guide vanes. This is done to provide a set of data that can be used to validate the use of CFD to such flows.

For the present study, a down-scaled model of the catalytic converter is constructed, see figure 1. The experiments are performed at laboratory conditions, with lower pressure, temperature and velocity than the full-scale catalytic converter. The Reynolds number based on the velocity in the inlet pipe and the diameter of the converter is Re = 200000. A preliminary study shows that this Reynolds number is high enough to ensure very small dependence of the Reynolds number. The inlet pipe has a diameter of D = 0.1 m. The catalytic container has a diameter of 2.8D and a length of 8D. The diffusor connecting the pipe and the converter container is expanding abruptly within a length of 0.5D. The wall section has a length of 20D to give almost fully developed flow conditions before the expansion. Several inlet conditions will be investigated, including a straight pipe, one 90° bend and two out-of-plane bends. A catalyst dummy will also be mounted and tested. For the catalyst dummy different model factors will be tested to insure the corrected pressure resistance. The distanced from the expansion to the dummy will also be varied and tested. Then different guide vane configurations will be mounted to investigate the flow uniformity at the catalyst converter. The investigation is done with Stereoscopic Particle Image Velocimetry (PIV). The measuring plane, a cross plane through the converter pipe, will be transverse along the flow direction (z-axis at figure 1). The cross plane is created with a 200 mJ Nd:YAG double cavity laser. Two 16 MPixel cameras are placed in forward and backward scatter, respectively. Glycerine droplets with a diameter of about 2 μm, are used as tracer particles.

Example results are shown in Figure 2, where the cross plane is placed 5D downstream of the expansion. Here the mean velocity field of 500 snapshots from the empty converter with a straight inlet shows that the flow consist of a fast ‘jet’ in the middle and negative velocity at the walls. A snapshot been selected to represent a very common flow structure corresponding to the first mode found from a snapshot proper orthogonal decomposition (POD) analysis [2]. The white line indicate the change from positive to negative velocity. In the snapshot, the ‘jet’ has spread along a line through the center and is in contact with two opposite walls. At the rest of the walls, a recirculation zone is seen. As seen in Figure 2, the wall region is well resolved except at the bottom where velocity vectors are missing due to optical reflections.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Gotfredsen, E. (Intern), Meyer, K. E. (Intern)
Number of pages: 2
Publication date: 2017
Event: Abstract from 12th International Symposium on Particle Image Velocimetry (ISPIV 2017), Busan, Korea, Republic of
Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_ISPIV2017_Gotfredsen_Meyer.pdf
Source: PublicationPreSubmission
Source-ID: 136766478
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Flow visualization and simulation of the filling process during injection molding
To directly compare experimental moldings from an injection molding machine with simulations, a special mold has been produced with a glass window. The injection plane is perpendicular to the opening and closing planes, in order for the 55. mm thick glass window to be easily visible from the side. A high speed camera recording 500 frames per second was employed, and the mold had three thermocouples and two pressure sensors installed. The molded part is a 2. mm thick plate with a 0.5. mm thin section, which creates a characteristic V-shaped flow pattern. Two different materials were employed, namely ABS and a high viscosity PC. Simulations were performed using the actual machine data as input, including the injection screw acceleration. Furthermore, the nozzle and barrel geometries were included as a hot runner to capture the effect of compressibility of the material in front of the screw. These two had significant effects on the filling
times and injection pressure calculated by the simulations. Other effects investigated included transient thermal management of the mold, pressure dependent viscosity and wall slip, but their effect were not remarkably large in this work. The obtained simulation results showed deviations within 10-30 ms (relative deviation in the order of 5-10%) for the ABS and slightly more for the high viscosity PC in the range of 100-500 ms (relative deviation in the order of 20-30%) on timings between different sections during filling.

Formation and stabilization of reversed austenite in supermartensitic stainless steel
The formation and stabilization of reversed austenite upon inter-critical annealing was investigated in a X4CrNiMo16-5-1 (EN 1.4418) supermartensitic stainless steel by means of scanning electron microscopy, electron backscatter-diffraction, transmission electron microscopy, energy-dispersive X-ray spectroscopy and dilatometry. The results were supported by thermodynamics and kinetics models, and hardness measurements. Isothermal annealing for 2 h in the temperature range of 475 to 650 °C led to gradual softening of the material which was related to tempering of martensite and the steady increase of the reversed austenite phase fraction. Annealing at higher temperatures led to a gradual increase in hardness which was caused by formation of fresh martensite from reversed austenite. It was demonstrated that stabilization of reversed austenite is primarily based on chemical stabilization by partitioning, consistent with modeling results.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Guerrier, P. (Intern), Tosello, G. (Intern), Hattel, J. H. (Intern)
Pages: 12–20
Publication date: 2017
Main Research Area: Technical/natural sciences

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Guerrier, P. (Intern), Tosello, G. (Intern), Hattel, J. H. (Intern)
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Fracture Characterization of PVC Foam Core Sandwich Specimen Using the DCB-UBM Test Method

Face/core debond failure in sandwich composites is a critical failure mode. Lack of cohesion between face and core will lead to loss of structural integrity. The estimation of interface fracture toughness especially at the face/core interface is extremely challenging, provided the dissimilarity of material properties across the interface. The crack path and fracture also depend on the loading configuration at the crack tip. Depending on the type of loading applied, a measure of shear deformation at the crack tip is expressed by the mode-mixity phase angle (ψ). A suitable fracture mechanics approach coupled with experimental validation is paramount to determine the fracture resistance of the face/core interface. In this paper, the test-rig exploiting the double cantilever beam with uneven bending moments (DCB-UBM) concept is used to determine the fracture toughness of PVC foam core sandwich composites. The DCB-UBM test enables fracture testing over a large range of mode-mixities as expressed by a phase angle (ψ) which is a measure of the amount of shear loading at the crack tip. A desired phase angle may be achieved by changing the moment-ratio (MR = M_d/M_s).

Fracture Surface Morphology Under Ductile Tearing of Metal Plates

The present work takes as offset the hypothesis that microstructural parameters, related to particle size and distribution, govern the transition between crack surface morphologies observed in experiments. The key question is; why does tearing of a given metal plate leave a specific morphology on the fracture surface?

Gaming with Teaching Philosophies

Professional practice in general is to a large extent based on tacit knowledge (Schön 1983). For university teachers, tacit knowledge includes knowledge about what works – and what does not work – when teaching a specific group of students a specific subject matter in a specific context.
Making tacit knowledge explicit is important for at least two reasons: For the individual it may facilitate a more conscious linking of loose impressions and observations from own teaching practice to general principles of teaching and learning, thus enabling a more systematic interpretation and development of own teaching (Mcalpine and Weston 2002). It is also useful – if not necessary - for communication with others about teaching and learning, e.g. when peer coaching less experienced colleagues, or sharing experience and collaborating on teaching development with colleagues. Teaching Portfolios are a well-known means for the individual teacher to develop a reflective approach to own teaching practice and the underlying values and presumptions, including a process of making tacit knowledge explicit (Smith and Tillema 2006). However, we see a need for methods for sharing, discussing and developing teaching philosophies in a collective process. The perspectives of introducing such methods are to support a team-oriented approach to teaching and to strengthen communities of practice (Wenger 2008)/ communities of learning among teachers.

So how can we do this? The authors have conceived and designed a game to identify and clarify teachers’ values, attitudes and preferences related to their teaching. The core element of the game is a deck of cards each with a statement about teaching and/or learning, e.g. “Students must learn to dare to fail and learn from their mistakes”, “I teach what students learn”, and “Blackboards are an overlooked method of teaching”. While the statements do not give the “solution” to what good teaching practice is, their purpose is to start a personal reflection. During the game, the players go through an individual reflection process leading to the selection of a number of cards with statements each player find relevant and important in relation to the question “What is good teaching?” These are then ranked and discussed in a group of players who are asked to see if some consensus can be reached and explore if they can identify common approaches to teaching and learning. This consensus may differ from the individual player’s choices.

We have tested the game in different scenarios: as part of a training course for experienced teachers, in a study group for faculty members on university pedagogy, among teachers and students at a specific education programme, among directors of Bachelor of Engineering programmes, and at an international conference. Based on our experiences, we have identified a number of possible scenarios where the game can be used:

• Participants in a teachers’ training course. Purpose: to clarify and articulate own teaching philosophy.
• A team of teachers teaching the same course. Purpose: to reach consensus on ground principles.
• Teachers and students in a course or education program. Purpose: to clarify mutual expectations and roles.
• Across an educational institution: Purpose: to create and support an increased awareness and discussion of approaches to good teaching practice.

In cases where the game is played among colleagues who collaborate e.g. on teaching a course or coordinating an education programme, the process may also contribute to developing and strengthening the community of practice they are engaged in.

In the hands-on session, which is a revised version of a previous workshop, we will introduce the ideas and intentions of the game and guide the participants in playing the game. Ample time will be given for individual reflection and collective discussion of identified values and approaches to teaching and the general outcome of playing the game. At the end of the session, we will invite to a discussion of possible applications and use scenarios, and to suggestions of improvement of the game.

**General information**

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Organisations: National Food Institute, Research Group for Microbial Food Safety, Office for Study Programmes and Student Affairs, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Jensen, L. B. (Intern), Christiansen, B. L. (Intern), Hansen, C. T. (Intern)
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Gas-liquid two-phase flows in double inlet cyclones for natural gas separation

The gas-liquid two-phase flow within a double inlet cyclone for natural gas separation was numerically simulated using the discrete phase model. The numerical approach was validated with the experimental data, and the comparison results agreed well with each other. The simulation results showed that the strong swirling flow produced a high centrifugal force to remove the particles from the gas mixture. The larger particles moved downward on the internal surface and were removed due to the outer vortex near the wall. Most of the tiny particles went into the inner vortex zones and escaped from the up-outlet. The swirling flow was concentric due to the design of the double inlet for the cyclonic separator, which greatly improved the separating efficiency. The separating efficiency was greater than 90% with the particle diameter of more than 100 μm.
Gastric mucus and mucuslike hydrogels: Thin film lubricating properties at soft interfaces

Mucus is a viscous slime that plays a vital role in protecting and lubricating biological tissues, in particular, soft epithelium interfaces such as in the stomach, intestines, and esophagus. Previous attempts to generate mucus models that mimic or simulate its characteristics have been predominantly focused on the rheological properties. This study investigates both rheological and tribological shear properties of thin films of gastric mucus from a porcine source and its mimics at compliant soft interfaces. The lubricating efficacy of biological mucus and its mimics was observed to be superior at hydrophilic tribological interfaces compared to hydrophobic ones. Facile spreading of all mucus samples at hydrophilic steel-polydimethylsiloxane (PDMS) interfaces allowed for the retainment of the lubricating films over a wide range of speed, slide/roll ratio, and external load. In contrast, poor wetting at hydrophobic PDMS–PDMS interfaces led to depletion of the mucus samples from the interface with increasing speed. Among the different mucus models investigated in this study, fluid mixtures of commercially available porcine gastric mucin (PGM) and polyacrylic acid (PAA) displayed the most persistent lubricating effects under various tribological experimental conditions. A mixture of PGM and PAA holds a high potential as mucus mimic, not only for its rheological similarity, but also for its excellent lubricity in soft compliant and hydrophilic contacts.
Geometrically Optimized 3D Printed Mini-Devices for Oral Drug Delivery

**General information**

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Organisations: Department of Micro- and Nanotechnology, Nanoprobes, Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Vaut, L. (Intern), Juszczyk, J. J. (Ekstern), Jensen, K. E. (Intern), Andersen, A. J. (Intern), Tosello, G. (Intern), Boisen, A. (Intern)
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Geometrically Optimized 3D Printed Mini-Devices for Oral Drug Delivery

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Publication date: 2017
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Geo.pdf
**Geothermal Power Technologies**

Although geothermal energy has been widely deployed for direct use in locations with especial geologic manifestations, its potential for power generation has been traditionally underestimated. Recent technology developments in drilling techniques and power conversion technologies from low-temperature heat resources are bringing geothermal energy to the spotlight as a renewable baseload energy option for a sustainable energy mix. Although the environmental impact and economic viability of geothermal exploitation must be carefully evaluated for each case, the use of deep low-temperature geothermal reservoirs could soon become an important contributor to the energy generation around the world.

**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.

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Organisations: Department of Mechanical Engineering, Thermal Energy, Universidad de Valladolid
Authors: Montagud, M. E. M. (Intern), Chamorro, C. (Ekstern)
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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 $h = 0.8$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.
Gradient plasticity crack tip characterization by means of the extended finite element method

Strain gradient plasticity theories are being widely used for fracture assessment, as they provide a richer description of crack tip fields by incorporating the influence of geometrically necessary dislocations. Characterizing the behavior at the small scales involved in crack tip deformation requires, however, the use of a very refined mesh within microns to the crack. In this work a novel and efficient gradient-enhanced numerical framework is developed by means of the extended finite element method (X-FEM). A mechanism-based gradient plasticity model is employed and the approximation of the displacement field is enriched with the stress singularity of the gradient dominated solution. Results reveal that the proposed numerical methodology largely outperforms the standard finite element approach. The present work could have important implications on the use of microstructurally-motivated models in large scale applications. The non-linear X-FEM code developed in MATLAB can be downloaded from www.empaneda.com/codes.
Grain interaction mechanisms leading to intragranular orientation spread in tensile deformed bulk grains of interstitial-free steel

The spatially resolved intragranular orientation spread in two representative bulk grains of interstitial-free steel deformed to 9% tension has been investigated. A three-dimensional X-ray diffraction microscopy experiment revealed that the two similarly oriented grains are both embedded in local environments representing the bulk texture, yet their deformation-induced rotations are very different. The ALAMEL model is employed to analyse the grain interaction mechanisms. Predictions of this model qualitatively agree with the directionality and magnitude of the experimental orientation spread. However, quantitative agreement requires fine-tuning of the boundary conditions. The majority of the modelled slip is accounted for by four slip systems also predicted to be active by the classical Taylor model in uniaxial tension, and most of the orientation spread along the grain boundaries is caused by relative variations in the activities of these. Although limited to two grains, the findings prove that shear at the grain boundaries as accounted for by the ALAMEL model is a dominant grain interaction mechanism.
Graphite nodules and local residual stresses in ductile iron: Thermo-mechanical modeling and experimental validation

Ductile iron is nowadays widely used in key industrial sectors like off-shore, transport and energy production, accounting for as much as 25% of the total casting production in the world. It is well known that ductile iron parts, depending on their size, may contain residual stresses developing over distances of a few millimeters or more, which arise due to the presence of constraints that hinder the free thermal contraction of the material during cooling. Fortunately, dedicated studies performed in the last few decades have provided a detailed understanding of the phenomenon, and today reliable tools exist that allow predicting and coping with the problem in almost all practical cases.
On the other hand, the intrinsic composite nature of ductile iron suggests the possible formation of another type of residual stresses, at much shorter length scales, associated with the thermal contraction mismatch between the two main metallurgical phases forming the material microstructure: the graphite nodules and the metallic matrix. Surprisingly, the subject has not received much consideration in the past, probably due to the common belief that the graphite particles are very soft and unable to withstand any kind of loading. As a matter of fact, however, experimental evidence exists for their mechanical importance, especially at relatively high temperature and under compressive loadings, indicating that ductile iron might not be considered as a merely “voided material” in all situations.

Taking this as point of departure, the present work initially focuses on finding a satisfactory description of the nodules’ thermo-elastic behavior, which is shown to be missing in the published literature, by means of micro-mechanical homogenization analyses based on a representative unit cell. These, combined with the application of elastic bound theory for polycrystalline materials, lead to the conclusion that the nodules cannot be considered as homogeneous and isotropic at the microstructural scale. Consequently, a novel strategy to simulate their elastic response is proposed, which consists in modeling their characteristic internal structure, composed of graphite platelets arranged into conical sectors, in an explicit manner. The resulting anisotropic model turns out to provide homogenized values for the ductile iron thermo-elastic properties at the macro-scale in excellent agreement with the experiments. In addition, it also indicates that the average thermal contraction of the nodules is likely 3 to 4 times smaller compared to that of the surrounding matrix, hence confirming the existence of a driving force for the formation of stresses at the local scale. In order to investigate this last aspect, the final stages of the manufacturing process are simulated numerically, accounting for the different thermal expansion of the nodules and of the matrix during both the eutectoid transformation and the subsequent cooling to room temperature. The results show the formation of significant residual stresses in the matrix region close to the nodules, which are mainly deviatoric and strongly affected by the number of conical sectors forming the graphite particles.

To support the numerical findings, whose relevance calls for an adequate experimental validation, two techniques are employed. The Oliver-Pharr nano-indentation method is considered first, with the aim of obtaining some direct information concerning the constitutive behavior of the individual graphite particles. Unfortunately, the technique turns out to feature a number of assumptions that pose strong limitations to its applicability to brittle, inhomogeneous and anisotropic structures like the nodules. Interestingly, one of them is related to a concealed way of accounting for the particular contact condition arising between the indenter and the sample during the test, which is revealed in detail in this work for the first time in literature.

The second technique considered is a novel 3D X-ray diffraction method based on synchrotron radiation. This time, the experiments are successful and lead to the determination of the residual stress state around a single nodule lying beneath the material surface. The results are the first ever produced, and confirm the theoretical predictions that local stresses up to approximately half the macroscopic yield strength may remain in the ductile iron microstructure after manufacturing. Needless to say, this new type of residual stresses is expected to play an important role in determining the properties of ductile iron. Knowledge of the factors controlling it will pave the way for further optimization of the material performance under in-service loading.

**Green fiber bottle: Towards a sustainable package**

The Green Fiber Bottle is a fully biodegradable bottle made from molded paper pulp. Its development depends on the establishment of the manufacturing technology. Impulse drying, an innovative way of drying, has the potential to improve significantly the manufacturing process of the Green Fiber Bottle, towards a sustainable packaging solution.

**General information**

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Authors: Didone, M. (Intern), Tosello, G. (Intern), Howard, T. J. (Intern)
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Green Fiber Bottle: Towards a Sustainable Package and a Manufacturing Process

The Green Fiber Bottle is a fully biodegradable bottle made from molded paper pulp, which is a renewable resource. Its development depends on the development of the manufacturing technology. Impulse drying, an innovative way of drying, and FORMCELL, a method to speed the mold reconfiguration, have the potential to improve significantly the manufacturing process of Green Fiber Bottle, towards a sustainable packaging.

Hardness loss and microstructure evolution of 90% hot-rolled pure tungsten at 1200-1350°C

Tungsten is a promising plasma-facing material because of its low sputtering yield, high melting point and high thermal conductivity. The hardness loss and microstructure evolution of pure tungsten hot-rolled to 90% thickness reduction is investigated by isothermal annealing at temperature range of 1200-1350°C. Changes in the mechanical properties caused by recovery and recrystallization during heat treatment are detected by Vickers hardness measurements. Additionally, the microstructural evolution is analyzed with light optical microscopy and X-ray diffraction. The results indicate that the hardness evolution can be divided into two stages: recovery and recrystallization. Recrystallization of W90 in the temperature range of 1200 to 1350°C is governed by the same activation energy as grain boundary diffusion. The average recrystallized grain size is larger for lower annealing temperatures.
Hard Surface Layers by Pack Boriding and Gaseous Thermo-Reactive Deposition and Diffusion Treatments

Thermo-reactive deposition and diffusion (TRD) and boriding are thermochemical processes that result in very high surface hardness by conversion of the surface into carbides/nitrides and borides, respectively. These treatments offer significant advantages in terms of hardness, adhesion, tribo-oxidation, and high wear resistance compared to other conventional surface hardening treatments. In this work, 4 different materials, ARMCQO, AISI 409, Uddeholm ARNE® (AISI O1 equivalent), and VANADIS® 6 PM steel representing different classes of alloys, i.e., pure iron, stainless steel, and tool steels, were subjected to TRD (chromizing and titanizing) and boriding treatments. For the steels with low carbon content, chromizing results in surface alloying with chromium, i.e., formation of a (soft) “stainless” surface zone. Steels containing higher levels of carbon form chromium carbide (viz. $\text{Cr}_23\text{C}_6$, $\text{Cr}_7\text{C}_3$) layers with hardnesses up to 1800 HV. Titanizing of ARNE tool steel results in a surface layer consisting of TiC with a hardness of approximately 4000 HV. Duplex treatments, where boriding is combined with subsequent (TRD) titanizing, result in formation of hard TiB$_2$ on top of a thick layer of Fe-based borides. The obtained surface layers were characterized with X-ray diffraction, scanning electron microscopy, reflected light microscopy, and micro-indentation.
Hierarchical Structure and Strengthening Mechanisms in Pearlitic Steel Wire

Microstructure evolution and strengthening mechanisms have been analyzed in a cold-drawn pearlitic steel wire (the strongest engineering materials in the world) with a nanostructure down to 10 nm and a flow stress up to 5.4 GPa. The interlamellar spacing and the cementite lamellae thickness are reduced during drawing in accordance with the change in wire diameter up to a strain of 2.5. At a higher strain enhanced thinning of cementite lamellae points to decomposition and carbon enrichment of the ferrite lamellae. Dislocations are stored as individual dislocations and in low angle boundaries. No saturation in the dislocation density is observed and it increases to 5E16 m\(^{-2}\) at a strain of 5.4. A high dislocation density at the ferrite/cementite(ferrite) interface is also observed. Boundary strengthening, dislocation strengthening and solid solution hardening are suggested and good agreement is found between the calculated flow stresses and experimental values.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Wind Energy, Manufacturing Engineering, Materials science and characterization, Materials and Surface Engineering
Authors: Zhang, X. (Intern), Hansen, N. (Intern), Huang, X. (Intern), Godfrey, A. W. (Intern)
Higher-order multi-resolution topology optimization using the finite cell method

This article presents a detailed study on the potential and limitations of performing higher-order multi-resolution topology optimization with the finite cell method. To circumvent stiffness overestimation in high-contrast topologies, a length-scale is applied on the solution using filter methods. The relations between stiffness overestimation, the analysis system, and the applied length-scale are examined, while a high-resolution topology is maintained. The computational cost associated with nested topology optimization is reduced significantly compared with the use of first-order finite elements. This reduction is caused by exploiting the decoupling of density and analysis mesh, and by condensing the higher-order modes out of the stiffness matrix.
High-Resolution Single-Grain Diffraction of Polycrystalline Materials

Polycrystalline bulk materials are ubiquitous in everyday life, including biological, geological, and engineered structural and functional materials. Their fundamental units are individual grains, which are characterized by their microstructure; i.e., the arrangement of lattice defects. The microstructure usually influences the materials properties critically.

It has been demonstrated that, by using high-energy synchrotron radiation, diffraction peaks off individual grains can be recorded in-situ during processing. Important information such as the orientation, average strain, and size of individual grains can be obtained, even if the peak shapes are commonly not analyzed. However, it is also well-known that the shape of diffraction peaks, if observed with sufficient resolution, contains significant information about the microstructure.

While the intensity distribution in reciprocal space of a perfect lattice consists of delta functions located at the reciprocal lattice points, defects induce characteristic peak broadening. In order to exploit the wealth of microstructural information contained in broadened diffraction peaks, the intensity distribution has to be characterized in all three dimensions of reciprocal space. Distinguished directions are the radial direction, parallel to the reciprocal lattice vector \( g \) and quantified by differences in the scattering angle \( 2\theta \), and the azimuthal directions, perpendicular to the reciprocal lattice vector and quantified by the angles \( \eta \) and \( \omega \) (Figure 1). Conventional radial profile (line shape) analysis techniques average over many grains with possibly significantly different microstructure. Under conditions of single-grain diffraction, these limitations are overcome and the intensity distributions along all three directions of reciprocal space are accessible.

General information

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Deutsches Elektronen-Synchrotron, Eötvös University, University of Manchester
Authors: Lienert, U. (Ekstern), Ribárik, G. (Ekstern), Ungar, T. (Ekstern), Wejdemann, C. (Intern), Pantleon, W. (Intern)
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Publication date: 2017
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High Temperature Heat Pump Integration using Zeotropic Working Fluids for Spray Drying Facilities

This paper presents an analysis of high temperature heat pumps in the industrial sector and demonstrates the approach of using zeotropic mixtures to enhance the overall efficiency. Many energy intensive processes in industry, such as drying processes, require heat at a temperature above 100 °C and show a large potential to reuse the excess heat from exhaust gases. This study analyses a heat pump application with an improved integration by choosing the working fluid as a mixture in such a way, that the temperature glide during evaporation and condensation matches the temperature glide of the heat source and sink best possibly. Therefore, a set of six common working fluids is defined and the possible binary mixtures of these fluids are analyzed. The performance of the fluids is evaluated based on the energetic performance (COP) and the economic potential (NPV). The results show that the utilization of mixtures allows a heat pump application to preheat the drying air to 120 °C with a COP of 3.04 and a NPV of 0.997 Mio. €, which could reduce the natural gas consumption by 36 %.
Hot-blade cutting of EPS foam for double-curved surfaces—numerical simulation and experiments
In the present paper, experimental and numerical studies of a newly developed process of Hot-Blade Cutting used for free forming of double-curved surfaces and cost effective rapid prototyping of expanded polystyrene foam is carried out. The experimental part of the study falls in two parts. The first presents a number of large-scale cutting samples combining linear cuts with and without inclination measured from the horizontal direction of cutting, while in the second, the thermal phenomena in the process are studied based on infrared measurements of the hot-blade tool made by observation during the cutting process. A novel measurement method for determination of kerfwidth (i.e., the gap space after material removal) applying a commercially available large-scale optical 3D scanning technique was developed and used. A one-dimensional thermo-electro-mechanical numerical model for Hot-Blade Cutting similar to the one previously proposed by Petkov and Hattel (Int J Machine Tools Manuf 107:50–59 2016) for Hot-Wire Cutting of Polystyrene foam is used to simulate the process and describe the effects taking place within the hot-blade during different cutting procedures. The obtained results are graphically presented and discussed in relation to the aim for higher geometrical accuracy of the Hot-Blade Cutting process.
How can design science contribute to a circular economy?

Circular Economy is increasingly seen as a key approach to operationalising goals and supporting the transition to a sustainable society by enhancing competitiveness and economic growth. Creating a Circular Economy requires fundamental changes throughout the value chain, from innovation, product design and production processes all the way to end of life, new business models and consumption patterns. This paper explores how design science can support the transition from the traditional linear 'take-make-consume-dispose' approach, to a Circular Economy. By means of a systematic literature review, this paper discusses the role of a set of design topics in this transition.
proposed framework was tested. The results from the testing confirm that the framework is applicable, as it leads to strategic and smart decisions regarding the implementation of PCS.

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Organisations: Department of Management Engineering, Management Science, Operations Management, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Kristjansdottir, K. (Intern), Shafiee, S. (Intern), Hvam, L. (Intern)
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**Humidity Buildup in Electronic Enclosures Exposed to Constant Conditions**
Electronic components and devices are exposed to a wide variety of climatic conditions, therefore the protection of electronic devices from humidity is becoming a critical factor in the system design. The ingress of moisture into typical electronic enclosures has been studied with defined parameters such as openings in the enclosure (drain holes, intentional openings or leak) and sealing and casing material. Related corrosion reliability issues due to humidity buildup have been evaluated using an interdigitated surface insulation resistance pattern placed inside the enclosure during exposure. The moisture buildup inside the enclosure has been simulated using an equivalent RC circuit consisting of variables like controlled resistors and capacitors to describe the diffusivity, permeability, and storage in polymers.

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BFI (2016): BFI-level 1
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.612 SNIP 1.472 CiteScore 1.82
Hybrid Simulation of Composite Structures

Hybrid simulation is a substructural method combining a numerical simulation with a physical experiment. A structure is thereby simulated under the assumption that a substructure’s response is well known and easily modelled while a given substructure is studied more accurately in a physical experiment. The technique has primarily been used within earthquake engineering but many other fields of engineering have utilized the method with benefit. However, these previous efforts have focused on structures with a simple boundary between the numerical and physical substructure i.e. few degrees of freedom. In this dissertation the main focus is to develop hybrid simulation for composite structures e.g. wind turbine blades where the boundary between the numerical model and the physical experiment is continues i.e. in principal infinite amount of degrees of freedom. This highly complicates the transfer system and the control and monitoring techniques in the shared boundary is therefore a key issue in this type of hybrid simulation. During the research, hybrid simulation platforms have been programmed capable of running on different time scales with advanced control and monitoring techniques at the shared boundary. The hybrid simulation programs have been tested on different simple composite structures and they have proven able to increase the accuracy in tests with a complex transfer system.

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Publication: Research › Ph.D. thesis – Annual report year: 2017

Hybrid vortex simulations of wind turbines using a three-dimensional viscous-inviscid panel method
A hybrid filament-mesh vortex method is proposed and validated to predict the aerodynamic performance of wind turbinerotorst and to simulate the resulting wake. Its novelty consists of using a hybrid method to accurately simulate the
wakedownstream of the wind turbine while reducing the computational time used by the method. The proposed method uses a hybrid approach, where the near wake is resolved by using vortex filaments, which carry the vorticity shed by the trailing edge of the blades. The interaction of the vortex filaments in the near vicinity of the wind turbine is evaluated using a direct calculation, whereas the contribution from the large downstream wake is calculated using a mesh-based method. The hybrid method is first validated in detail against the well-known MEXICO experiment, using the direct filament method as a comparison. The second part of the validation includes a study of the influence of the time-integration scheme used for evolving the wake in time, aerelastic simulations of the National Renewable Energy Laboratory 5 MW wind turbine and an analysis of the central processing unit time showing the gains of using the hybrid filament-mesh method.
Hydraulic pitch control system for wind turbines: Advanced modeling and verification of an hydraulic accumulator

Hydraulic pitch systems provide robust and reliable control of power and speed of modern wind turbines. During emergency stops, where the pitch of the blades has to be taken to a full stop position to avoid over speed situations, hydraulic accumulators play a crucial role. Their efficiency and capability of providing enough energy to rotate the blades is affected by thermal processes due to the compression and decompression of the gas chamber. This paper presents an in depth study of the thermodynamical processes involved in an hydraulic accumulator during operation, and how they affect the energy efficiency of the component. An initial evaluation of the popular thermal time constant model is made and compared with experimental results for a 6 L accumulator, showing that the current estimation techniques for the thermal time constant are not suited for the application studied, predicting higher heat losses in the gas and resulting in lower pressure buildup. Furthermore, it is shown that the assumption of a constant value for the thermal time constant can provide extremely accurate results, provided that the compression ratios of the process are known in advance. For varying compression ratios, dynamical effects play an important role and the accuracy of the model decreases. To study the thermal processes, a simplified axisymmetric CFD model of the accumulator is developed. The results show that the main heat transfer losses are associated with heat diffusion in the solid parts of the accumulator, making up to 20% of the total heat losses. It is also shown that the heat transfer processes and the thermal time constant are tightly connected to variations in gas mass, in rate of change of volume and compression ratios. Comparison with experimental results validate the CFD model accurately, showing high level of agreement and repeatability between the predicted pressures and temperatures and the experimental measurements.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Fritz Schur Energy A/S.
Authors: Irizar, V. (Ekstern), Andreasen, C. S. (Intern)
Pages: 1-22
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Journal: Simulation Modelling Practice and Theory
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.4
BFI (2015): BFI-level 1
Hydrodynamics of microbial filter feeding

Microbial filter feeders are an important group of grazers, significant to the microbial loop, aquatic food webs, and biogeochemical cycling. Our understanding of microbial filter feeding is poor, and, importantly, it is unknown what force microbial filter feeders must generate to process adequate amounts of water. Also, the trade-off in the filter spacing remains unexplored, despite its simple formulation: A filter too coarse will allow suitably sized prey to pass unintercepted, whereas a filter too fine will cause strong flow resistance. We quantify the feeding flow of the filter-feeding choanoflagellate Diaphanoeca grandis using particle tracking, and demonstrate that the current understanding of microbial filter feeding is inconsistent with computational fluid dynamics (CFD) and analytical estimates. Both approaches underestimate observed filtration rates by more than an order of magnitude; the beating flagellum is simply unable to draw enough water through the fine filter. We find similar discrepancies for other choanoflagellate species, highlighting an apparent paradox. Our observations motivate us to suggest a radically different filtration mechanism that requires a flagellar vane (sheet), something notoriously difficult to visualize but sporadically observed in the related choanocytes (sponges). A CFD model with a flagellar vane correctly predicts the filtration rate of D. grandis, and using a simple model we can account for the filtration rates of other microbial filter feeders. We finally predict how optimum filter mesh size increases with cell size in microbial filter feeders, a prediction that accords very well with observations. We expect our results to be of significance for small-scale biophysics and trait-based ecological modeling.
Identification of critical technology building blocks

In order to have a better base for decisions, R&D managers need to know what the critical areas of development are in relation to the technologies they develop, mature, and include in the portfolio. As most of the technologies in a company have the potential to have a significant impact on competition, the challenge is to know how to identify and prioritize the development tasks. If possible, an effective strategy can be defined. This article suggests a framework for identification and analysis of a product portfolio, with special emphasis on identifying critical technology building blocks based on reasoning about product properties. Current approaches lack such views, and by focusing on these, potential make or break decisions are better supported. It is suggested to adopt the proposed framework to clarify where in the portfolio the technology needs critical attention for the next development steps. The framework is based on methods and theories in literature. The analysis of the portfolio is carried out through the framework in three steps: by creating an overview of the portfolio encompassing product and technology, assessing the elements in the overview with assessment metrics, and using property chains to identify critical technology building blocks.
Identification of Damping from Structural Vibrations

Reliable predictions of the dynamic loads and the lifetime of structures are influenced by the limited accuracy concerning the level of structural damping. The mechanisms of damping cannot be derived analytically from first principles, and in the design of structures the damping is therefore based on experience or estimated from measurements. This thesis consists of an extended summary and three papers which focus on enhanced methods for identification of damping from random structural vibrations. The developed methods are validated by stochastic simulations, experimental data and full-scale measurements which are representative of the vibrations in small and large-scale structures.

The first part of the thesis presents an automated procedure which is suitable for estimation of the natural frequencies and the modal damping ratios from random response of structures. The method can be incorporated within existing time domain Operational Modal Analysis (OMA) techniques to automatically select the most representative time lag in the correlation function and model order of the system, by fitting a cluster of estimated frequencies and damping ratios to the dynamic response data. The procedure is applied to stochastic simulations of the tower accelerations of an 8 MW offshore wind turbine generator during downtime. This is a scenario in which a limited amount of damping is expected to be available. Therefore, it may be significant for the next generation of wind turbines for which estimates from field measurements may be applied for design optimization. The expected level of error in the estimates of damping computed by stochastic simulations is validated by real vibration measurements of an offshore wind turbine in non-operating conditions. The best bias-variance error trade-off in the damping estimates is obtained by the covariance driven stochastic subspace (COV-SSI) identification technique in combination with the automated method. It has been estimated that the average damping in the fundamental fore-aft mode is 42% lower than the damping in the side-side mode and the scatter is within the expected standard deviation. It is notoriously difficult to separate the magnitude of the multiple sources of damping in offshore wind turbine generators. The magnitude of energy dissipation depends on the vibration amplitude and is associated with a spatial location which can be described by the non-classical viscous damping matrix.

The second part of the thesis demonstrates how the spatial location of damping can be obtained by a derived explicit expression of the non-classical damping matrix. The modal parameters without a specific scaling are required in the expression as well as the mass distribution. This expression can be incorporated into an output-only system identification technique as well as in traditional experimental modal analysis techniques. The identified damping matrix is of high accuracy and yields a real-valued symmetric matrix from simulations. It is furthermore shown, by measurements of a model-scale five-story shear building, that the estimated complex-valued mode shapes are reproducible and their convergence concerning the measurement duration validates that the non-classical damping matrix can be re-constructed robustly by estimating the complex-valued modal parameters of dynamic structures.

In the last part of the thesis a method for identification of damping in hysteretic systems is presented. The method extends the post-processing of the estimates obtained by the classical COV-SSI technique. Hysteresis is modeled by the Bouc-Wen model which is represented by an equivalent linear relaxation model. The linear relaxation model is related to the Bouc-Wen model by explicit expressions of the relation between the model parameters obtained by harmonic averaging. These expressions are incorporated in the identification procedure and they depend on the identification of a
cluster of non-oscillatory poles, the root-mean-square of the displacement response and the resonance frequency. Synthetic data provided by a benchmark challenge on identification of single-degree-of-freedom (SDOF) systems with hysteresis is used for validation. The displacement response from random excitation of a hysteretic system is contained in the data set, by which it is shown that the model parameters identified by the method can predict the response at both low and high-levels of excitation amplitudes.
Impact mechanics of ship collisions and validations with experimental results

Closed-form analytical solutions for the energy released for deforming and crushing of structures and the impact impulse during ship collisions were developed and published in Marine Structures in 1998 [1]. The proposed mathematical models have been used by many engineers and researchers although the methods were only validated with time-domain numerical simulation results at that time. Since then, model and full-scale measurementsthe have been carried out and experimental results are available in the public domain. The purpose of the present paper is to use such experimental results to further analyze the validity and robustness of the closed-form analytical methods as well as to further improve some parameter's accuracy. In total, 60 experimental results have been analyzed and compared with the analytical results and this paper presents the outcome. It can be concluded that the analytical methods give a reasonable agreement with the experimental results. The paper also introduces a simple concept to account for the effective mass of liquids with free surface carried on board of a ship and it is shown how the analytical analysis procedure can be expanded to take into account the effect of ship roll on the energy released for crushing.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Lloyd's Register EMEA, Wuhan University
Authors: Zhang, S. (Ekstern), Villavicencio, R. (Ekstern), Zhu, L. (Ekstern), Pedersen, P. 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 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.49 SJR 1.655 SNIP 2.636
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.618 SNIP 2.602 CiteScore 2.77
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.431 SNIP 3.026 CiteScore 2.18
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.314 SNIP 2.871 CiteScore 2.42
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.836 SNIP 3.464 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.611 SNIP 2.795 CiteScore 1.82
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.136 SNIP 2.518
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.165 SNIP 2.795
Web of Science (2009): Indexed yes
Implementation of Generalized Modes in a 3D Finite Difference Based Seakeeping Model

This work is an extension of the finite difference potential flow solver OceanWave3D-Seakeeping developed by Afshar (2014) to include generalized modes. The continuity equation is solved using a fourth-order centered finite difference scheme which requires that the entire fluid domain is discretized as opposed to the more popular panel method where only the body surface - and sometimes the free surface and sea bottom - are discretized. The advantage for the finite difference solver is thought to be found for complex or high-resolution problems where the computational time will scale better due to the sparse nature of the coefficient matrix. The solver is built using the open source framework Overture which consists of C++ libraries for solving partial differential equations on overlapping grids and has a built-in overlapping grid generator Ogen.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark
Authors: Andersen, M. H. (Ekstern), Amini Afshar, M. (Intern), Bingham, H. B. (Intern)
Number of pages: 4
Publication date: 2017
Event: Abstract from 32nd International Workshop on Water Waves and Floating Bodies (IWWWFB 2017), Dalian, China.
Main Research Area: Technical/natural sciences
Electronic versions: 170216_1327196.pdf
Publication: Research - peer-review » Conference abstract for conference – Annual report year: 2017

Implementation of the far-field method for calculation of added resistance using a high order finite-difference approximation on overlapping grids

The far-field method for calculation of the wave drift force is implemented in the high order finite-difference seakeeping solver. The implementation is based on the Maruo formulation which employs the Kochin function to obtain the complex amplitude of the velocity potential in the far-field. The results are shown both for zero and forward speed for the floating hemisphere and two ship geometries. Comparisons with WAMIT and near-field calculations are also presented.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Implementing optical fibres for the structural health monitoring of composite patch repaired structures

Structural health monitoring is increasingly being implemented to improve the level of safety of structures and to reduce inspection and repair costs by allowing for correct planning of these actions, if needed. Composite patch repairing presents an appealing alternative to traditional repair methods as it enables the reduction of closedown time and the mitigation of complications associated with traditional repair methods. As reinforcement with the use of composite patches is predominantly performed at defected structures, the urge to monitor the performance of the repair becomes even greater. This work deals with the use of Fabry Perot optical fibres and strain gages at suitable positions in such a repair. To this end a patch repaired notched steel plate has been tested in tension, opting to gain insight on the mechanisms which govern the failure. In order to investigate how these mechanisms are reflected to the recorded strain measurements, finite element models have been generated. Results indicate that composite patch repairing drastically increased the load bearing capacity of the plates and that optical fibres constitute an appealing health monitoring system for such applications, being able to capture the initiation and evolution of damage.
Improved HPC method for nonlinear wave tank

The recently developed Harmonic Polynomial Cell (HPC) method has been proved to be a promising choice for solving potential-flow Boundary Value Problem (BVP). In this paper, a flux method is proposed to consistently deal with the Neumann boundary condition of the original HPC method and enhance the accuracy. Moreover, fixed mesh algorithm with free surface immersed is developed to improve the computational efficiency. Finally, a two dimensional (2D) multi-block strategy coupling boundary-fitted mesh and fixed mesh is proposed. It limits the computational costs and preserves the accuracy. A fully nonlinear 2D numerical wave tank is developed using the improved HPC method as a verification.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Marine Design and Research Institute of China, Norwegian University of Science and Technology
Authors: Zhu, W. (Ekstern), Greco, M. (Ekstern), Shao, Y. (Intern)
Pages: 598-612
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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 (2016): CiteScore 0.98 SJR 0.771 SNIP 1.097
Scopus rating (2015): SJR 0.654 SNIP 0.997 CiteScore 0.84
Scopus rating (2014): SJR 0.446 SNIP 1.047 CiteScore 0.6
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 0.316 SNIP 0.767 CiteScore 0.41
ISI indexed (2013): ISI indexed yes
Scopus rating (2012): SJR 0.35 SNIP 1.017 CiteScore 0.53
Scopus rating (2011): SJR 0.182 SNIP 0.948 CiteScore 0.36
Scopus rating (2010): SJR 0.426 SNIP 1.097
Original language: English
: Harmonic polynomial cell method, Potential-flow theory, Flux method, Fixed mesh, Multi-block strategy, Nonlinear numerical wave tank
Improving efficiency of heat pumps by use of zeotropic mixtures for different temperature glides

The present study demonstrates the optimization of a heat pump for an application with a large temperature glide on the sink and a smaller temperature glide on the source side. The study includes a simulation of a heat pump cycle for all possible binary mixtures from a list of 14 natural refrigerants, which enables a match of the temperature glide of sink and source with the temperature of the working fluid during phase change and thus, a reduction of the exergy destruction due to heat transfer. The model was evaluated for four different boundary conditions. For a separated evaluation of the irreversibility solely caused by the fluid properties, the exergy destruction in the heat exchangers has been distinguished accordingly and an indicator quantifying the glide match has been defined to analyse the influence on the performance. It was observed that a good glide match can contribute to an increased performance. Dependent on the boundary conditions a performance increase of 20.0% for a simple cycle was observed and 26.9% increase if the required superheating can be avoided. The temperature glide match in the source was identified to have a higher influence on the performance than in the sink.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS, Danish Technological Institute
Authors: Zühlsdorf, B. (Intern), Jensen, J. K. (Intern), Cignitti, S. (Intern), Madsen, C. (Ekstern), Elmegaard, B. (Intern)
Number of pages: 15
Publication date: 2017

Including product features in process redesign

This article suggests a visual modelling method for integrating models of product features with business process models for redesigning the business processes involving specifications of customer-tailored products and services. The current methods for redesigning these types of business processes do not take into account how the product features are applied throughout the process, which makes it difficult to obtain a comprehensive understanding of the activities in the processes and to generate significant improvements. The suggested approach models the product family using the so-called product variant master and the business process modelling notation for modelling the process flow. The product model is combined with the process map by identifying features used in each step of the process flow. Additionally, based on the information absorbed from the integrated model, the value stream mapping modelling technique is applied to the specification process to evaluate its performance in quantifiable terms. The proposed modelling approach was investigated through three case studies. Experiences from the case studies were that the suggested modelling techniques gave additional insight into the specification processes and formed a good basis for process improvement. Furthermore, the case studies indicated that the suggested modelling techniques were applicable and easy to use.

General information
State: Published
Increased accuracy of cost-estimation using product configuration systems
This article describes an approach for utilizing Product Configuration Systems (PCS) for quantifying project costs in project-based companies. It presents a case study demonstrating a method of quantifying costs in a way that makes it possible to configure cost- and time estimates. Piecework costs, material costs and sub-supplier costs are used as principle cost elements and linked to structural and process elements to facilitate configuration. The cost data are used by the PCS to generate fast and accurate cost-estimates, quotations, time estimates and cost summaries. The described cost quantification principles have been used in a Scandinavian SME (Small and Medium-sized Enterprise) since the 90’s, but have since 2011 been adopted to be used in a configuration system. A longitudinal case study was conducted to compare cost and time-estimation accuracy before and after implementation. We conclude that the proposed method for grouping costs, combined with a PCS, can be used in project-based construction industries to make more accurate estimates of project costs. Reasons for improved accuracy are, according to company experts, the increased documentation and visibility of cost-estimates, dynamic allocation of variable costs, version control of cost-agreements and the ability to handle an increased level of cost details.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Department of Management Engineering, Management Science, Operations Management
Authors: Rasmussen, J. B. (Intern), Hvam, L. (Intern), Mortensen, N. H. (Intern)
Number of pages: 7
Publication date: 2017
Main Research Area: Technical/natural sciences
Publication: Research - peer-review › Paper – Annual report year: 2017

Industrial excess heat for district heating in Denmark
Excess heat is available from various sources and its utilisation could reduce the primary energy use. The accessibility of this heat is however dependent amongst others on the source and sink temperature, amount and potential users in its vicinity. In this work a new method is developed which analyses excess heat sources from the industrial sector and how they could be used for district heating. This method first allocates excess heat to single production units by introducing and validating a new approach. Spatial analysis of the heat sources and consumers are then performed to evaluate the potential for using them for district heating. In this way the theoretical potential of using the excess heat for covering the heating demand of buildings is determined. Through the use of industry specific temperature profiles the heat usable directly or via heat pumps is further found. A sensitivity analysis investigates the impact of future energy efficiency measures in the industry, buildings and the district heating grid on the national potential. The results show that for the case study of Denmark, 1.36 TWh of district heat could be provided annually with industrial excess heat from thermal processes which equals 5.1% of the current demand. More than half of this heat was found to be usable directly, without the need for a heat pump.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Management Engineering, Systems Analysis
Authors: Bühler, F. (Intern), Petrovic, S. (Intern), Karlsson, K. B. (Intern), Elmegaard, B. (Intern)
Pages: 991-1001
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: Applied Energy
Volume: 205
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Web of Science (2017): Indexed yes
Influence of de-icing salt chemistry on the corrosion behavior of AA6016

De-icing salts are commonly used on European roads during winter and are usually based on chlorides of sodium, magnesium, or calcium. The salt selection depends on the local climate and legislation. Therefore, the chemical composition of the de-icing mixture can be very different within Europe. This represents an important challenge for the automotive industry as the corrosion behavior of automotive parts is intricately linked to the chemistry of the road...
environment. Furthermore, the use of aluminium alloys in the automotive industry increases due to a constant search for weight reduction. Till now, most of the corrosion studies on aluminium alloys in chloride based solutions have only been focused on sodium chloride. In this study, the effect of different chloride based salts on the corrosion of AA6016 was investigated. For that purpose, potentiodynamic polarization measurements were combined with surface analysis by SEM-EDS and depth profiling using GDOES. Salts based on sodium and calcium showed similar effects on the corrosion behavior of AA6016 while the magnesium based salt reduced the corrosion rate. Mixture of sodium and magnesium based salts increased the corrosive attack.

**General information**

State: Accepted/In press
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Toyota Motor Europe, Technical University of Denmark
Authors: Schoukens, I. (Ekstern), Cavezza, F. (Ekstern), Cerezo, J. (Ekstern), Vandenberghe, V. (Ekstern), Gudla, V. C. (Intern), Ambat, R. (Intern)
Number of pages: 7
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

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- Web of Science (2018): Indexed yes
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- BFI (2016): BFI-level 1
- Web of Science (2016): Indexed yes
- Scopus rating (2016): CiteScore 1.21 SJR 0.526 SNIP 0.741
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Web of Science (2015): Indexed yes
- Scopus rating (2015): SJR 0.668 SNIP 1.033 CiteScore 1.53
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Web of Science (2014): Indexed yes
- Scopus rating (2014): SJR 0.76 SNIP 1.196 CiteScore 1.36
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.824 SNIP 1.434 CiteScore 1.44
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.669 SNIP 1.126 CiteScore 1.25
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.606 SNIP 1.124 CiteScore 1.13
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.572 SNIP 0.909
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.51 SNIP 0.681
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.633 SNIP 0.877
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.714 SNIP 0.876
- Web of Science (2007): Indexed yes

The objective of this research is to investigate the influence of injection molding parameters on the dimensional replication of microstructure surfaces in injection molding with additively manufactured soft tooling inserts in a photopolymer material. The replication degree of micropillars on injection-molded tine rings was assessed and a Design of Experiments (DOE) approach was used to investigate which factors influence the replication. A full factorial analysis with three factors at two levels lead to the conclusion that a high mold temperature increases the replication degree of the pillar diameter and decreases the replication degree of the pillar height. A high melt temperature increases the pillar diameter independently from the pillar height. A higher injection speed affects both pillar diameter and height negatively. In addition, the study showed a significant difference in the replication degree between inserts on the injection side and the ejector side of the mold respectively. Also, a position closer to the injection gate supports a higher replication degree. Insert wear was found insignificant within the experimental range of up to 100 injection cycles.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Mischkot, M. (Intern), Zhang, Y. (Intern), Segebrecht Getje, A. (Ekstern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 4
Publication date: 2017
Main Research Area: Technical/natural sciences
Micro Injection Molding, Micro overmolding, Optical micro metrology
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Publication: Research - peer-review › Paper – Annual report year: 2017

Influence of preoxidation on high temperature corrosion of a Ni-based alloy under conditions relevant to biomass firing

Development of corrosion resistant materials in biomass fired power plants demands specific attention since the condensation of deposits rich in KCl on heat exchanger surfaces induces severe corrosion attack, which is different from corrosion in traditional coal fired plants. Therefore, the ability of preoxidized layers formed on a commercial Cr-Ti-Al-containing Ni-based alloy (Nimonic 80A) to withstand biomass-induced corrosion was investigated. Preoxidation treatments at 900 °C in O2 and O2 + 10 vol% H2O, respectively, were conducted before samples were exposed to conditions that mimicked biomass firing. Complementary characterization methods were employed to study samples after preoxidation as well as after corrosion exposure. The oxides obtained by the preoxidation treatments protected the alloy during corrosion exposure at 560 °C for a period of 168 h. In contrast, non-preoxidized samples suffered corrosion attack and formed porous non-protective oxides containing the alloying elements, Ni, Cr, Ti and Al. The influence of the preoxidation layers on the corrosion mechanism is discussed.

General information
State: Published
Organisations: Department of Chemical and Biochemical Engineering, CHEC Research Centre, Department of Mechanical Engineering, Materials and Surface Engineering
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 are 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
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Department of Electrical Engineering
Authors: Doagou Rad, S. (Intern), Islam, A. (Intern), Jensen, J. S. (Intern)
Number of pages: 6
Pages: 131-136
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Main Research Area: Technical/natural sciences

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Scopus rating (2014): SJR 0.736 SNIP 1.419
Scopus rating (2013): SJR 0.515 SNIP 1.163
ISI indexed (2013): ISI indexed no
Original language: English
Composites, Injection molding, Carbon nanotubes, Nanostructures, Thermoplastic, Polymer, Manufacturing, Mechanical properties, Rheology
Electronic versions:
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Source: FindIt
Source-ID: 2371227065
Publication: Research - peer-review › Conference article – Annual report year: 2017

Influence of steam-based pre-treatment using acidic chemistries on the adhesion performance of powder coated aluminium alloy AA6060

In this study, the adhesion of a commercially applied powder coating on a steam treated AA6060 surface with pure steam and steam with citric and phosphoric acid chemistries has been investigated. Contact angle, roughness, and nanoscale pull off forces were determined as a function of the steam treatment prior to application of the powder coating. A focused ion beam technique was used to examine the cross section of the powder coating, interface adhesion, and fracture morphology after the boiling test and interface indentation method. Transmission electron microscopy was used to study the fracture after indentation. Regardless of the steam treatment method, the wettability of the AA6060 surface was increased after the steam treatment. Addition of citric and phosphoric acid resulted in a low degree of hydrophobicity for the oxide layer compared to the use of pure steam. Steam generated oxide with citric and phosphoric acid resulted in poor penetration of the adhesive over the intermetallic particles, and the interface showed mixed (cohesive/adhesive) fracture.
during interface indentation, while the pure steam treated surface showed dominant cohesive fracture.

**General information**

**State:** Published

**Organisations:** Department of Mechanical Engineering, Materials and Surface Engineering, Université des Sciences et Technologies de Lille

**Authors:** Din, R. U. (Intern), Nikogeorgos, N. (Intern), Jellesen, M. S. (Intern), Shabadi, R. (Ekstern), Ambat, R. (Intern)

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**Influence of the worn tool affected by built-up edge (BUE) on micro end-milling process performance: A 3D finite element modeling investigation**

Micro milling process has been utilized for several decades due to the flexibility of the process in producing complex components. The small size of the process makes the comprehension of cutting phenomenon details more difficult. This study presents a 3D finite element modeling (3D FEM) approach for the micro end-milling process of Aluminum material (Al6082-T6). 3D FEM simulations are carried out in full slot micro end-milling and contour up milling. The model first implements the actual tool geometry and then the effect of typical built-up edge (BUE) on the milling tool. The influence of BUE on the process performance is investigated by comparing the predicted 3d chip flow shape, burr formation and cutting forces with experiments conducted on an ultra-high precision micro milling center. Simulations indicate that BUE has significant impact on the chip shape and chip load for different teeth engagements. Results prove that also burr height is negatively affected by the presence of BUE. The predicted micro milling cutting forces resulted affected by BUE with different teeth engagements. Analysis of experimental measured forces indicates comparable results in respect to simulated profiles confirming the usefulness of the develop 3D FE modelling approach.

**General information**

**State:** Published

**Organisations:** Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Milano

**Authors:** Davoudinejad, A. (Intern), Tosello, G. (Intern), Annoni, M. (Ekstern)

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**Main Research Area:** Technical/natural sciences

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Scopus rating (2015): SJR 0.65 SNIP 1.075 CiteScore 1.42

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 0.707 SNIP 1.484 CiteScore 1.58

Web of Science (2014): Indexed yes

BFI (2013): BFI-level 1
Influence of tool texture on friction and lubrication in strip reduction

Tool texturing is studied as a method to enhance lubrication and prevent the occurrence of galling. Strip reduction test tools manufactured with longitudinal, shallow pocket geometries oriented perpendicular to the sliding direction are tested. The pockets have small angles to the workpiece surface and varying distance. The experiments show an optimum distance between the pockets to exist that creates table mountain topography with flat plateaus and narrow pockets in between. If the flat plateaus are too narrow, an increase in drawing load and pick-up on the tool plateaus is observed. The same occurs for too wide plateaus. A theoretical friction model supports the experimental findings of an optimum distance between the pockets, where the contribution to friction by mechanical interlocking of the strip in the pockets is limited and lubrication of the plateaus is enhanced by micro-plasto-hydrodynamic lubrication.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Sulaiman, M. H. B. (Intern), Christiansen, P. (Intern), Bay, N. O. (Intern)
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10.1016/j.proeng.2017.10.992
Influence of unbalance levels on nonlinear dynamics of a rotor-backup rolling bearing system

Rotor drops in magnetic bearing and unbalance in rotors have been objectives of study for many years. The combination of these two well-known phenomena led to an interesting chaotic response, when the rotor touches the inner race of the back-up bearing. The present work explores the nonlinear rotor backup bearing dynamics both theoretically and experimentally using a fully instrumented test rig, where the position of shaft, its angular velocity and the contact forces between the shaft and the backup bearing are sampled at 25 kHz. The test rig is built by a removable passive magnetic bearing, which allows for simulation of magnetic bearing failure (loss of carrying capacity and rotor fall). The rotor is studied numerically as well as experimentally. A theoretical approach is given beforehand and supplies the basis of the study. Finally the presented results are commented on the point of view of nonlinear dynamics applied to the practical use. The theoretical and numerical analyses are shown through orbit plots, phase plans, Poincaré maps, force response in time and double sided spectrum. The latter is important to characterize the condition at different levels of unbalance between forward and backward whirl. Our preliminary results indicate that for smaller amount of unbalance the rotor swings at the bottom of the bearing, the more the unbalance increases, other dynamical behavior occur and some can be extremely harmful, since the rotor can be lifted from the contact state and return, starting to impact innumerable times without reaching a steady state.
Successful transformation of design information from customer requirements to design implementation is critical for engineering design. As systems become complex the tracking of how customer requirements are implement becomes difficult. Existing approaches suggest so called domain modelling for mapping requirements to architecture. These approaches do not fully support the steps and information created during product design synthesis. Design Specifications used to guide the design are often documented in text based documents, outside the design models. This results in lack of traceability which may impede the ability to evolve, maintain or reuse systems. In this paper the Multi Entity Domain Approach (MEDA) is presented. The approach combines different design information within the domain views, incorporates both Software and Hardware design and supports iterative requirements definition. The results suggest that it is possible to present design information in structural domain views, presenting more elaborate information of the design synthesis than provided by previous approaches. However, further validation in a practical project setting is required to validate the approach.
Injection and injection-compression moulding replication capability for the production of polymer lab-on-a-chip with nanostructures

The manufacturing precision and accuracy in the production of polymer lab-on-a-chip components with 100-130 nm deep nanochannels are evaluated using a metrological approach. Replication fidelity on corresponding process fingerprint test nanostructures over different substrates (nickel tool and polymer part) is quantified through traceable atomic force microscope measurements. Dimensions of injection moulded (IM) and injection-compression moulded (ICM) thermoplastic cyclic olefin copolymer nanofeatures are characterized depending on process parameters and four different features positions on a 30 × 80 mm² area. Replication capability of IM and ICM technologies are quantified and the products tolerance at the nanometre dimensional scale verified.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Danish Fundamental Metrology
Authors: Calaon, M. (Intern), Tosello, G. (Intern), Garnaes, J. (Ekstern), Hansen, H. N. (Intern)
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Journal: Journal of Micromechanics and Microengineering
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Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.725 SNIP 1.224 CiteScore 1.84
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 0.611 SNIP 1.055 CiteScore 1.74
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Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.856 SNIP 1.402 CiteScore 1.92
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Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.038 SNIP 1.437 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
Additive Manufacturing is becoming a viable option for the production of injection molding inserts in pilot production settings. This work compares an insert made from brass using conventional machining with an insert made from a proprietary photopolymer using Digital Light Processing (DLP) through the application of precision injection molding. The performance of the inserts is analyzed focusing on design, metrological aspects, tool lifetime, and thermal performance. In the experiment, a disk-shape geometry (diameter 41.5 mm, thickness 3.5 mm) was injection molded in Low-Density Polyethylene in a two-cavity mold. The inserts as well as selected injection molded parts were analyzed with an optical 3D micro-coordinate measuring machine. It was found that additive manufacturing technology can lead to a significantly more cost-effective pilot production, both in terms of development time and investment. DLP technology enables fast production of micro-features, however insert production with DLP is less reliable than milling e.g. when considering process repeatability. Photopolymer and brass inserts lead to differences in optical surface appearance on the injection molded parts. The lifetime of the photopolymer inserts is challenging to predict reliably. Depending on how many parts need to be produced, the use of several photopolymer inserts instead of one brass insert is a means to overcome the shorter lifetime and can represent a cost-effective alternative to machined inserts. In order to exploit the advantages of using additive manufactured injection mold inserts, specific tool design rules have to be applied.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Number of pages: 5
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Host publication information
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.

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State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Technical University of Denmark
Authors: Islam, A. (Intern), Li , X. (Ekstern)
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Main Research Area: Technical/natural sciences
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

In-line 3D print failure detection using computer vision

Here we present our findings on a novel real-time vision system that allows for automatic detection of failure conditions that are considered outside of nominal operation. These failure modes include warping, build plate delamination and extrusion failure. Our system consists of a calibrated camera whose position and orientation is known in the machine coordinate system. We simulate what the object under print should look like for any given moment in time. This is compared to a segmentation of the current print, and statistical detection of significant deviation. We demonstrate that this methodology precisely and unambiguously detects the time point of print failure.

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Failure detection, Computer vision, Fused deposition modeling (FDM)
Source: PublicationPreSubmission
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**Inner centering in parting line area of injection mould using side locks**

Injection moulding is characterized by high precision requirements. In particular, the demands regarding the mould plates alignment are in order of few micro meters. This research introduces a methodology to measure the misalignment in injection moulding. Eddy current sensors are used in the system to perform measurements for a whole cycle. In a long run of the mould, a comparison of mould deviation between the first and the last cycles is obtained.

**General information**
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Mahshid, R. (Intern), Hansen, H. N. (Intern)
Number of pages: 2
Publication date: 2017

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Main Research Area: Technical/natural sciences
Conference: 17th euspen International Conference & Exhibition, Hannover, Germany, 29/05/2017 - 29/05/2017
Injection moulding, Centering, Misalignment, Displacement sensors, Guiding system
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Innovative Methods and Applications in Mucoadhesion Research**

The present review is aimed at elucidating relatively new aspects of mucoadhesion/mucus interaction and related phenomena that emerged from a Mucoadhesion workshop held in Munster on 2–3 September 2015 as a satellite event of the ICCC 13th—EUCHIS 12th. After a brief outline of the new issues, the focus is on mucus description, purification, and mucus/mucin characterization, all steps that are pivotal to the understanding of mucus related phenomena and the choice of the correct mucosal model for in vitro and ex vivo experiments, alternative bio/mucomimetic materials are also presented. Then a selection of preparative techniques and testing methods are described (at molecular as well as micro and macroscale) that may support the pharmaceutical development of mucus interactive systems and assist formulators in the scale-up and industrialization steps. Recent applications of mucoadhesive systems (including medical devices) intended for different routes of administration (oral, gastrointestinal, vaginal, nasal, ocular, and intravesical) and for the treatment of difficult to treat pathologies or the alleviation of symptoms are described.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Research Group for Nano-Bio Science, National Food Institute, University of Leeds, University of Erlangen-Nuremberg, University of Pavia, University of Oslo, S.I.I.T. S.r.l Pharmaceutical & Health Food Supplements, University of Copenhagen
Authors: Mackie, A. (Ekstern), Goycoolea, F. M. (Ekstern), Menchicchi, B. (Ekstern), Caramella, C. M. (Ekstern), Saporito, F. (Ekstern), Lee, S. (Intern), Boutrup Stephansen, K. (Intern), Chronakis, I. S. (Intern), Hlorth, M. (Ekstern), Adamczak, M. (Ekstern), Waldner, M. (Ekstern), Nielsen, H. M. (Ekstern), Marcelloni, L. (Ekstern)
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In-situ investigations of structural changes during cyclic loading by high resolution reciprocal space mapping

Abstract A major failure reason for structural materials is fatigue-related damage due to repeatedly changing mechanical loads. During cyclic loading dislocations self-organize into characteristic ordered structures, which play a decisive role for the materials lifetime. These heterogeneous dislocation structures can be identified using advanced electron microscopy and synchrotron techniques. A detailed characterization of the microstructure during cyclic loading by in-situ monitoring the internal structure within individual grains with high energy x-rays can help to understand and predict the materials behavior during cyclic deformation and to improve the material design. While monitoring macroscopic stress and strain during cyclic loading, reciprocal space maps of diffraction peaks from single grains are obtained with high resolution. High Resolution Reciprocal Space Mapping was applied successfully in-situ during cyclic deformation of macroscopic aluminium samples at the Advanced Photon Source to reveal the structural reorganization within single grains embedded in the bulk material during fatigue.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Leibniz Institute for Solid State and Materials Research Dresden, Deutsches Elektronensynchrotron DESY
Authors: Diederichs, A. M. (Intern), Thiel, F. (Ekstern), Lienert, U. (Ekstern), Pantleon, W. (Intern)
Pages: 268-274
Publication date: 2017
Conference: 3rd International Symposium on Fatigue Design and Material Defects (FDMD 2017), Lecco, Italy, 19/09/2017 - 19/09/2017
Main Research Area: Technical/natural sciences
In situ observations of graphite formation during solidification of cast iron

Grey cast irons are a group of alloys with a unique combination of properties in terms of mechanical performance and castability. These properties are strongly related to their composite structure where graphite precipitates are embedded in a metallic matrix. The graphite precipitates form during solidification and growth continues throughout solid state cooling and the eutectoid transformation. Years of research have greatly improved the understanding of the basic mechanisms that control graphite growth as well as the ability to control graphite morphology during industrial production of cast components. This is important since the shapes of the graphite precipitates play a determining role for the properties of grey cast irons. However, to reach the full potential of cast irons and enable high-performance light-weight designs, more in-depth knowledge of the mechanisms controlling graphite growth and morphological developments is required. It is the aim of the present thesis to contribute with new insights within these fields.

In ductile cast irons graphite precipitate as spheroids which result in a material in which the mechanical properties are similar to those of steel. To predict the mechanical properties of ductile cast iron it is important to estimate the density of nodules as well as the distribution of nodule shapes and sizes at room temperature. This emphasises the importance of models which can correctly describe the nucleation and growth of spheroidal graphite during solidification.

In this thesis, the solidification of cast iron is studied with focus on formation and growth of spheroidal graphite. To this end, an experiment is conducted at the Diamond Light Source synchrotron facility in Harwell, UK: Employing an environmental cell developed at the Manchester X-ray Imaging Facility at the University of Manchester, a small cylindrical sample of ductile cast iron is melted. During re-solidification, the sample is continuously imaged. As a result, the first time resolved imaging of graphite formation in three dimensions is presented in the present thesis.

A comparison of a one dimensional model for spheroidal graphite growth to experimental observations showed that the model can describe the observations relatively well despite its simplicity. The investigation also showed that a gradually decreasing growth rate towards the end of solidification is not reflected in the model in spite of an extension to solid state growth presented in the present thesis. From the analysis it is clear that the presented data is of an unprecedented quality and that it represents a solid basis for validation of future models.

Solidification simulations of a ductile cast iron component highlights the importance of the nucleation model for the correct prediction of the final nodule density as well as the cooling curve. The tomographic data showed that nucleation within the studied sample is initiated at very high undercoolings and that it accelerates rapidly as eutectic solidification takes off. Experimental data can be reasonably described by two different models both emphasising the importance of taking into account the fraction solid in nucleation models.

Since very limited graphite particle movement is observed during the course of solidification, the particles must be anchored in austenite and most likely also encapsulated while they grow. Simultaneously, spherical graphite particles undergo significant morpho-logical changes and in many cases develop irregular features. Furthermore, the particles which are the most irregular after solidification grow significantly faster than their regular counterparts and it seems that fast growth is associated to the development of irregular features. These observations are slightly surprising and highly interesting as it is usually assumed that irregular graphite shapes develop when the graphite is in contact with the liquid melt. These results have important implications for how degeneracy of spheroidal graphite should be understood and theoretically described in the future.
In-situ regeneration of activated carbon with electric potential swing desorption (EPSD) for the H₂S removal from biogas
In-situ regeneration of a granular activated carbon was conducted for the first time using electric potential swing desorption (EPSD) with potentials up to 30V. The EPSD system was compared against a standard non-potential system using a fixed-bed reactor with a bed of 10g of activated carbon treating a gas mixture with 10,000ppm H₂S. Breakthrough times, adsorption desorption volume, capacities, effect of regeneration and desorption kinetics were investigated. The analysis showed that desorption of H₂S using the new EPSD system was 3 times quicker compared with the no potential system. Hence, physical adsorption using EPSD over activated carbon is efficient, safe and environmental friendly and could be used for the in-situ regeneration of granular activated carbon without using a PSA and/or TSA system. Additionally, adsorption and desorption cycles can be obtained with a classical two column system, which could lead towards a more efficient and economic biogas to biomethane process.
Intact stability analysis of dead ship conditions using FORM

The IMO Weather Criterion has proven to be the governing stability criteria regarding minimum GM for e.g. small ferries and large passenger ships. The formulation of the Weather Criterion is based on some empirical relations derived many years ago for vessels not necessarily representative for current new buildings with large superstructures. Thus it seems reasonable to investigate the possibility of capsizing in beam sea under the joint action of waves and wind using direct time domain simulations. This has already been done in several studies. Here it is combined with the First Order Reliability Method (FORM) to define possible combined critical wave and wind scenarios leading to capsize and corresponding probability of capsize. The FORM results for a fictitious vessel are compared with Monte Carlo simulation and good agreement is found at a much lesser computational effort. Finally, the results for an existing small ferry will be discussed in the light of the current weather criterion.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Lloyd's Register EMEA
Authors: Choi, J. H. (Intern), Jensen, J. J. (Intern), Kristensen, H. O. H. (Intern), Nielsen, U. D. (Intern), Erichsen, H. (Ekstern)
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1
Integrated Computational Modelling of Thermochemical Surface Engineering of Stainless Steel

An implicit finite difference method (FDM) based numerical model for the prediction of composition- and stress-depth profiles developing during low temperature gas nitriding (LTGN) of 316 stainless steel is presented. The essential effects governing the kinetics of composition and coupled stress evolution are taken into account in the model: concentration-dependent diffusion of nitrogen atoms, a slow surface reaction, elasto-plastic accommodation of lattice expansion and thermal and mechanical influences on thermodynamics (solubility) and diffusion kinetics. The model is one-dimensional and assumes a plane-stress mechanical state. Huge compressive stress levels and steep stress gradients have previously been suggested to have an influence on the concentration profile. The corresponding large plastic deformation that occurs in the developing case is addressed in the model by isotropic plasticity and force equilibrium. The model is used to explore the role and to assess the kinetics of the surface reaction.
Integrated Quality Control of Precision Assemblies using Computed Tomography

Computed Tomography (CT) is bringing about a profound change in the way that tolerance verification is performed in industry. CT allows the inner and the outer geometry of a workpiece to be measured without the need for external access or destructive testing. These are significant advantages over coordinate measuring machines (CMMs) when working with complex and fragile parts. This Ph.D. project at DTU Mechanical Engineering concerns the applicability of CT for quality control of precision assemblies. Investigations to quantify the accuracy of CT measurements, reference artefacts to correct systematic errors in CT, and an international comparison on CT of Assemblies have been carried out during the project.

A series of investigations regarding the influence of the CT post-processing factors on the accuracy of CT measurements was carried out. Post-processing factors such as surface determination, data filtering and feature fitting were considered within the present investigations. The investigations were conducted on two CT systems, showing different metrological performances, and involved a variety of multi-material assemblies, having different shapes and materials. The investigation results have showed that CT measurements on assemblies can be successfully conducted and that the surface determination method appears to be able to segment multi-material workpieces without any loss of accuracy.

A novel type of artefact for calibration of the scale error in CT has been developed within the project. One kind of artefact comprises a carbon fibre tubular structure on which a number of reference ruby spheres are glued. Another kind comprises an invar disc on which several reference ruby spheres are positioned at different heights using carbon fibre rods. The artefact is positioned and scanned together with the workpiece inside the CT scanner producing a 3D reference system for the measurement. The two artefacts were calibrated on a tactile CMM and their applicability demonstrated using different calibrated workpieces. The use of the developed artefacts ensures a considerable reduction of time by compressing the full process of calibration, scanning, measurement, and re-calibration, into a single imaging. The use of the artefacts also allows a considerable reduction of the amount of data generated from CT scanning.

Interlaboratory comparison on Computed Tomography of assemblies was carried out as a part of the Ph.D. study. The comparison involved 22 research laboratories from 7 countries, and was based on the circulation of two assemblies. With respect to previous comparisons that only focused on physical items, the present comparison introduced a voxel item, which was an assembly scanned by the coordinator and distributed electronically to participants. The comparison results demonstrated that (i) length measurements are made without problems by most of the participants who corrected systematic errors effectively; (ii) CT post-processing has a sizable impact as the measurand complexity increases; (iii) the majority of the participants stated measurement uncertainties although many of them provided poor statements.
Integrated working fluid-thermodynamic cycle design of organic Rankine cycle power systems for waste heat recovery

Today, some established working fluids are being phased out due to new international regulations on the use of environmentally harmful substances. With an ever-increasing cost to resources, industry wants to converge on improved sustainability through resource recovery, and in particular waste heat recovery. In this paper, an organic Rankine cycle process and its pure working fluid are designed simultaneously for waste heat recovery of the exhaust gas from a marine diesel engine. This approach can overcome design issues caused by the high sensitivity between the fluid and cycle design variables and otherwise high resource demands, which through conventional methods cannot be addressed. The global optimal design was a 1.2 MW cycle with 2,2,3,3,4,4,5,5-octafluorohexane as the new fluid. The fluid has no ozone depletion potential and a global warming potential under the regulatory limit. By using the simultaneous design approach the optimum solution was found in 5.04 s, while a decomposed approach found the same solution in 5.77 h. However, the decomposed approach provided insights on the correlation between the fluid and cycle design variables by analyzing all possible solutions. It was shown that the high sensitivity between the fluid and cycle design variables was overcome by using the simultaneous approach. Correlation between net power output and the product of the overall heat transfer coefficient and the heat transfer area could further be addressed by employing a new solution strategy including maximum constraints for this product. The use of such constraints resulted in the design of a new fluid (5-chloro-4,5,5-trifluoro-2,3-dimethylpent-2-ene) with a 1.25 MW net power output. Finally, a comparison with conventional fluids was shown where 2,2,3,3,4,4,5,5-octafluorohexane offered an improvement on net power output and economic and environmental metrics.
Integration of Fiber-Reinforced Polymers in a Life Cycle Assessment of Injection Molding Process Chains with Additive Manufacturing

Additive manufacturing technologies applied to injection molding process chain have acquired an increasingly important role in the context of tool inserts production, especially by vat polymerization. Despite the decreased lifetime during their use in the injection molding process, the inserts come with improvements in terms of production time, costs, exibility, as well as potentially improved environmental performance as compared to conventional materials in a life cycle perspective. This contribution supports the development of additively manufactured injection molding inserts with the use of fiber-reinforced vat polymerization technology. The life cycle assessment of the prototyping process chain for rapid prototyping with high exibility provides a base for industrial applications in injection molding.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Hofstätter, T. (Intern), Bey, N. (Intern), Mischkot, M. (Intern), Stotz, P. M. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Pages: 287-295
Publication date: 2017

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ISBN (Electronic): 978-3-319-66866-6
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Additive Manufacturing in Products and Applications (AMPA 2017), Zürich, Switzerland, 13/09/2017 - 13/09/2017
Fiber-reinforced Polymers, Life Cycle Assessment, Additive Manufacturing, Injection Molding, Process Chains
DOIs:
Interface strength and degradation of adhesively bonded porous aluminum oxides

For more than six decades, chromic acid anodizing has been the main step in the surface treatment of aluminum for adhesively bonded aircraft structures. Soon this process, known for producing a readily adherent oxide with an excellent corrosion resistance, will be banned by strict international environmental and health regulations. Replacing this traditional process in a high-demanding and high-risk industry such as aircraft construction requires an in-depth understanding of the underlying adhesion and degradation mechanisms at the oxide/resin interface resulting from alternative processes. The relationship between the anodizing conditions insulfuric and mixtures of sulfuric and phosphoric acid electrolytes and the formation and durability of bonding under various environmental conditions was investigated. Scanning electron microscopy was used to characterize the oxide features. Selected specimens were studied with transmission electron microscopy coupled with energy-dispersive X-ray spectroscopy to measure resin concentration within structurally different porous anodic oxide layers as a function of depth. Results show that there are two critical morphological aspects for strong and durable bonding. First, a minimum pore size is pivotal for the formation of a stable interface, as reflected by the initial peel strengths. Second, the increased surface roughness of the oxide/resin interface caused by extended chemical dissolution at higher temperature and higher phosphoric acid concentration is crucial to assure bond durability under water ingress. There is, however, an upper limit to the beneficial amount of anodic dissolution above which bonds are prone for corrosive degradation. Morphology is, however, not the only prerequisite for good bonding and bond performance also depends on the oxides’ chemical composition.

Interfacial crack arrest in sandwich beams subjected to fatigue loading using a novel crack arresting device – Numerical modelling

A novel crack arresting device is implemented in foam-cored composite sandwich beams and tested using the Sandwich Tear Test (STT) configuration. A finite element model of the setup is developed, and the predictions are correlated with observations and results from a recently conducted experimental fatigue test study. Based on a linear elastic fracture mechanics approach, the developed FE model is utilised to simulate crack propagation and arrest in foam-cored sandwich beam specimens subjected to fatigue loading conditions. The effect of the crack arresters on the fatigue life is analysed, and the predictive results are subsequently compared with the observations from the previously conducted fatigue tests. The FE model predicts the energy release rate and the mode mixity based on the derived crack surface displacements, utilising algorithms for the prediction of accelerated fatigue crack growth as well as the strain field evolution in the vicinity of the crack tip on the surface of the sandwich specimens. It is further shown that the developed finite element analysis methodology can be used to gain a deeper insight onto the physics and behavioural characteristics of the novel peel stopper concept, as well as a design tool that can be used for the implementation of crack arresting devises in engineering
applications of sandwich components and structures.

**General information**
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, Aalborg University
Authors: Martakos, G. (Ekstern), Andreasen, J. (Ekstern), Berggreen, C. (Intern), Thomsen, O. (Ekstern)
Number of pages: 17
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Journal of Sandwich Structures and Materials
ISSN (Print): 1099-6362
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.52 SJR 1.025 SNIP 1.101
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.314 SNIP 1.06 CiteScore 2.61
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.792 SNIP 0.818 CiteScore 1.21
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.758 SNIP 1.026 CiteScore 1.11
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.451 SNIP 1.094 CiteScore 0.7
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.506 SNIP 0.984 CiteScore 0.73
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.442 SNIP 1.218
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.043 SNIP 1.044
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.686 SNIP 0.737
Scopus rating (2007): SJR 0.72 SNIP 0.818
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.209 SNIP 0.438
Scopus rating (2005): SJR 0.178 SNIP 0.297
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.142 SNIP 0.282
Scopus rating (2003): SJR 0.188 SNIP 0.465
Scopus rating (2002): SJR 0.87 SNIP 0.694
Scopus rating (2001): SJR 0.621 SNIP 1.34
Scopus rating (2000): SJR 0.213 SNIP 0.898
Original language: English
Sandwich structures, Finite Element Analysis, Composites, Fracture Mechanics, Fatigue
Electronic versions:
Interfacial Crack Arrest in Sandwich Panels with Embedded Crack Stoppers Subjected to Fatigue Loading

A novel crack arresting device has been implemented in sandwich panels and tested using a special rig to apply out-of-plane loading on the sandwich panel face-sheets. Fatigue crack propagation was induced in the face-core interface of the sandwich panels which met the crack arrester. The effect of the embedded crack arresters was evaluated in terms of the achieved enhancement of the damage tolerance of the tested sandwich panels. A finite element (FE) model of the experimental setup was used for predicting propagation rates and direction of the crack growth. The FE simulation was based on the adoption of linear fracture mechanics and a fatigue propagation law (i.e. Paris law) to predict the residual fatigue life-time and behaviour of the test specimens. Finally, a comparison between the experimental results and the numerical simulations was made to validate the numerical predictions as well as the overall performance of the crack arresters.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Aalborg University
Authors: Martakos, G. (Ekstern), Andreasen, J. H. (Ekstern), Berggreen, C. (Intern), Thomsen, O. T. (Ekstern)
Pages: 55-76
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Composite Materials
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.49 SJR 0.554 SNIP 1.104
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.661 SNIP 1.225 CiteScore 1.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.788 SNIP 1.186 CiteScore 1.45
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.709 SNIP 1.878 CiteScore 1.44
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.513 SNIP 1.147 CiteScore 0.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.448 SNIP 1.292 CiteScore 1.02
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.613 SNIP 1.268
Interfacial Interaction of Oxidatively Cured Hydrogen Silsesquioxane Spin-On-Glass Enamel with Stainless Steel Substrate

Thin film silica coatings have proven to be efficient barrier coatings to protect stainless steels from corrosion in aggressive environments. The deposition of sub-μm silica films from liquid hydrogen silsesquioxane precursor has previously been demonstrated on metallic substrates, whereby the films were thermally cured in inert atmosphere, which required complicated processing equipment, such as gas or vacuum furnaces. In contrast, curing in air is a promising routine to simplify the curing process, reduce curing cost and increase the curing efficiency. In the present work, silica-like thin films were deposited on 316L grade austenitic stainless steel and oxidatively cured at 450 °C in ambient air. Oxidative curing yielded well adherent films which solely showed microscopic delamination after standardized adherence testing. Further, the oxidative curing led to the formation of a pronounced interfacial duplex-oxide with an outer zone composed of Fe₂O₃ in a SiO₂-x matrix and an inner zone composed of complex (Cr³⁺,Fe²⁺,Mn²⁺)-oxides. Moreover, a Cr depletion of the substrate in the immediate vicinity of the surface was observed. It was concluded that the interfacial formation is controlled by the kinetic limitation of Cr transport to the interface, which consequently led to the Cr-depletion of the sub-surface region.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Center for Electron Nanoscopy, SiOx ApS
Authors: Lampert, F. (Intern), Kadkhodazadeh, S. (Intern), Jensen, A. H. (Ekstern), Din, R. U. (Intern), Møller, P. (Intern)
Pages: C231-C239
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of The Electrochemical Society
Volume: 164
Issue number: 6
ISSN (Print): 0013-4651
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Interfacial Shear Rheology of β-Lactoglobulin - Bovine Submaxillary Mucin Layers Adsorbed at Air/Water Interface

The interfacial rheological properties of solutions of β-lactoglobulin (BLG), as a model food compound, mixed with bovine submaxillary mucin (BSM), a major salivary protein, have been investigated. Time, frequency, stress sweep and flow measurements have been performed at different pHs (7.4, 5.0 and 3.0), to investigate the air/water interfacial properties. All protein layers (BLG, BSM, and BLG-BSM mixtures) formed an elastic network at the air/water interface with low frequency dependence of the interfacial modulus. The results indicated that BLG moves faster as smaller molecule than mucin, and dominate the surface adsorption and the network formation for the BLG-BSM mixtures. Moreover, BLG-BSM protein mixtures exhibited interfacial properties with lower elastic and viscous moduli than BLG, as a result of competitive displacement of BLG proteins with BSMs from the interface. It is suggested that hydrophobic patches of BSM can be imbedded into the BLG monolayer as driven by a strong hydrophobic interaction with air and disrupt the cohesive assembly of BLG, whereas the hydrophilic (negatively charged) parts of the BSM chain are protruding from the interface towards the bulk water.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering, Technical University of Denmark
Authors: Celebioglu, H. Y. (Intern), Kmiecik-Palczewska, J. (Forskerdatabase), Lee, S. (Intern), Chronakis, I. S. (Intern)
Number of pages: 11
Pages: 857-867
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: International Journal of Biological Macromolecules
Volume: 102
ISSN (Print): 0141-8130
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.84 SJR 0.872 SNIP 1.288
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.815 SNIP 1.316 CiteScore 3.38
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.861 SNIP 1.325 CiteScore 3.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.849 SNIP 1.452 CiteScore 3.48
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.796 SNIP 1.313 CiteScore 2.77
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.689 SNIP 1.21 CiteScore 2.73
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.865 SNIP 1.211
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.799 SNIP 1.189
Internal Casting Stresses and Dimensional Stability

It is common knowledge that cast iron components may be affected by the presence of residual stresses. This often represents a serious threat, because residual stresses almost invariably cause a significant degradation of the most important material properties, such as reduced fracture toughness, accelerated stress corrosion, decreased fatigue resistance, and so on. In addition, they can also be responsible for undesirable shape distortions, which may compromise the fulfillment of geometrical tolerance requirements. As a consequence, a good understanding of what residual stresses are, how they form during the process, and how they can be prevented or at least minimized is indispensable to achieve the highest casting quality.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Andriollo, T. (Intern), Vedel-Smith, N. K. (Intern), Thorborg, J. (Intern), Hattel, J. H. (Intern)
Pages: 600-605
Publication date: 2017

Internal Combustion Engine Principles with Vehicle Applications

The book is an introductory text on the subject of internal combustion engines, intended for use in engineering courses at the senior or introductory graduate student level. The focus is on describing the basic principles of engine operation on a broad basis, to provide a foundation for further study, research and development. The goal is to describe the main variables involved in engine operation of different engine types, and how their interaction determines engine performance. Topics included are: general engine parameters, thermodynamic cycles including simple engine simulation, air exchange processes, combustion in different engine types, exhaust emissions, engine control including mean value engine models, pressure charging, fuels and fuel systems, balancing, friction, and heat transfer. In addition, methods to establish the connection between engine characteristics and vehicle performance in terms of acceleration, maximum speed and fuel consumption are presented.

General information
State: Published
Internal shear cracking in bulk metal forming

This paper presents an uncoupled ductile damage criterion for modelling the opening and propagation of internal shear cracks in bulk metal forming. The criterion is built upon the original work on the motion of a hole subjected to shear with superimposed tensile stress triaxiality and its overall performance is evaluated by means of side-pressing formability tests in Aluminium AA2007-T6 subjected to different levels of pre-strain. Results show that the new proposed criterion is able to combine simplicity with efficiency for predicting the onset of fracture and the crack propagation path for the entire set of test cases regardless the amount of pre-strain derived from previous upsetting under near frictionless conditions. The new proposed criterion can be easily implemented in existing finite element programs and its scope of application allows extending previous work on the opening modes in surface cracking to internal cracks formed under three-dimensional states of stress that are typical of bulk metal forming.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Lisbon
Authors: Christiansen, P. (Intern), Nielsen, C. V. (Intern), Bay, N. O. (Intern), Martins, P. A. F. (Ekstern)
Number of pages: 12
Publication date: 2017
Main Research Area: Technical/natural sciences
Investigation of different piston ring curvatures on lubricant transport along cylinder liner in large two-stroke marine diesel engines

A theoretical investigation of the hydrodynamic lubrication of the top compression piston ring in a large two-stroke marine diesel engine is presented. The groove mounted piston ring is driven by the reciprocal motion of the piston. The ring shape follows a circular geometry and the effect of changes in radii is analysed. A numerical model based on the finite difference method in 1D has been developed for solving Reynolds equation in combination with the load equilibrium equation together with flow continuity between the piston ring surface and liner for analysis of the lubricant transport. The cyclic variation throughout one stroke is presented for the minimum film thicknesses at different interesting locations of the piston ring surface together with the friction and the pressure distribution history. The aforementioned parameters have been investigated numerically. The numerical results are presented and discussed.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, MAN Diesel & Turbo SE
Authors: Overgaard, H. (Intern), Klit, P. (Intern), Vølund, A. (Ekstern)
Number of pages: 9
Publication date: 2017
Main Research Area: Technical/natural sciences

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Ratings:
BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.18 SJR 0.634 SNIP 0.819
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.61 SNIP 0.858 CiteScore 0.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Investigation of journal orbit and flow pattern in a dynamically loaded journal bearing

A hydrodynamic journal bearing has been investigated using both the traditional two-dimensional (2D) Reynolds equation, and the full solution being the three-dimensional (3D) Navier-Stokes equations.

The two approaches are compared by performing an investigation of two inlet groove designs: the axial and the circumferential groove, respectively, on a bearing with length-to-diameter ratio of 0.5 exposed to a sinusoidal load pattern. Pressure distributions, journal orbits and frictional losses are compared. The modelling of grooves by pressure boundary conditions versus geometric conditions is examined. It is investigated if the presence of a groove increases frictional losses and the increase relates to groove dimensions. Furthermore, the influence of the groove design on the flow field is studied using the 3D solution.

General information
State: Published
Organisations: Center for Bachelor of Engineering Studies, Afdelingen for Maskin og Design, Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Solid Mechanics, MAN Diesel & Turbo
Authors: Christiansen, C. K. (Intern), Walther, J. H. (Intern), Klit, P. (Intern), Vølund, A. (Ekstern)
Pages: 450-457
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Investigation of moisture uptake into printed circuit board laminate and solder mask materials

Presence of moisture in a printed circuit board (PCB) laminate, typically made of glass fibres reinforced epoxy polymer, significantly influences the electrical functionality in various ways and causes problems during soldering process. This paper investigates the water uptake of laminates coated with different solder mask materials and exposed to saturated water vapour and liquid water. The solder masks are characterised for their microstructure and constituent phases using scanning electron microscopy and X-ray diffraction. The observations are correlated with the moisture absorption characteristic such as diffusivity, permeability, and solubility. In addition, the effect of a reflow soldering simulation on microstructural changes and on increase of water uptake of the materials has been analysed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Conseil, H. (Intern), Gudla, V. C. (Intern), Borgaonkar, S. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Number of pages: 14
Pages: 6138-6151
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Main Research Area: Technical/natural sciences

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Journal: Journal of Materials Science: Materials in Electronics
Volume: 28
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.82 SJR 0.481 SNIP 0.798
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.52 SNIP 0.814 CiteScore 1.93
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.561 SNIP 1.012 CiteScore 2.06
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.65 SNIP 1.208 CiteScore 2.27
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.577 SNIP 0.962 CiteScore 1.75
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.486 SNIP 0.884 CiteScore 1.47
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.571 SNIP 0.841
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.603 SNIP 0.901
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.694 SNIP 0.848
Scopus rating (2007): SJR 0.644 SNIP 0.814
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.58 SNIP 0.746
Scopus rating (2005): SJR 0.503 SNIP 0.784
Investigation of process parameters influence on flash formation in injection moulding of polymer micro features through design of experiments

Micro injection moulding is one of the key technologies for micro manufacture due to its mass-production capability and relatively low component cost. Flash defects are among the most critical issues in the replication of micro features and constitute a manufacturing constrain in applying injection moulding in a range of micro engineering applications. In the present research the effects of four processing parameters on the amount of flash on a micro finger test structure were investigated using two different polymer materials and applying DOE approach. In particular, the following process parameters were considered: injection speed, holding pressure, melt temperature and mould temperature. The study revealed that for the materials with lower viscosity the injection speed, followed by barrel temperature, are the most influential parameters for increasing the amount of flash. On the other hand, barrel temperature, injection velocity, and mould temperature resulted as the most influential parameters for increasing the flash amount when moulding with high viscosity materials. Conversely, the holding pressure did not have a clear effect on the flash amount.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Mansoura University
Authors: Eladl, A. (Ekstern), Tosello, G. (Intern), Mostafa, R. (Ekstern), Soltan, H. (Ekstern), Hansen, H. N. (Intern)
Number of pages: 1
Publication date: 2017
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Main Research Area: Technical/natural sciences
Electronic versions:
Euspen2017_Abdelkhalik_IM_features.pdf
Publication: Research - peer-review › Poster – Annual report year: 2017

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
Main Research Area: Technical/natural sciences
Investigation of the molecular level interactions between mucins and food proteins: Spectroscopic, tribological and rheological studies

The thesis investigated the structure and molecular-level interaction of β-lactoglobulin (BLG) and mucins, representing major components of the dairy products and saliva/digestion systems, respectively. Mucins are long glycoprotein molecules responsible for the gel nature of the mucous layer covers epithelial surfaces throughout the body. A literature review of the interactions of different mucin types and saliva mucins with several food proteins and food protein emulsions, as well as their functional properties related to the food oral processing is presented at the first chapter of the thesis (Paper V). Most of the studies suggest an electrostatic attraction between positively charged food proteins with negatively charged moieties of mucins (mainly on glycosylated region of mucins).

The structural changes occurring during the interaction between BLG, the major whey protein, and bovine submaxillary mucin (BSM), a major salivary protein, were studied using high and low field Nuclear Magnetic Resonance (NMR), Dynamic Light Scattering (DLS), and Circular Dichroism (CD) spectroscopy. The zeta potentials of the proteins were also measured to provide information on the role of electrostatic forces in the interaction. These spectroscopic results suggested that the interaction between BSM and BLG led to a compact aggregation. The interaction between the two proteins was concluded to be mostly of hydrophilic origin (Paper I). The interaction characteristics between mucins and BLG under tribological stress were investigated by comparing the lubricity of mixed solutions of mucin-BLG with that of neat protein solutions at compliant hydrophobic interfaces. BSM and porcine gastric mucin (PGM) showed distinctly higher adsorbed masses compared to BLG onto polydimethylsiloxane (PDMS) or polystyrene (PS) surfaces. The adsorbed masses of the mixed protein solutions, namely BLG-BSM and BLG-PGM, reduced significantly. The dominant lubrication mechanism of the protein solutions was boundary lubrication. The pH-dependent lubricating properties of BLG-BSM mixed solutions appeared to be determined by competitive adsorption of the two proteins onto the substrates, which suggests that they do not form as strong aggregates as BLG-saliva, especially under tribological stress (Paper II). Moreover, the interfacial rheological properties of solutions of BLG mixed with BSM have been investigated. BLG-BSM protein mixtures exhibited interfacial properties with lower elastic and viscous moduli than BLG, as a result of competitive displacement of BLG proteins with BSMs from the interface. It is suggested that hydrophobic patches of BSM can be imbedded into the BLG monolayer as driven by a strong hydrophobic interaction with air and disrupt the cohesive assembly of BLG, whereas the hydrophilic (negatively charged) parts of the BSM chain are protruding from the interface towards the bulk water (Paper III). To elucidate the interaction mechanisms of BLG and two types of mucins, BSM and PGM, specifically focusing on the role of hydrophobic residues of the proteins at different pH conditions, intrinsic fluorescence spectroscopy, the fluorescent dye ANS techniques and high field NMR spectroscopy were used. Results from intrinsic fluorescence spectroscopy indicated stronger hydrophobic interactions of BLG with PGM than with BSM, which was further supported by extrinsic fluorescence spectroscopy. Stronger interactions of BLG with PGM also suggest a more abundant presence of hydrophobic moieties in PGM than BLG. Furthermore, HF-NMR studies indicated that the hydrophilic interaction also contributed to the interactions with both mucins, especially at acidic conditions (Paper IV). In the final Chapter VI, the tribological and physicochemical properties (emulsion particle size, viscosity, contact angle measurements, microscopy) of a model mucus compound, namely highly concentrated BSM, with the negatively charged BLG-stabilized emulsion (at pH 6.8) were determined as an attempt to understand the physicochemical basis of BLG-stabilized emulsion in the oral environment.

General information
State: Published
Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Celebioglu, H. Y. (Intern), Chronakis, I. S. (Intern), Lee, S. (Intern), Guðjónsdóttir, M. (Intern)
Number of pages: 160
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Publisher: National Food Institute, Technical University of Denmark
Original language: English
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Projects:
Investigation of the molecular level interactions between mucins and food proteins: Spectroscopic, tribological and rheological studies
Publication: Research › Ph.D. thesis – Annual report year: 2018
Investigation of Tooling for Anisotropic Optical Functional Surfaces

This paper studied steel inserts with anisotropic surfaces for injection moulding. The inserts surfaces were machined by a five-axis micro-milling machine and the surface structures will be replicated by injection moulding. The aim of the surface structuring is to maximize visible contrast between horizontally orthogonal textured surfaces from a certain viewing angle, of both the insert and the polymer replicas. The contrast is defined by the difference of the reflectance between two areas with horizontally orthogonal textures under a certainly fixed light source. The brightness of the surface is assessed by processing the images obtained from a digital microscope Hirox RH-2000 [1]. Figure 1 illustrates the studied surface structure and the microscope. The optical axis of microscope can be tilted within 90 degrees from the horizontal level, which simulates the viewing angle; the analysed surface texture can be rotated horizontally by the adjusting the stage so only one surface was used to achieve orthogonal textures and images at different rotation angle can be captured. Via image processing tool, the reflectance (brightness of the obtained images) will be analysed and therefore the contrast can be calculated.

Investigation on the micro injection molding process of an overmolded multi-material micro component

Micro injection molding (\(\mu\)IM) is one of the few technologies capable of meeting the increasing demand of complex shaped micro plastic parts. This process, combined with the overmolding technique, allows a fast and cost-efficient production of multi-material micro components, saving numerous and difficult assembly steps, being the plastic molded directly on a metal substrate. In this scenario, an investigation on the fully automated micro overmolding manufacturing technology of a three-material micro component for acoustic applications has been carried out. Preliminary experiments allowed to identify an initial process window by considering the main defects affecting the part quality (flashes and gate marks). Within this range, the effect of three injection molding parameters, namely mold temperature, melt temperature and injection speed, has been evaluated with respect to the critical geometrical characteristics of the component. An optical CMM with sub-micrometric resolution has been employed for the measurements. Results show that the process parameters have a significant influence on some component features, while others mainly depend on the insert alignment inside the micro mold cavity.

Is Earth recognized as a finite system in corporate responsibility reporting?

Companies are increasingly encouraged to frame their sustainability activities and communication around ecological limits, as captured by concepts such as planetary boundaries, climate tipping points or regenerative capacity. Ecological limits may serve as scientific basis for defining environmental sustainability targets at the company level and, moreover, inspire
companies to align their product portfolios with emerging societal needs related to sustainable transformations. Although corporate environmental reporting is widely researched, little attention has, hitherto, been given to company use of the ecological limits concepts in stakeholder communication. This study presents a comprehensive review of references made to ecological limits in corporate responsibility (CR) reports in 2000-2014. An exhaustive list of terms related to ecological limits was developed and used to search the CorporateRegister database, which contained approximately 40,000 CR reports from this time period. For every identified reference, we analyzed the context in which the ecological limit term was used in the CR report. We found a 10-fold increase in the number of references made to ecological limits in CR reports during the period 2000-2014. The number of CR reports published in this time period has also increased at a similar rate. Hence, the proportion of companies referring to ecological limits in their CR reports has over the years remained stable; roughly 5%. The most commonly invoked ecological limits were related to climate change and references to "2°C" were by far the most frequent. The vast majority of companies referring to ecological limits did so without specific references to ongoing or planned changes in their activities as a consequence of recognizing these limits. Only a small percentage, predominately high-tech companies (31 in total), explicitly used ecological limits to define targets for resource consumption, emissions reductions and/or as a stated reason for adjusting their product portfolio. In defining targets for resource consumption or emissions, only a few CR reports dealt explicitly with the issue of allocating resource and emission rights within ecological limits amongst companies and other actors. A longitudinal study of three companies showed that these did not directly report progress towards planned changes based on ecological limits and offered explanations as to why some companies abandoned planned changes altogether. Our findings provide novel insights into the current use of the ecological limits concept by companies and may be useful for actors trying to motivate companies to align their activities with the finite nature of Earth's natural systems.

**General information**

State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Mechanical Engineering, Aalborg University
Authors: Bjørn, A. (Intern), Bey, N. (Intern), Georg, S. (Ekstern), Røpke, I. (Forskerdatabase), Hauschild, M. Z. (Intern)
Pages: 106-117
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Cleaner Production
Volume: 163
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.83 SJR 1.615 SNIP 2.382
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.609 SNIP 2.383 CiteScore 5.57
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.661 SNIP 2.477 CiteScore 4.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.644 SNIP 2.581 CiteScore 4.47
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.706 SNIP 2.328 CiteScore 4.07
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.461 SNIP 1.825 CiteScore 3.19
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Iterative Brinkman penalization for simulation of impulsively started flow past a sphere and a circular disc

We present a Brinkman penalization method for three-dimensional (3D) flows using particle vortex methods, improving the existing technique by means of an iterative process. We perform simulations to study the impulsively started flow past a sphere at Re=1000 and normal to a circular disc at Re=500. The simulation results obtained for the flow past a sphere are found in qualitative good agreement with previously published results obtained using respectively a 3D vortex penalization method and a 3D vortex method combined with an accurate boundary element method. From the results obtained for the flow normal to a circular disc it is found that the iterative method enables the use of a time step that is one order of magnitude larger than required by the standard non-iterative Brinkman penalization method.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Spietz, H. J. (Intern), Hejlesen, M. M. (Intern), Walther, J. H. (Intern)
Pages: 261–274
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Computational Physics
Volume: 336
ISSN (Print): 0021-9991
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
Joining end-to-end tubing of dissimilar materials by forming
Kinetics analysis of two-stage austenitization in supermartensitic stainless steel

The martensite-to-austenite transformation in X4CrNiMo16-5-1 supermartensitic stainless steel was followed in-situ during isochronal heating at 2, 6 and 18 K min\(^{-1}\) applying energy-dispersive synchrotron X-ray diffraction at the BESSY II facility. Austenitization occurred in two stages, separated by a temperature region in which the transformation was strongly decelerated. The region of limited transformation was more concise and occurred at higher austenite phase fractions and temperatures for higher heating rates. The two-step kinetics was reproduced by kinetics modeling in DICTRA. The model indicates that the austenitization kinetics is governed by Ni-diffusion and that slow transformation kinetics separating the two stages is caused by soft impingement in the martensite phase. Increasing the lath width in the kinetics model had a similar effect on the austenitization kinetics as increasing the heating-rate.

General information
State: Published
Organisations: Centre for oil and gas – DTU, Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Nießen, F. (Intern), Villa, M. (Intern), Hald, J. (Intern), Somers, M. A. J. (Intern)
Number of pages: 8
Pages: 8-15
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Materials & Design
Volume: 116
ISSN (Print): 0264-1275
Ratings:
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.9 SJR 1.751 SNIP 2.481
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.822
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.93 SNIP 1.81
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68
Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Kinetics modeling of delta-ferrite formation and retainment during casting of supermartensitic stainless steel

The kinetics model for multi-component diffusion DICTRA was applied to analyze the formation and retainment of δ-ferrite during solidification and cooling of GX4-CrNiMo-16-5-1 cast supermartensitic stainless steel. The obtained results were compared with results from the Schaeffler diagram, equilibrium calculations and the Scheil model in Thermo-Calc, and validated by using microscopy and energy dispersive X-ray spectroscopy for chemical analysis on a cast ingot. The kinetics model showed that micro-segregation from solidification homogenizes within 2–3 s (70 °C) of cooling, and that retained δ-ferrite originates from the incomplete transformation to austenite. The kinetics model predicted the measured amount of δ-ferrite and the partitioning of Cr and Ni reasonably well. Further, it showed that slower cooling for the investigated alloy leads to less retained δ-ferrite, which is in excellent agreement with experimental results.

General information
State: Published
Organisations: Centre for oil and gas – DTU, Department of Mechanical Engineering, Manufacturing Engineering, Materials and Surface Engineering
Authors: Nießen, F. (Intern), Tiedje, N. S. (Intern), Hald, J. (Intern)
Pages: 138-145
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Materials & Design
Volume: 118
ISSN (Print): 0264-1275
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.9 SJR 1.751 SNIP 2.481
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.822
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.93 SNIP 1.81
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68
Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Scopus rating (2004): SJR 0.52 SNIP 1.167
Scopus rating (2003): SJR 0.565 SNIP 1.201
Scopus rating (2002): SJR 0.574 SNIP 1.165
Scopus rating (2001): SJR 0.374 SNIP 0.59
Scopus rating (2000): SJR 0.242 SNIP 0.716
Scopus rating (1999): SJR 0.192 SNIP 0.339
Original language: English
Casting, Delta ferrite, Diffusion, Kinetics modeling, Solid state transformation, Solidification, Supermartensitic stainless steel
DOIs:
10.1016/j.matdes.2017.01.026
Source: FindIt
Source-ID: 2351072950
Publication: Research - peer-review › Journal article – Annual report year: 2017

Konvertering af en 2D AutoCAD model til en 3D konfigurerbar assembly for en Træningspavillon

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Christensen, G. K. (Intern)
Number of pages: 15
Publication date: 2017

Publication information
Media of output: PowerPoint
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Configurable_products_in_CAD.pdf
Source: PublicationPreSubmission
Source-ID: 1398009867
Publication: Communication › Sound/Visual production (digital) – Annual report year: 2017

Laser additive manufacturing of multimaterial tool inserts: a simulation-based optimization study
Selective laser melting is fast evolving into an industrially applicable manufacturing process. While components produced from high-value materials, such as Ti6Al4V and Inconel 718 alloys, are already being produced, the processing of multi-material components still remains to be achieved by using laser additive manufacturing. The physical handling of multi-material in a SLM setup continues to be a primary challenge along with the selection of process parameters/plan to achieve the desired results – both challenges requiring considerable experimental undertakings. Consequently, numerical process modelling has been adopted towards tackling the latter challenge in an effective manner.

In this paper, a numerical simulation based optimization study is undertaken to enable selective laser melting of multi-material tool inserts. A standard copper specimen covered by a thin layer of nickel is chosen, over which a layer of steel has been deposited using cold-spraying technique, such as to protect the microstructure of Ni during selective laser melting. The process modelled thus entails additively manufacturing a steel tool insert around the multi-material specimen with a goal of achieving a dense product while preventing recrystallization in the Nickel layer. The process is simulated
using a high-fidelity thermo-microstructural model with constant processing parameters to capture the effect on Nickel layer. Based on results, key structural and process parameters are identified, and subsequently an optimization study is conducted using evolutionary algorithms to determine the appropriate process parameter values as well as processing sequence. The optimized process plan is then used to manufacture real multi-material tool insert samples by selective laser melting.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Mohanty, S. (Intern), Hattel, J. H. (Intern)
Number of pages: 10
Publication date: 2017

**Host publication information**
Title of host publication: Proceedings of Laser 3D Manufacturing IV
Volume: 10095
Publisher: SPIE - International Society for Optical Engineering
Editors: Gu, B., Helvajian, H., Piqué, A., Dunsky, C. M., Liu, J.
Article number: 100950G
Series: Proceedings of SPIE - International Society for Optical Engineering
ISSN: 0277-786X
Main Research Area: Technical/natural sciences
Conference: Laser 3D Manufacturing IV, San Francisco, United States, 30/01/2017 - 30/01/2017
Selective laser melting, Multi-material tool inserts, Multiscale 3DADI-2DCA modelling, Thermomicrostructural analysis, Multiobjective optimization, Optimized process parameters

**Electronic versions:**
100950G.pdf
DOIs: 10.1117/12.2253600
Source: FindIt
Source-ID: 2358509177
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

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**Laser confocal microscope noise evaluation on injection compression moulded (ICM) transparent polymer Fresnel lenses**
The evaluation of an adequate and robust measuring strategy, for roughness assessment of polymer Fresnel lenses is put under assessment. An 'on-sample' measurement noise, is evaluated using a laser confocal microscope (OLYMPUS © Lext). Secondly, the lowest-noise roughness measuring procedure, on an injection compression moulded (ICM) Fresnel lens, is defined. A set of two different objectives is considered, i.e. a standard series (SO), against a long working distance one (LWD); two different magnifications objectives, 50x and 100x and the use or not of a dark environment. The noise evaluation is performed by comparing 'on-sample' noise with the one calculated on an optical flat. Noise is investigated by means of established methods, i.e. subtraction and averaging methods. Afterwards, the lowest-noise analysis is structured following a 23 full factorial experimental planning, whose factors are measuring working distance, objective magnification and room lighting. The result confirms a strong difference of noise, using the considered objectives. The most interesting result is that the performance of SO 50x objective is better than LWD 100x.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Milano
Number of pages: 1
Publication date: 2017
Event: Poster session presented at 17th euspen International Conference & Exhibition, Hannover, Germany.
Main Research Area: Technical/natural sciences

**Electronic versions:**
Poster_euspen2017_LaserScanningConfocal_v3.pdf
Source: PublicationPreSubmission
Source-ID: 13328653
Publication: Research - peer-review › Poster – Annual report year: 2017

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**Lessons Learnt from Experts in Design Rationale Knowledge Capture**
The focus of this paper is on the use of argumentation models and software tools to support knowledge capture in the design of long-life engineering products. The results of semi-structured interviews with a number of experts in the field are presented, exploring their collective experience of knowledge capture and eliciting guidelines for successful
implementation of such models and tools. The results of this research may be used as the basis for the design of future tools and techniques for knowledge capture.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Airbus Group Innovations
Authors: Hall, M. (Ekstern), Bermell-Garcia, P. (Ekstern), Ravindranath, R. (Ekstern), McMahon, C. A. (Intern)
Pages: 247-256
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of the 21st International Conference on Engineering Design (ICED 17) : Design Information and Knowledge
Volume: 6
Publisher: Design Society
Editors: Maier, A., Škec, S., Kim, H., Kokkolaras, M., Oehmen, J., Fadel, G., Salustri, F., Van der Loos, M.
ISBN (Electronic): 978-1-904670-94-0
Main Research Area: Technical/natural sciences
Conference: ICED17: 21st International Conference on Engineering Design, Vancouver, Canada, 21/08/2017 - 21/08/2017
Design rationale, Knowledge management, Argumentation, Information management, Technology
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**Life Cycle Assessment of Fiber-Reinforced Additive Manufacturing for Injection Molding Insert Production**

Additively manufactured (AM) injection molding (IM) inserts have proved to be capable to substitute conventionally manufactured metal inserts with polymer-based insert enforced with short, virgin, unseized carbon fibers (CFs). It has been shown that the implementation of AM technology resulted in significant improvements when investigating costs and cycle time for smaller part series. However, being a novel technology, AM inserts yield undesired characteristics, e.g. in terms of potential environmental impact because of the lower lifetime compared to metal inserts. Based on physical performance tests, this contribution provides a comparison of environmental performance of conventionally vs. additively manufactured inserts in a full life cycle perspective indicated in Figure 1, including materials, production, use and end-of-life (EoL) stages.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Management Engineering, Quantitative Sustainability Assessment
Authors: Hofstätter, T. (Intern), Stotz, P. M. (Intern), Bey, N. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 1
Publication date: 2017

**Host publication information**

Title of host publication: Book of Abstracts Sustain 2017
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
201712_DTUSustainConference_Abstract_v2_2
Source: PublicationPreSubmission
Source-ID: 140313219
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

**Linking Scales in Plastic Deformation and Fracture**

We investigate crack growth initiation and subsequent resistance in metallic materials by means of an implicit multi-scale approach. Strain gradient plasticity is employed to model the mechanical response of the solid so as to incorporate the role of geometrically necessary dislocations (GNDs) and accurately capture plasticity at the small scales involved in crack tip deformation. The response ahead of the crack is described by means of a traction-separation law, which is characterized by the cohesive strength and the fracture energy. Results reveal that large gradients of plastic strain accumulate in the vicinity of the crack, elevating the dislocation density and the local stress. This stress elevation enhances crack propagation and significantly lowers the steady state fracture toughness with respect to conventional plasticity. Important insight is gained into fracture phenomena that cannot be explained on the grounds of classic continuum theories. Namely, we show that strain gradient plasticity provides a rational basis for cleavage fracture in the presence of significant plastic flow, with the lattice cohesive strength being attained with meaningful values of the fracture energy and the length scale parameter. In addition, the investigation of short cracks in hydrogen-embrittled steels accounting for the
GND-effect shows that failure takes place at low ductility levels, in agreement with experimental observations.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, University of Cambridge
Authors: Martínez-Paneda, E. (Ekstern), Niordson, C. F. (Intern), S. Deshpande, V. (Ekstern), Fleck, N. A. (Ekstern)
Number of pages: 1
Pages: 123
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
Fracture, Cohesive zone model, Strain gradient plasticity, Cleavage
Electronic versions:
linking_scales.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Local microstructure and flow stress in deformed metals
The microstructure and flow stress of metals are related through many well-known strength-structure relationships based on structural parameters, where grain size and dislocation density are examples. In heterogeneous structures, the local stress and strain are important as they will affect the bulk properties. A microstructural method is presented which allows the local stress in a deformed metal to be estimated based on microstructural parameters determined by an EBSD analysis. These parameters are the average spacing of deformation introduced boundaries and the fraction of high angle boundaries. The method is demonstrated for two heterogeneous structures: (i) a gradient (sub)surface structure in steel deformed by shot peening; (ii) a heterogeneous structure introduced by friction between a tool and a workpiece of aluminum. Flow stress data are calculated based on the microstructural analysis, and validated by hardness measurement and 2D numerical simulations. A good agreement is found over a plastic strain range from ~1 to 5.

General information
State: Published
Organisations: Department of Wind Energy, Materials science and characterization, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Zhang, X. (Intern), Hansen, N. (Intern), Nielsen, C. V. (Intern)
Number of pages: 7
Publication date: 2017
Conference: 38th Risø International Symposium on Materials Science, Roskilde, Denmark, 04/09/2017 - 04/09/2017
Main Research Area: Technical/natural sciences

Publication information
Journal: I O P Conference Series: Materials Science and Engineering
Volume: 219
Article number: 012053
ISSN (Print): 1757-8981
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.39 SJR 0.187 SNIP 0.499
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.172 SNIP 0.281 CiteScore 0.22
Scopus rating (2014): SJR 0.186 SNIP 0.306 CiteScore 0.18
Scopus rating (2013): SJR 0.183 SNIP 0.256 CiteScore 0.16
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.161 SNIP 0.203 CiteScore 0.14
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.155 SNIP 0.149 CiteScore 0.1
ISI indexed (2011): ISI indexed no
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.

Low Loss Polycarbonate Polymer Optical Fiber for High Temperature FBG Humidity Sensing

We report the fabrication and characterization of a polycarbonate (PC) microstructured polymer optical fiber (mPOF) Bragg grating (FBG) humidity sensor that can operate beyond 100°C. The PC preform, from which the fiber was drawn, was produced using an improved casting approach to reduce the attenuation of the fiber. The fiber loss was found reduced by a factor of two compared to the latest reported PC mPOF [20], holding the low loss record in PC based fibers. PC mPOFBG was characterized to humidity and temperature, and a relative humidity (RH) sensitivity of 7.31 ± 0.13 pm/% RH in the range 10–90% RH at 100°C and a temperature sensitivity of 25.86 ± 0.63 pm/°C in the range 20–100 °C at 90% RH were measured.
Lubricant transport across the piston ring with flat and triangular lubrication injection profiles on the liner in large two-stroke marine diesel engines

A theoretical investigation of the lubricant transport across the top compression piston ring in a large two-stroke marine diesel engine is presented. A numerical model for solving Reynolds equation between the piston ring and cylinder liner based on the finite difference method in one dimension has been made. The model includes force equilibrium of the piston ring, perturbation of Reynolds equation, and transient mass conservation. The model represents a new method of achieving mass conservation across the piston ring and between different time-dependent positions. For analyzing the lubricant transport across the piston ring, two different kinds of initial lubricant profile on the liner and two different kinds of load are investigated i.e. a flat profile and an approximated triangular profile as well as no load and a combustion load based on a combustion pressure profile. The impact from the different load conditions and different lubricant profiles on the liner are presented for film thicknesses, development in the lubricant profiles on the liner as well as the lubricant consumption at each stroke.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Solid Mechanics, MAN Diesel & Turbo SE
Authors: Overgaard, H. T. (Intern), Klit, P. (Intern), Vølund, A. (Ekstern)
Number of pages: 11
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
ISSN (Print): 1350-6501
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.18 SJR 0.634 SNIP 0.819
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.61 SNIP 0.858 CiteScore 0.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.581 SNIP 0.917 CiteScore 0.89
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.034 CiteScore 0.83
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.658 SNIP 0.957 CiteScore 0.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.685 SNIP 1.174 CiteScore 0.8
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Make your own product in the Customerpedia

In a configuration system, we use the computers to store, examine, retrieve, and manipulate data related to products, demands and processes. The main consequences are fewer expenses for the customers and more revenue for producers.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Operations Management
Authors: Shafiee, S. (Intern)
Publication date: 2017

Publication information
Type: White paper
Source/Publisher: MADE - Manufacturing Academy of Denmark
Main Research Area: Technical/natural sciences
Electronic versions:
05_12_2017_Communication_paper.pdf
Links:
Source: PublicationPreSubmission
Source-ID: 140263635
Publication: Communication › Internet publication – Annual report year: 2017

Making the Transition to Circular Economy through readiness assessment

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: McAloone, T. C. (Intern), Pigosso, D. C. A. (Intern), Holstebroe, L. S. S. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
Title of host publication: Book of Abstracts, Sustain 2017
Martensite formation in Fe-C alloys at cryogenic temperatures

Magnetometry was applied to quantify the fraction of austenite retained in Fe-C alloys subjected to various treatments. These treatments consisted of: (i) water quenching; (ii) water quenching followed by immersion in boiling nitrogen and again in water; (iii) as for (ii) but re-heating from 77 K at a rate of 0.0083 K s\(^{-1}\); (iv) as for (iii) but (re-)heating at 0.167 K s\(^{-1}\) interrupted by an isothermal step. Data was coupled with hardness measurements and demonstrates that the re-heating conditions from 77 K significantly influence the fraction of austenite retained at the end of the thermal cycle.

General information

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Micro- and Nanotechnology, Magnetic Systems
Authors: Villa, M. (Intern), Hansen, M. F. (Intern), Somers, M. A. J. (Intern)
Pages: 129–132
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.71 SJR 1.901 SNIP 1.696
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.3 SNIP 1.876 CiteScore 3.54
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.744 SNIP 2.124 CiteScore 3.55
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.347 SNIP 1.975 CiteScore 3.19
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.309 SNIP 2.022 CiteScore 3.01
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.333 SNIP 2.108 CiteScore 3.21
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 2.445 SNIP 2.125
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Mass entrainment rate of an ideal momentum turbulent round jet

We propose a two-phase-fluid model for a full-cone turbulent round jet that describes its dynamics in a simple but comprehensive manner with only the apex angle of the cone being a disposable parameter. The basic assumptions are that (i) the jet is statistically stationary and that (ii) it can be approximated by a mixture of two fluids with their phases in dynamic equilibrium. To derive the model, we impose conservation of the initial volume and total momentum fluxes. Our model equations admit analytical solutions for the composite density and velocity of the two-phase fluid, both as functions...
of the distance from the nozzle, from which the dynamic pressure and the mass entrainment rate are calculated. Assuming a far-field approximation, we theoretically derive a constant entrainment rate coefficient solely in terms of the cone angle. Moreover, we carry out experiments for a single-phase turbulent air jet and show that the predictions of our model compare well with this and other experimental data of atomizing liquid jets.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Kyushu University
Authors: Medrano, F. F. (Ekstern), Fukumoto, Y. (Ekstern), Velte, C. M. (Intern), Hodzic, A. (Intern)
Number of pages: 10
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of the Physical Society of Japan
Volume: 86
Article number: 034401
ISSN (Print): 0031-9015
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.1 SJR 0.715 SNIP 0.602
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.719 SNIP 0.649 CiteScore 1.06
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.915 SNIP 0.607 CiteScore 1.04
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.807 SNIP 0.422 CiteScore 0.85
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.353 SNIP 0.733 CiteScore 1.39
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.935 SNIP 0.962 CiteScore 2.09
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.218 SNIP 1.004
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.076 SNIP 0.932
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.913 SNIP 0.957
Scopus rating (2007): SJR 1.824 SNIP 1.146
Scopus rating (2006): SJR 1.379 SNIP 0.917
Scopus rating (2005): SJR 1.262 SNIP 0.92
Scopus rating (2004): SJR 1.274 SNIP 0.809
Scopus rating (2003): SJR 1.506 SNIP 1.026
Scopus rating (2002): SJR 1.419 SNIP 0.987
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.482 SNIP 0.956
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.414 SNIP 1.057
Scopus rating (1999): SJR 1.679 SNIP 1.004
Original language: English
Electronic versions:
Mass Production Tools and Process Readiness for Uniform Parts—Injection Molding Application

A mass production always aims to produce uniform performing products. Production tools such as pressing dies, casting dies and injection moulds, play a significant role by producing uniform parts for achieving final products. Tool complexity increases when multiple cavities are present. These tools pass through several stages of quality maturation, before starting production, where the tool capability for part uniformity can be assessed, corrected and aligned to mass production variables. This research article describes the process of systematic understanding of the impact of variables and of finding opportunities to counter them. Application is assessed over a hypothetical plastic injection mould and found feasible. Proposed process could evaluate the tool capability for producing uniform parts, at its digital design verification and its physical validation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Boorla, S. M. (Intern), Eifler, T. (Intern), Howard, T. J. (Intern), McMahon, C. A. (Intern)
Pages: 30-40
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Main Research Area: Technical/natural sciences

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Journal: Journal of Polymer & Composites
Volume: 5
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Links:
http://engineeringjournals.stmjournals.in/index.php/JoPC/article/view/58
Publication: Research - peer-review › Journal article – Annual report year: 2017

Material testing of copper by extrusion-cutting

An investigation was carried out on the use of extrusion-cutting as a material test method operating at severe conditions of strain, strain-rate and temperature, such as in machining. In extrusion-cutting, a shoe constrains the chip back surface producing a geometrically defined orthogonal cutting process which can be modelled using methods from the theory of plasticity such as, e.g., slip-line and upper-bound. The process was previously proposed for use as a material testing technique to determine the shear flow stress of materials under strains, strain rates and temperatures relevant for analytical modelling of metal cutting. This work represents a new step where the final objective is the generation of stress-strain curves that can be used in analytical models as well as using Finite Element Method (FEM) simulations. A new experimental setup for extrusion-cutting using discs as workpieces was developed and implemented on a CNC lathe. An investigation was carried out extrusion-cutting copper discs using high-speed-steel cutting tools at 100 m/min cutting speed. Flow stress values for copper under machining-relevant conditions were obtained from measurement of the extrusion-cutting force on the tool and application of a simple upper-bound model for the extrusion-cutting process. An attempt to extend the validity of test data to cover a range of cutting conditions was made, and suggestions for improvement of the simple theoretical model given. (C) 2017 Published by Elsevier B.V.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Segalina, F. (Ekstern), De Chiffre, L. (Intern)
Pages: 375-380
Publication date: 2017
Conference: 16th CIRP Conference on Modelling of Machining Operations, Cluny, France, 15/06/2017 - 15/06/2017
Main Research Area: Technical/natural sciences

Publication information
Mathematical modelling of moisture transport into an electronic enclosure under non-isothermal conditions

In contrast to high fidelity CFD codes which require higher computational effort/time, the well-known Resistor-Capacitor (RC) approach requires much lower calculation time, but has a lower resolution of the geometrical arrangement. Therefore, for enclosures without too complex geometry in their interior, it is more efficient to use the RC method for thermal management and design of electronic compartments. Thus, the objective of this paper is to build an in-house code based on the RC approach for simulating coupled heat and mass transport into a (closed) electronic enclosure. The developed code has the capability of combining lumped components and a 1D description. Heat and mass transport is based on a FVM discretization of the heat conduction equation and Fick’s second law. Simulation results are compared with corresponding experimental findings and good agreement is found. Since, the paper concerns climatic cyclic conditions, a study is accomplished on investigating different material properties (thermal conductivity, diffusivity, solubility) for moisture control inside an enclosure. Further simulations were performed to study the response of temperature and moisture inside an enclosure exposed to the B2 STANAG climatic cyclic conditions. Moreover, the time for moisture build-up inside an enclosure under cyclic conditions is presented for different material properties.
The focus of this work is on two new techniques for imposing maximum length scale in topology optimization. Restrictions on the maximum length scale provide designers with full control over the optimized structure and open possibilities to tailor the optimized design for a broader range of manufacturing processes by fulfilling the associated technological constraints. One of the proposed methods is based on combination of several filters and builds on top of the classical density filtering which can be viewed as a low pass filter applied to the design parametrization. The main idea is to construct band pass filter which restricts the appearance of very thin and very thick elements in the design. In combination with the robust design optimization formulation the methodology results in manufacturable designs without the need of any post processing. The second technique provides more strict control on the maximum design features and is developed with the help of morphological operators. The formulation relies on a small number of additional constraints. Both approaches are demonstrated on optimization problems in linear elasticity.

**Maximum length scale in density based topology optimization**

The focus of this work is on two new techniques for imposing maximum length scale in topology optimization. Restrictions on the maximum length scale provide designers with full control over the optimized structure and open possibilities to tailor the optimized design for a broader range of manufacturing processes by fulfilling the associated technological constraints. One of the proposed methods is based on combination of several filters and builds on top of the classical density filtering which can be viewed as a low pass filter applied to the design parametrization. The main idea is to construct band pass filter which restricts the appearance of very thin and very thick elements in the design. In combination with the robust design optimization formulation the methodology results in manufacturable designs without the need of any post processing. The second technique provides more strict control on the maximum design features and is developed with the help of morphological operators. The formulation relies on a small number of additional constraints. Both approaches are demonstrated on optimization problems in linear elasticity.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Lazarov, B. S. (Intern), Wang, F. (Intern)
Pages: 826–844
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Computer Methods in Applied Mechanics and Engineering
Volume: 318
ISSN (Print): 0045-7825
Measured resolved shear stresses and active slip systems in austenitic steel

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Xnovo Technology ApS
Authors: Winther, G. (Intern), Juul, N. Y. (Intern), Oddershede, J. (Ekstern)
Publication date: 2017
Event: Abstract from 18th International Conference on Textures of Materials (ICOTOM 18), St. George, Utah, United States.
Main Research Area: Technical/natural sciences
Electronic versions: Abstract_Grethe_Winther.pdf

Relations
Activities:
Measured resolved shear stresses and active slip systems in austenitic steel
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Measured resolved shear stresses and Bishop-Hill stress states in individual grains of austenitic stainless steel
The full three-dimensional stress state of 172 individual bulk grains in austenitic stainless steel 316L at 0.1 and 1% sample elongation has been determined with sufficient accuracy to allow comparison with the theoretical Bishop-Hill stress states for plastically deforming grains as well as calculation of the resolved shear stresses on the individual slip systems. At 0.1%, the resolved shear stresses exhibit quite large variations between grains of similar orientation. When averaging over similarly oriented grains, the resolved shear stresses correspond to the Schmid factors for uniaxial tension. At 1%, only about half of the grains were close to a Bishop-Hill stress state. The stress state of the other half of the grains was closer to the applied uniaxial stress, in between Bishop-Hill states, or in some cases none of these. The orientation dependence of the assigned stress states deviate somewhat from the theoretical expectation. These deviations are found to originate from a larger tensile stress component than in the theoretical Bishop-Hill stress states and to be associated also with deviations from axisymmetric plastic strain. This conclusion was supported by finite-element crystal plasticity simulations.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Physics, Neutrons and X-rays for Materials Physics, University of Illinois at Urbana-Champaign, Cornell High Energy Synchrotron Source, Air Force Research Laboratory
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Main Research Area: Technical/natural sciences
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Scopus rating (2016): CiteScore 5.67 SJR 3.283 SNIP 2.674
Web of Science (2016): Indexed yes
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Scopus rating (2015): SJR 3.542 SNIP 2.927 CiteScore 5.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.045 SNIP 3.348 CiteScore 5.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Measurement and tailoring of residual stress in expanded austenite on austenitic stainless steel

Expanded austenite on stainless steel with a high interstitial nitrogen content is characterized by elasto-plastic accommodation of the large composition-induced lattice expansion leading to huge compressive residual stress. The elasto-plastic accommodation as well as the (steep) concentration profile has implications for the measurement strategy to determine lattice strains and associated residual stresses with X-ray diffraction. Lattice strain measurements were performed on nitrided as well as subsequently de-nitrided expanded austenite on AISI 316L stainless steel, for various grazing incidence angles. It is demonstrated that keeping the information depth constant by choosing appropriate combinations of grazing incidence and tilt angle leads to reliable results for the 111 reflection, while the 200 reflection should be avoided. Further, it is shown for the first time that the residual stresses in expanded austenite can be tailored by de-nitriding after nitriding, such that a condition of virtually zero stress at the surface is obtained.
Measurement noise of a point autofocus surface topography instrument

Optical instruments for areal topography measurement can be especially sensitive to noise when scanning is required. Such noise has different sources, including those internally generated and external sources from the environment.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Nottingham, Politecnico di Torino
Authors: Feng, X. (Ekstern), Quagliotti, D. (Intern), Maculotti, G. (Ekstern), P. Syam, W. (Ekstern), Tosello, G. (Intern), Hansen, H. N. (Intern), Galetto, M. (Ekstern), Leach, R. (Ekstern)
Number of pages: 2
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Main Research Area: Technical/natural sciences
Areal, Measurement, Noise, Surface, Texture, Point autofocus, Optical microscope
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Measurement_noise_of_a_point_autofocus_surface_topography_instrument_1.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Measurement of turbulent kinetic energy spectrum - Part 1: Convection record method

A novel exact temporal to spatial mapping for point measurements in turbulence has been developed. The spatial record is obtained based on the instantaneous velocity magnitude, u =|u|, creating an exact mapping between the sampling interval, Δt, and the spatial record counterpart, Δs, through the relation Δ s n =|u|Δt n. n indicates the sample number in a measurement sequence. Summation of the consecutive streakline elements, Δ s n, corresponding to the convection distance of the fluid, results in a spatial "convection record". The exact mapping applies to all flows, since it is based on the instantaneous velocity magnitude, thereby incorporating all relevant aspects of the flow dynamics. Even high intensity non-equilibrium spatial records can be measured using this mapping, which is most straightforwardly applied using laser Doppler anemometry measurements. Computer simulated high intensity LDA data demonstrate the technique. The method will also be demonstrated on measurements in a round turbulent jet in part 2.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Intarsia Optics
Authors: Buchhave, P. (Ekstern), Velte, C. M. (Intern)
Number of pages: 7
Pages: 163-169
Publication date: 2017
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Editors: Peinke, J., Kampers, G., Oberlack, M., Waclawczyk, M., Talamelli, A.
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Series: Springer Proceedings in Physics
ISSN: 0930-8989
Measurement of turbulent kinetic energy spectrum - Part 2: Convection record measurements

A novel exact temporal to spatial mapping for point measurements in turbulence has been applied to various flow conditions existing in a round turbulent jet. The conditions range between equilibrium and non-equilibrium as well as mid to high turbulence intensities. The exact mapping applies to all flows, including high intensity non-equilibrium flows, since it is based on the instantaneous velocity magnitude, thereby incorporating all relevant aspects of the flow dynamics. Development of the jet turbulence along the stream, from non-equilibrium to equilibrium, is observed. In the developed region of the jet, Taylor’s hypothesis is tested and the spectra using the novel exact mapping is validated with excellent agreement against directly measured spatial spectra in a mapped similarity space using PIV. The method is observed to produce the expected results even at turbulence intensities of the order of 450%.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Intarsia Optics
Authors: Velte, C. M. (Intern), Buchhave, P. (Ekstern), Hodzic, A. (Intern)
Number of pages: 6
Pages: 171-176
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Measurement of Turbulent Skin Friction Drag Coefficients Produced by Distributed Surface Roughness of Pristine Marine Coatings

Skin friction drag coefficients are determined for marine antifouling coatings in pristine condition by use of Constant Temperature Anemometry (CTA) with uni-directional hot-wires. Mean flow behaviour for varying surface roughness is analysed in zero pressure gradient, flat plate, turbulent boundary layers for Reynolds numbers from \( \text{Re}_x = 1.91 \times 10^5 \) to \( \text{Re}_x = 9.54 \times 10^5 \). The measurements were conducted at the Technical University of Denmark in a closed-loop wind tunnel redesigned for investigations as this. Ensemble averages of the boundary layer velocity profiles allowed for determination of skin friction drag coefficients for practically smooth surfaces at low Reynolds numbers compared to normal operation mode for the antifouling coatings. Thus, better estimates for skin friction of rough hulls can be realised using the proposed method to optimise preliminary vessel design.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark, Dantec Dynamics A/S
Authors: Zafiryadis, F. (Ekstern), Meyer, K. E. (Intern), Gökhan Ergin, F. (Ekstern)
Number of pages: 6
Publication date: 2017
Event: Paper presented at Tenth International Symposium on Turbulence and Shear Flow Phenomena (TSFP10), Chicago, United States.
Measurement of turbulent spatial structure and kinetic energy spectrum by exact temporal-to-spatial mapping

We present a method for converting a time record of turbulent velocity measured at a point in a flow to a spatial velocity record consisting of consecutive convection elements. The spatial record allows computation of dynamic statistical moments such as turbulent kinetic wavenumber spectra and spatial structure functions in a way that completely bypasses the need for Taylor’s hypothesis. The spatial statistics agree with the classical counterparts, such as the total kinetic energy spectrum, at least for spatial extents up to the Taylor microscale. The requirements for applying the method are access to the instantaneous velocity magnitude, in addition to the desired flow quantity, and a high temporal resolution in comparison to the relevant time scales of the flow. We map, without distortion and bias, notoriously difficult developing turbulent high intensity flows using three main aspects that distinguish these measurements from previous work in the field: (1) The measurements are conducted using laser Doppler anemometry and are therefore not contaminated by directional ambiguity (in contrast to, e.g., frequently employed hot-wire anemometers); (2) the measurement data are extracted using a correctly and transparently functioning processor and are analysed using methods derived from first principles to provide unbiased estimates of the velocity statistics; (3) the exact mapping proposed herein has been applied to the high turbulence intensity flows investigated to avoid the significant distortions caused by Taylor’s hypothesis. The method is first confirmed to produce the correct statistics using computer simulations and later applied to measurements in some of the most difficult regions of a round turbulent jet—the non-equilibrium developing region and the outermost parts of the developed jet. The proposed mapping is successfully validated using corresponding directly measured spatial statistics in the fully developed jet, even in the difficult outer regions of the jet where the average convection velocity is negligible and turbulence intensities increase dramatically. The measurements in the developing region reveal interesting features of an incomplete Richardson-Kolmogorov cascade under development.
Measuring the implementation of ecodesign management practices: a review and consolidation of process-oriented performance indicators

Ecodesign plays an important role in manufacturing companies’ quest for improved sustainability performance. However, many ecodesign efforts are geared towards tackling single-issue discrete improvements, in contrast to operationalizing, measuring and acting upon the consistent improvement of ecodesign implementation and management. To enable a systematic and streamlined integration of ecodesign practices into the product development processes, adequate mechanisms are needed to capture and measure performance improvements, and thereby achieve consistent improvements in a company’s efforts towards enhanced sustainability performance. In face of this challenge, this paper aims at providing organizations with a set of process-oriented indicators to supporting and enhancing ecodesign implementation and management. This research was grounded on a 2-phase approach to (i) cross-analyze performance indicators from literature against ecodesign practices at the process level and (ii) propose, evaluate and consolidate new indicators. After being subjected to the evaluation of 8 experts in ecodesign, a repository is presented with 27 indicators from literature and a set of 114 newly proposed indicators for companies to customize, adapt, mix and derive according to their needs, strategic drivers and overall context.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Rodrigues, V. P. (Intern), Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
Metal alloys for the new generation of compressors at hydrogen stations: Parametric study of corrosion behavior

Compressors are one of the most costly components at hydrogen stations, which leads to the high price of hydrogen production. The substitution of a solid piston with ionic liquid is a promising option that may solve some of the challenges related to conventional reciprocating compressors and, consequently, significantly reduce the final cost of hydrogen production. The correct choice of ionic liquid and construction materials is critical for avoiding significant corrosion problems. Hence, the objective of this study is to evaluate the compatibility of various austenitic stainless steels and nickel-based alloys as construction materials in contact with 80 °C ionic liquids in an ionic liquid hydrogen compressor, considering the role of parameters such as the temperature, viscosity, ionic liquid cation and anion, and water absorption. The results show that temperature contributes to increasing the corrosion rate. However, even at 80 °C, the very low corrosion current densities proved that all of the tested alloys are safe to use as construction materials. AISI 347 showed very high corrosion resistance in all of the ionic liquids. The highest corrosion resistance among all of the tested alloys was observed in trihexyltetradeeyl phosphonium bis (trifluoromethylsulfonyl) imide, which had a relatively high viscosity and the lowest water content.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Energy Conversion and Storage, Proton conductors
Authors: Arjomand Kermani, N. (Intern), Petrushina, I. (Intern), Nikiforov, A. V. (Intern), Rokni, M. (Intern)
Pages: 805-814
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 4.83 SJR 1.697 SNIP 2.044
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.845 SNIP 2.118 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.983 SNIP 2.687 CiteScore 4.51
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.066 SNIP 2.767 CiteScore 4.63
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.852 SNIP 2.745 CiteScore 3.97
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.688 SNIP 2.404 CiteScore 3.9
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.494 SNIP 2.215
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.305 SNIP 1.945
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.449 SNIP 1.867
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.214 SNIP 1.65
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.137 SNIP 1.486
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.215 SNIP 1.26
Scopus rating (2004): SJR 0.76 SNIP 1.154
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.965 SNIP 0.948
Scopus rating (2002): SJR 0.473 SNIP 0.539
Scopus rating (2001): SJR 0.554 SNIP 0.449
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.466 SNIP 0.697
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.264 SNIP 0.627
Original language: English
Ionic liquids, Hydrogen, Hydraulic and pneumatic industry, Gravimetric method, Tafel plots, Corrosion resistance
DOIs:
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Source: FindIt
Source-ID: 2373442876
Publication: Research - peer-review › Journal article – Annual report year: 2017

**Metric-driven Robust Design – Robustness Quantification of Complex Engineering Systems**

This PhD dissertation was carried out at the Technical University of Denmark in the Department of Mechanical Engineering and has been supervised by Associate Professor Anders Ivarsson and co-supervised by Professor Jesper Schramm. The project has been a part of the RADIATE project funded by the Danish Council for Strategic Research. Other supporters of the project have been MAN Diesel & Turbo A/S, DTU Mechanical Engineering, DTU Chemical Engineering, Sandia National Laboratories USA, Norwegian University of Science & Technology (NTNU) and University of Nottingham, Malaysia Campus. The continuing stringency of emission regulations for marine diesel engines forces a deeper understanding of the complex physical processes occurring inside the engine cylinder. A deeper understanding can lead to higher accuracy of predictive numerical models, thereby enabling evaluation of multiple engine design parameter variations which would otherwise be extremely costly and difficult to evaluate experimentally. The aim of this work is to provide a wide range of reliable experimental data of which to validate current Computational Fluid Dynamic models employing complex physics such as evaporation of atomized liquid sprays, turbulent heat and mass transport, reaction kinetics, soot formation and radiant heat transfer. These computational models are to some degree based on true physics, but simplified empirical models are unavoidable. Complex experiments are needed in order to accurately measure the specific physical quantities needed in CFD validation of these types of flames. This work is a testament to that fact. The first part of this thesis is an extensive study of optical combustion diagnostics applied to complex transient spray flames in a high temperature and pressure environment. The physicochemical properties and electromagnetic interactions in flames, of which various optical combustion diagnostics are based, have been reviewed. Key diagnostics have been presented with practical examples of their application which, together with a comprehensive review of fuel spray flames, form the motivations for the selection of diagnostics to apply in measuring key quantities in complex spray flames. In addition, the extinction imaging technique has been refined to optimize applicability in the optically harsh ambient environments into which the sprays are injected. Well defined back illumination characteristics, dimensioned according to the collection optics, removes artifacts caused by steep gradients in the refractive index while promoting high temporal resolution capabilities. The second part of this thesis consists of a comprehensive experimental campaign of fuel spray and combustion characteristics from cavitating and non-cavitating large bore injectors. The injectors have been specifically machined to isolate the effects of in-nozzle cavitation on the resulting spray and combusting characteristics. Experiments were carried out in an optically accessible constant volume combustion vessel, generating a controlled
ambient environment into which the fuel sprays were injected, achieving a high degree of reproducibility. Measurements of liquid and vapor boundaries, determining key spray characteristics, were made using extinction and schlieren imaging respectively. Flame lift-off, ignition delay and soot volume fraction was measured, determining key combustion characteristics, using OH* chemiluminescence-, natural flame luminosity- and extinction imaging respectively. The enhanced spray break-up induced by cavitation does not seem to have a radical effect when the fuel is injected into a high pressure and temperature environment. Rather, the break-up length is shortened such that the spray/jet obtains a fully developed flow closer to the nozzle, consequently shifting the flow and combustion characteristics with it. Considerations regarding the optical setup, optical elements, corrections for camera non-idealities and post processing methods have been developed and refined in this work to measure the optical thickness of the soot in the transient spray flames as accurately as possible. The soot cloud from these wide bore injectors was so optically thick that it appeared opaque to the camera at higher ambient temperatures. The soot volume fraction could, however, be determined in the initial formation regions up to an optical thickness of around 4, with a higher degree of certainty than prior applications of extinction imaging of soot. CFD modeled soot fields, showing good agreement with measurements, were translated to optical thickness revealing that these flames can potentially have an optical thickness up to 50 at 635 nm in the later stages of soot formation.

Micro-EDM process modeling and machining approaches for minimum tool electrode wear for fabrication of biocompatible micro-components

Micro-electrical discharge machining (micro-EDM) is a potential non-contact method for fabrication of biocompatible micro devices. This paper presents an attempt to model the tool electrode wear in micro-EDM process using multiple linear regression analysis (MLRA) and artificial neural networks (ANN). The governing micro-EDM factors chosen for this investigation were: voltage (V), current (I), pulse on time (Ton) and pulse frequency (f). The proposed predictive models generate a functional correlation between the tool electrode wear rate (TWR) and the governing micro-EDM factors. A multiple linear regression model was developed for prediction of TWR in ten steps at a significance level of 90%. The optimum architecture of the ANN was obtained with 7 hidden layers at an R-sq value of 0.98. The predicted values of TWR using ANN matched well with the practically measured and calculated values of TWR. Based on the proposed soft computing-based approach towards biocompatible micro device fabrication, a condition for the minimum tool electrode wear rate (TWR) was achieved.
Micro injection moulding process optimization of an ultra-small POM three-dimensional component

Replication-based manufacturing processes are a cost effective method for producing complex and net-shaped components [1]. Micro injection moulding has a prominent place among them for its capability of accurately and precisely produce micro plastic parts in large production scale [2], [3]. In this study, the optimization of the micro injection moulding process of an ultra-small (volume: 0.07 mm³; mass: 0.1 mg) three-dimensional Polyoxymethylene (POM) micro component for medical applications (see Figure 1) is presented. Preliminary experiments highlighted the need for venting channels in order to facilitate the evacuation of air from the micro cavity, allowing the consistent achievement of complete filling. If, on one hand, the implemented venting channel (depth: 4 μm) solved the issue, on the other, it caused the formation of a micro-scaled flash on the part. In order to optimize the part geometry with respect to design specifications, the flash areal size was utilized as quality indicator. A design of the experiments approach was carried out in order to study the effects of melt temperature, mould temperature, holding pressure and injection speed. For this task, a two-level full factorial design was selected. The flash size (i.e. flash area) of each moulded part was characterized and measured using a state-of-the-art 3D focus variation microscope featuring sub-micrometric lateral resolution (see Figure 2). The results of the analysis show that the flash can be successfully used to highlight the most significant process parameters with respect to the part quality (see Figure 3). Being the flash area also measurable using an appropriate 2D camera, this opens the door to future in-line and cost-effective dimensional quality assurance. Figure 1.

Micro/Nano manufacturing

Micro- and nano-scale manufacturing has been the subject of an increasing amount of interest and research effort worldwide in both academia and industry over the past 10 years. Traditional (MEMS) manufacturing, but also precision manufacturing technologies have been developed to cover micro-scale dimensions and accuracies. Furthermore, these fundamentally different technology ecosystems are currently combined in order to exploit strengths of both platforms. One example is the use of lithography-based technologies to establish nanostructures that are subsequently transferred to 3D geometries via injection molding. [...]

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Micro-structural evolution in plastically deformed crystalline materials

Two rate-independent strain gradient crystal plasticity models are developed and applied in numerical studies designed to identify the properties inherent to model predictions of plastic deformation. The two models incorporate gradients of slip into the framework of conventional crystal plasticity in order to model size-dependent plasticity effects. This gradient dependence is achieved by relating a slip measure which combines both slip and their gradients to a shear hardening curve, as commonly done in conventional plasticity theories. Finite element codes are implemented which allow for numerical predictions for the two models to be obtained. Application of the two models to the pure shear boundary value problem is used to characterize plastic behavior, which also allows for the identification of inherent properties through closed form expressions. Single crystal Monazite containing a void is studied through a plane analysis. The conditions that allow for a plane analysis of single crystal Monazite are identified through crystallographic symmetry considerations. Predictions of the slip and micro-structure around a void are presented for size-independent and size-dependent plastic behavior, highlighting the effects due to gradients of slip.
at 1900 K displays large, almost equiaxed grains with low aspect ratios as well as distinct brittle properties. Therefore, it is suggested that a high aspect ratio of the grains is important for the ductile behaviour of tungsten wire and that embrittlement is caused by the loss of the preferable elongated grain structure rather than by recrystallization. In addition, a detailed evaluation of the plastic deformation behaviour during tensile test gives guidance to the design and optimization of tungsten fibre-reinforced composites.

**General information**

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Microstructure of Z-phase strengthened martensitic steels: Meeting the 650°C challenge

We studied three series of Z-phase strengthened steels using scanning electron microscopy, transmission electron microscopy, and atom probe tomography to reveal the detailed microstructure of these steels. In particular, the phase transformation from M(C,N) to Z-phase (CrMN) was studied. Carbon content in the steels is the governing factor in this transformation. The impact toughness of some test alloys was rather low. This is attributed to the formation of a continuous W-rich film along prior austenite grain boundaries. Cu and C addition to the test alloys changed Laves phase morphology to discrete precipitates and improved toughness dramatically. BN particles were found in some steels. Formation of BN is directly linked to the B concentration in the steels.

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State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Chalmers University of Technology, Technical University of Denmark
Authors: Liu, F. (Ekstern), Rashidi, M. (Ekstern), Hald, J. (Intern), Reißig, L. (Ekstern), Andrén, H. O. (Ekstern)
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Minimum Compliance Topology Optimization of Shell-Infill Composites for Additive Manufacturing

Additively manufactured parts are often composed of two sub-structures, a solid shell forming their exterior and a porous infill occupying the interior. To account for this feature this paper presents a novel method for generating simultaneously optimized shell and infill in the context of minimum compliance topology optimization. Our method builds upon two recently developed approaches that extend density-based topology optimization: A coating approach to obtain an optimized shell that is filled uniformly with a prescribed porous base material, and an infill approach which generates optimized, non-uniform infill within a prescribed shell. To evolve the shell and infill concurrently, our formulation assigns two sets of design variables: One set defines the base and the coating, while the other set defines the infill structures. The resulting intermediate density distributions are unified by a material interpolation model into a physical density field, upon which the compliance is minimized. Enhanced by an adapted robust formulation for controlling the minimum length scale of the base, our method generates optimized shell-infill composites suitable for additive manufacturing. We demonstrate the effectiveness of the proposed method on numerical examples, and analyze the influence of different design specifications.
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.
Modeling and evaluation of the influence of micro-EDM sparking state settings on the tool electrode wear behavior

Micromachining technologies are now being employed in various industries for generation of precise features on engineering components. Among these processes, micro electrical discharge machining is a 'non-contact' machining technology suitable for material removal from electrically conductive materials characterized by considerable wear oft the tool used for material removal. This paper presents an investigation involving modeling and estimation of the effect of settings for generation of discharges in stable conditions of micro-EDM on the phenomenon of tool electrode wear. A stable sparking condition during the process is achieved with varying voltage (V), capacitance (C), threshold (T), and discharge frequency (f). The tool electrode wear model has revealed that the energy of the sparks interacting with the tool surfaces control the phenomenon through the settings of capacitance followed by the voltage. The variables controlling the
current settings for generation of stable discharges are not found to interact with each other to generate a variation on the tool wear. An increase in feed rate from 2 to 6 μm/s causes a decrease in TWR by 17%. The analysis and modeling approach helps achieve a condition for the minimum tool wear for this micro-EDM process configuration.

Modeling of the effect of tool wear per discharge estimation error on the depth of machined cavities in micro-EDM milling

In micro-EDM milling, real time electrode wear compensation based on tool wear per discharge (TWD) estimation permits the direct control of the position of the tool electrode frontal surface. However, TWD estimation errors will cause errors on the tool electrode axial depth. A simulation tool is developed to determine the effects of errors in the initial estimation of TWD and its propagation effect with respect to the error on the depth of the cavity generated. Simulations were applied to micro-EDM milling of a slot of 5000 μm length and 50 μm depth and validated through slot milling experiments performed on a micro-EDM machine. Simulations and experimental results were found to be in good agreement, showing the effect of error amplification through the cavity depth.
Engineering of surface structure to obtain specific anisotropic reflectance properties has interesting applications in large scale production of plastic items. In recent work, surface structure has been engineered to obtain visible reflectance contrast when observing a surface before and after rotating it 90 degrees around its normal axis. We build an analytic anisotropic reflectance model based on the microstructure engineered to obtain such contrast. Using our model to render synthetic images, we predict the above mentioned contrasts and compare our predictions with the measurements reported in previous work. The benefit of an analytical model like the one we provide is its potential to be used in computer vision for estimating the quality of a surface sample. The quality of a sample is indicated by the resemblance of camera-based contrast measurements with contrasts predicted for an idealized surface structure. Our predictive model is also useful in optimization of the microstructure configuration, where the objective for example could be to maximize reflectance contrast.
Modelling of LEG tilting pad journal bearings with active lubrication

This work constitutes the first step in a research effort aimed at studying the feasibility of introducing an active lubrication concept in tilting pad journal bearings (TPJBs) that feature the leading edge groove (LEG) lubrication system. The modification of the oil flow into each pad supply groove by means of servovalves renders the bearing active. This article focuses on obtaining and validating a numerical model capable of simulating the studied system, in terms of its steady state and dynamics characteristics. The developed model is then used to simulate a simple system, in order to portray the feasibility of affecting its static and dynamic properties by introducing this novel active bearing design.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Pontificia Universidad Catolica de Valparaiso
Authors: Cerda Varela, A. J. (Ekstern), Garcia, A. B. (Ekstern), Santos, I. (Intern)
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Modelling of Split Condenser Heat Pump: Optimization and Exergy Analysis

This paper presents a numerical study of a split condenser heat pump (SCHP). The SCHP setup differs from a traditional heat pump (THP) setup in the way that two separate water streams on the secondary side of the condenser are heated in parallel to different temperature levels, whereas only one stream is heated in a THP. The comparison between the SCHP and a THP was made for equal heat load and equal total pressure drop on the secondary side. It was found that the SCHP setup offered solutions that resulted in smaller/more compact plate heat exchangers for reaching the same COP as a traditional unit. For a water temperature of 40°C/85°C and an evaporating temperature of 5°C, the total area of the two plate heat exchangers was reduced by 3%. When using the SCHP setup the exergy destruction was slightly smaller compared to the THP.

General information

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Modelling of Split Condenser Heat Pump with Limited Set of Plate Heat Exchanger Dimensions

This paper presents a numerical study of optimal plate dimensions in a split condenser heat pump (SCHP), using ammonia as refrigerant. The SCHP setup differs from a traditional heat pump (THP) setup in the way that two separate water streams on the secondary side of the condenser are heated in parallel to different temperature levels, whereas only one stream is heated in a THP. The length/width ratio of the plate heat exchangers on the high pressure side of a SCHP was investigated to find the optimal plate dimensions with respect to minimum area of the heat exchangers. The total heat exchanger area was found to decrease with an increasing length/width ratio of the plates. The marginal change in heat exchanger area was shown to be less significant for heat exchangers with high length/width ratios.

In practice only a limited number of plate dimensions are available and feasible in the production. This was investigated to
find the practical potential of a SCHP compared to a THP. Using plates optimized for a SCHP in a THP, the total required heat exchanger area increased by approximately 100% for the conditions investigated in this study, indicating that available plate dimensions influence whether a THP or SCHP is beneficial.

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Modelling of temporal and spatial evolution of sulphur oxides and sulphuric acid under large, two-stroke marine engine-like conditions using integrated CFD-chemical kinetics
In this work, three-dimensional computational fluid dynamics (CFD) studies of sulphur oxides (SOx) and sulphuric acid (H2SO4) formation processes in a large, low speed two-stroke marine diesel engine are carried out. The current numerical study aims to investigate the conversion of sulphuric dioxide (SO2) to sulphuric trioxide (SO3) and the possibility of H2SO4 condensation, which are the prerequisites to better understand the corrosion-induced wear phenomenon. This is achieved with the aid of the implementation of a multicomponent surrogate model, which comprises a skeletal n-heptane mechanism and a reduced sulphur subset mechanism. In the present work, performance of the coupled CFD-chemical kinetic model is evaluated using both qualitative and quantitative methods. The modelling results show that the temporal and spatial evolutions of SOx predicted by the skeletal model are similar to those by the base mechanism. Predictions of the variations of SO2 and the associated SO2 to SO3 conversion in response to the change of fuel sulphur content, swirl velocity, start of injection, scavenger pressure, and low load, high scavenging pressure case agree well with numerical and experimental results from the literature. The model is further evaluated using the measured SO2 to SO3 conversion levels in a low load, high scavenger pressure case. The absolute values of simulated and measured conversion levels are close, although the former appear to be higher. The current results show that the flame impingements at the cylinder liner near top dead centre. The gas is cooled rapidly by the wall temperature and H2SO4 is produced in the region where the local temperature is less than 600 K. Based on the fluegas correlation, the acid dew point temperature is higher than the wall temperature, suggesting that acid condensation may begin early at the top part of the cylinder liner. The predicted distribution corresponds well with the distribution of corroded parts observed in service engines. The model is expected to serve as an important tool to simulate the rates of SO2 absorption into lubricating oil film and H2SO4 condensation in this combustion system.

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Authors: Pang, K. M. (Intern), Karvounis, N. (Intern), Walther, J. H. (Intern), Schramm, J. (Intern), Glarborg, P. (Intern), Mayer, S. (Ekstern)
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The purpose of the present work is to quantify the effect of the inside coating on chills for casting of large wind turbine main shafts with respect to the evolution of internal stresses. These are known to affect the lifetime of the chills, and this is...
a major cost for the foundries today. Simulations of the casting process are performed with four different heat transfer coefficients (HTCs) between the casting and the chill, and the resulting transient stress fields are reported in the chill. The microstructural evolution in the casting in terms of the nodule count is also modelled in the simulations. The outcome is validated by comparisons with samples taken out from a critical region of main shafts cast in sand and in chills. The results reveal minor reductions in the maximum principal stresses on the inner and outer surfaces of the chill of 3.1% and 18.5%, respectively, from changing the HTC from 2000 to 500 W m\(^{-2}\) K\(^{-1}\). These results indicate that the lifetime of the chill will not be significantly improved by adding a thicker layer of coating. The microstructure evolution is not very much affected by the HTC value with a maximum reduction in nodule count of 6.5%. Therefore, it is concluded that the material quality obtained from casting the main shafts in chills (and hence the performance of the part) is still much better than for sand casting, even though a very thick layer of coating is applied. Copyright © 2017 John Wiley & Sons, Ltd.
Chill casting, Coating, Ductile cast iron, Stresses, Wind turbine main shaft

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**Molding 4.0 - The Economics of an Injection Molding As-a-Service Business Model**

During the last few years, the term Industry 4.0 or The Fourth Industrial Revolution, made its appearance and spread across industries. While it is accepted that the term broadly refers to a set of recent innovations with potential to disrupt value and process chains, the heterogeneity of actors involved contributes to a hazy definition of the phenomenon. In this work, Industry 4.0 is analyzed by analyzing into its influence on the plastics industry, with a focus on the injection molding technology. A new business model for the plastic industry is proposed, which fosters closer cooperation with suppliers and Internet-of-Things integration of equipment on the manufacturing company shop-floor. Automated quality control, predictive maintenance, and energy efficiency are identified as main levers of improvement, and associated cost savings are quantified for a total of 4.13Me. This study shows how the paradigm of Industry 4.0 is able to disrupt the industry by decreasing machine downtime and offering remarkable improvements in machine up-time. The present research aims to highlighting some of the opportunities for the plastic industry enabled by the implementation of an Internet of Things architecture.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Charalambis, A. (Intern), Tonetti, M. A. (Ekstern), Tosello, G. (Intern)
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**Monitoring microstructural evolution in-situ during cyclic deformation by high resolution reciprocal space mapping**

The recently developed synchrotron technique High Resolution Reciprocal Space Mapping (HRRSM) is used to characterize the deformation structures evolving during cyclic deformation of commercially pure, polycrystalline aluminium AA1050. Insight into the structural reorganization within single grains is gained by in-situ monitoring of the microstructural evolution during cyclic deformation. By HRRSM, a large number of individual subgrains can be resolved within individual grains in the bulk of polycrystalline specimens and their fate, their individual orientation and elastic stresses, tracked during different loading regimes as tension and compression. With this technique, the evolution of dislocation structures in selected grains was followed during an individual load cycle.

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Authors: Diederichs, A. M. (Intern), Thiel, F. (Ekstern), Fischer, T. (Ekstern), Lienert, U. (Ekstern), Pantleon, W. (Intern)
Monitoring of the thermal deformations on polymer parts using a vision system

Dimensional measurements in production environment are affected by non-controlled temperature conditions. In the case of polymer parts the high thermal expansion coefficient leads to significant dimensional changes. In order to achieve high accuracy in dimensional measurements, thermal deformations must be monitored and the measurements compensated.

In this investigation thermal deformations on polymer parts are monitored using a vision system consisting of a camera equipped with telecentric lenses focused on the surface of the part. The magnification of the optics and an axial illumination allow appreciating the surface texture and surface details on the parts. A set of images is acquired at varying temperature. Digital image correlation with subpixel resolution is performed on images to estimate the displacement of the surface features. The effectiveness of the calculation is related to the quality of the surface features caught by the camera. Experimental tests are performed on a commercial ABS (Acrylonitrile Butadiene Styrene) part. Two series of pictures are acquired in different locations of the part during a cooling period of 10 minutes. Traceability of the method is established through a calibrated artefact for optical microscopes. Displacement measurement uncertainties lower than 0.5 μm have been documented.

Mosquito inspired medical needles

The stinging proboscis in mosquitos have diameters of only 40-100 μm which is much less than the thinnest medical needles and the mechanics of these natural stinging mechanisms have therefore attracted attention amongst developers of injection devises. The mosquito use a range of different strategies to lower the required penetration force hence allowing a thinner and less stiff proboscis structure. Earlier studies of the mosquito proboscis insertion strategies have shown how each of the single strategies reduces the required penetration force. The present paper gives an overview of the advanced set of mechanisms that allow the mosquito to penetrate human skin and also presents other biological mechanisms that facilitate skin penetration. Results from experiments in a skin mimic using biomimetic equivalents to the natural mechanisms are presented. This includes skin stretching, insertion speed and vibration. Combining slow insertion speed with skin tension and slow vibration reduces the penetration force with 40%
Moulded Pulp Manufacturing: Overview and Prospects for the Process Technology

Eco-friendly packaging such as moulded pulp products have gained commercial importance in the recent years. However, it remains a greatly under-researched area, and there is an arising need to consolidate the best practices from research and industry in order to increase its implementation. The goal of this paper is to give an overview of the main aspects involved in the manufacture of moulded pulp products. This includes a classification of moulded pulp products, historical and current applications, production processes, materials, mechanical properties and environmental sustainability. Moreover, based on the latest research in the field, an innovative drying technique that utilizes concepts derived from impulse drying is presented, and the implementation of this process technology is discussed.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Engineering Design and Product Development
Authors: Didone, M. (Intern), Saxena, P. (Intern), Meijer, E. B. (Intern), Tosello, G. (Intern), Bissacco, G. (Intern), McAloone, T. C. (Intern), Pigosso, D. C. A. (Intern), Howard, T. J. (Intern)
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BFI (2008): BFI-level 1
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Scopus rating (2007): SJR 0.395 SNIP 1.099
Scopus rating (2006): SJR 0.339 SNIP 0.748
It is well known that modal parameters play a key role towards understanding the dynamics of a structure. Their estimation, by means of experiments, forms the crux of modal analysis. Modal parameters not only help in characterizing the dynamics of the structure but are also used for several other purposes including, finite element model updating, design optimization, sensitivity analysis, etc. It is therefore important to estimate them accurately and several modal parameter estimation techniques have been developed over the years for this purpose. Despite advance methods, estimation of modal parameters is always accompanied with certain uncertainty, which can be attributed to several factors including, noisy measurements, complexities inherent in the structure, modeling errors etc. Remarkably, the usual practice is to provide the estimated modal parameters as they are, without providing any means to validate the accuracy of these estimates. In other words, the estimation procedure often does not include, or overlooks, the measures for quantifying the uncertainty associated with estimated modal parameters.
Multi-objective optimization of cellular scanning strategy in selective laser melting

The scanning strategy for selective laser melting - an additive manufacturing process - determines the temperature fields during the manufacturing process, which in turn affects residual stresses and distortions, two of the main sources of process-induced defects. The goal of this study is to develop a multi-objective approach to optimize the cellular scanning strategy such that the two aforementioned defects are minimized. The decision variable in the chosen problem is a combination of the sequence in which cells are processed and one of six scanning strategies applied to each cell. Thus, the problem is a combination of combinatorial and choice optimization, which makes the problem difficult to solve. On a process simulation domain consisting of 32 cells, our multi-objective evolutionary method is able to find a set of trade-off solutions for the defined conflicting objectives, which cannot be obtained by performing merely a local search. Possible similarities in Pareto-optimal solutions are explored.

Multi-scale characterization of White Etching Cracks (WEC) in a 100Cr6 bearing from a thrust bearing test rig

A common cause for premature bearing failures in wind turbine gearboxes are the so-called White Etching Cracks (WEC). These undirected, three-dimensional cracks are bordered by regions of altered microstructure and ultimately lead to a cracking or spalling of the raceway. An accelerated WEC test was carried out on a FE8 test rig using cylindrical roller thrust bearings made of martensitic 100Cr6 steel. The resulting WECs were investigated with several characterisation techniques. Ultrasonic measurements showed the WEC were mainly located in the region of the overrolled surface in which negative slip occurs, which agrees with hypotheses based on an energetic approach for a prognosis. SEM orientation contrast imaging of the area around WEC revealed an inhomogeneous structure with varied grain sizes and a large amount of defects. Microstructure characterization around the WEA using EBSD showed significant grain refinement. Atom probe tomography showed the microstructure in the undamaged zone has a plate-like martensitic structure with carbides, while no carbides were detected in the WEA where the microstructure consisted of equiaxed 10 nm grains. A three dimensional characterisation of WEC network was successfully demonstrated with X-ray computerized tomography, showing crack interaction with unidentified inclusion-like particles.
Multi Scale Micro and Nano Metrology for Advanced Precision Moulding Technologies

The technological revolution that has deeply influenced the manufacturing industry over the past two decades opened up new possibilities for the realisation of advanced micro and nano systems but, at the same time, traditional techniques for quality assurance became not adequate any longer, as the technology progressed. The gap between the needs of the manufacturing industry and the well-organized structure of the dimensional and geometrical metrology appeared, above all, related to the methodologies and, also, to the instrumentation used to deal with the incessant scaling down of the critical dimensions of the novel micro and nano production. Nowadays, design methodologies and concurrent tolerance guidelines are not yet available for advanced micro manufacture. Moreover, there are no shared methodologies that deals with the uncertainty evaluation of feature of size in the sub-millimetre scale.

On the other hand, a large choice of measurement equipment is now available but limitations in their use and of the instruments themselves are, in many cases, not completely understood, yet. In this context, the ambition of the PhD project was to develop and implement a complete metrological framework for advanced precision micro moulded products with micro/nano structured surfaces and micro/nano geometries, across several length scales. Uncertainty evaluation and traceability, specification intervals formulation, assessment of the moulded parts replication and a deep investigation on the optical instruments currently available for micro/nano dimensional and geometrical measurements were all subjects of the research conducted during the three years of the PhD course of study and that were collected in this final work.

Traceability and uncertainty evaluation were dealt with the development of a comprehensive statistical methodology based on the well-known frequentist approach. It was successfully applied to dimensional and geometrical measurements in the micro/nano length scale.

A novel method was developed on purpose for the formulation of specification intervals. Based on the evaluation of the shrinkage uncertainty, it allows to discriminate between the shrinkage of 1D and 2D features and cope with the influence of length scale. The method was applied and validated in the specific case of a micro-powder injection moulding production. Nevertheless, it is of general validity for any moulding process in which the material undergoes a change in dimensions from the mould cavity, due to a phase transformation. In parallel to the formulation of specification intervals, an investigation of two instruments with two different working principle proved a mutual dependence between the quality of the measurement process and the quality of the production. The measurement process influenced the quality assurance, but the lack of quality of the parts influenced the measurement process.

The surface texture replication was investigated about the amplitude (Sa, Sq) and the slope (Sdq) and assessed by the replication fidelity, i.e., comparing the produced parts with the tool used to replicate the geometry and evaluating the measurement uncertainty. The evaluation included the repeatability and reproducibility of the production process, the amplitude and slope replication of the features on the surface, the evaluation of the uncertainty of the replication fidelity. The investigation of optical instruments started with the processing of the data of an international comparison of surface texture measurements, in the sub-micrometre scale, by optical instruments, organised under the umbrella of the Scientific Technical Committee on ‘Surfaces’ (STC-S) of The International Academy for Production Engineering (CIRP). The comparison unveiled the state-of-the-art performance, in the sub-micrometre scale, of the three main microscopes working principle currently used in areal topography measurement (confocal microscopy, coherent scanning interferometry and focus variation microscopy). Results showed that agreement between optical instruments and reference measurements (by atomic force microscopy) could be reached to some extent, largely depending on the technology of the instruments used.

The limitations of the performance of the optical instruments were, also, inspected in specific cases that can arise during practical operation and that are becoming more and more common in modern micro and nano manufacturing. Several environmental sources were identified (thermal drifts, air conditioning system, stray light), which can introduce substantial environmental noise into the measurements, but, also, internal noise related to a prolonged use of an instrument.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Quagliotti, D. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
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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)
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Nickel-aluminum diffusion: A study of evolution of microstructure and phase

Microstructural and phase evolution of an aluminum deposit on nickel, after heat treatment at 883 K, is studied by means of various microscopy techniques, i.e. energy dispersive X-ray spectroscopy, backscattered electron imaging, electron backscatter diffraction, ion channeling contrast imaging and scanning transmission electron microscopy. AlNi₃ crystallites are observed on the aluminum grain boundaries after only 3 min of heat treatment indicating that nickel and nickel rich phases are the initially diffusing and forming species. Heat treatment for 120 min or longer results in the formation of Al₃Ni₂ and a porous Al₃Ni₂/γ-Al₂O₃ structure at the surface. The Al₃Ni₂ layer is composed of two different grain morphologies, indicating the position of a Kirkendall plane, and hence, there is a high diffusion rate of aluminum in this phase.

General information
State: Published
Organisations: Center for Electron Nanoscopy, Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Alimadadi, H. (Intern), Kjartansdóttir, C. K. (Intern), Burrows, A. (Intern), Kasama, T. (Intern), Møller, P. (Intern)
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Scopus rating (2016): CiteScore 2.75 SJR 1.24 SNIP 1.54
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.373 SNIP 2.025 CiteScore 2.47
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.183 SNIP 1.79 CiteScore 2.31
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.227 SNIP 2.063 CiteScore 2.26
ISI indexed (2012): ISI indexed yes
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Nominal vs. Effective Wake Fields and their Influence on Propeller Cavitation Performance

Propeller designers often need to base their design on the nominal model scale wake distribution, because the effective full scale distribution is not available. The effects of such incomplete design data on cavitation performance is examined in this paper. The behind-ship cavitation performance of two propellers is evaluated, where the cases considered include propellers operating in the nominal model and full scale wake distributions and in the effective wake distribution, also in model and full scale. The method for the analyses is a combination of RANS for the ship hull and a panel method for the propeller flow, with a coupling of the two for the interaction of ship and propeller flows. The effect on sheet cavitation due to the different wake distributions is examined for a typical full-form ship. Results show considerable differences in cavitation extent, volume, and hull pressure pulses.

General information
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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Regener, P. B. (Intern), Mirsadraee, Y. (Intern), Andersen, P. (Intern)
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Non-Invasive Parameter Identification in Rotodynamics via Fluid Film Bearings: Linking Active Lubrication and Operational Modal Analysis

In recent years, theoretical and experimental efforts have transformed the conventional tilting-pad journal bearing (TPJB) into a smart mechatronic machine element. The application of electromechanical elements into rotating systems makes feasible the generation of controllable forces over the rotor as a function of a suitable control signal. The servovalve input signal and the radial injection pressure are the two main parameters responsible for dynamically modifying the journal oil film pressure and generating active fluid film forces in controllable fluid film bearings. Such fluid film forces, resulting from a strong coupling between hydrodynamic, hydrostatic and controllable lubrication regimes, can be used either to control or to excite rotor lateral vibrations. If non-invasive forces are generated via lubricant fluid film, in situ parameter identification can be carried out, enabling evaluation of the mechanical condition of the rotating machine. Using the lubricant fluid film as a non-invasive calibrated shaker is troublesome, once several transfer functions among mechanical, hydraulic and electronic components become necessary. In this framework the main original contribution of this paper is to show experimentally that the knowledge about the several transfer functions can be bypassed by using output-only identification techniques. The manuscript links controllable (active) lubrication techniques with operational modal analysis, allowing for in-situ parameter identification in rotordynamics, i.e. estimation of damping ratio and natural frequencies.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Authors: Santos, I. (Intern), Svendsen, P. K. (Ekstern)
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Scopus rating (2015): SJR 0.916 SNIP 1.422 CiteScore 1.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.666 SNIP 1.473 CiteScore 1.45
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.679 SNIP 1.422 CiteScore 1.33
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.677 SNIP 1.53 CiteScore 0.97
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.709 SNIP 1.456 CiteScore 0.88
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BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.689 SNIP 1.706
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.845 SNIP 1.38
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Nucleation from a cluster of inclusions, leading to void coalescence

A cell model analysis is used to study the nucleation and subsequent growth of voids from a non-uniform distribution of inclusions in a ductile material. Nucleation is modeled as either stress controlled or strain controlled. The special clusters considered consist of a number of uniformly spaced inclusions located along a plane perpendicular to the maximum principal tensile stress. A plane strain approximation is used, where the inclusions are parallel cylinders perpendicular to the plane. Clusters with different numbers of inclusions are compared with the nucleation and growth from a single inclusion, such that the total initial volume of the inclusions is the same for the clusters and the single inclusion. After nucleation, local void coalescence inside the clusters is accounted for, since this makes it possible to compare the rate of growth of the single larger void that results from coalescence in the different clusters. Nucleation parameters leading to rather early nucleation, or to later nucleation, are considered. Also, different transverse stresses on the unit cell are considered to see the influence of different levels of stress triaxiality, and results are shown for different levels of strain hardening in the material.

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Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Tvergaard, V. (Intern)
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Scopus rating (2016): CiteScore 3.13 SJR 1.408 SNIP 1.837
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Scopus rating (2015): SJR 1.39 SNIP 1.813 CiteScore 2.76
BFI (2014): BFI-level 1
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
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Numerical Calibration of Cohesive Zone Energy for Plate Tearing Homogenization-Based Topology Optimization for High-Resolution Continuum, Frame and Truss Structures

In a cohesive zone model, neighboring elements are connected by nonlinear springs (instead of directly sharing a node) which are designed to i) absorb the fracture energy, ii) release the connection between elements in the fracture zone. Unfortunately, it is often necessary to conduct lab tests combined with curve fitting in order to define the potential energy and the peak traction of the nonlinear springs.

Numerical Investigation of Damping of Torsional Beam Vibrations by Viscous Bimoments

Damping of torsional beam vibrations of slender beam-structures with thin-walled cross-sections is investigated. Analytical results from solving the differential equation governing torsion with viscous bimoments imposed at the boundary, are compared with a numerical approach with three-dimensional, isoparametric elements. The viscous bimoments act on the axial warping displacements associated with inhomogeneous torsion, and are in a numerical format realized by suitable configurations of concentrated, axial forces describing discrete dampers. It is illustrated by an example that significant damping ratios may be obtained for a beam with an open cross-section.
Numerical modelling of the bonding process for wind turbine blades: model validation

Adhesive is typically used in the joint between the two shells composing a wind turbine blade. The bonding process of a blade can be characterized as a squeeze flow problem where the top shell is forced towards the bottom shell, resulting in a deformation in the adhesive. In this study, a 3-D numerical model is developed in order to analyse adhesive propagation in squeeze flow problems with 3-D flow effects. The model is validated by comparison with an experiment where a rectangular prism shaped adhesive sample is squeezed between two parallel plates. In the numerical model the rheological behaviour of the adhesive is approximated with the Bingham material model. The numerical model is in good agreement with the experimental results. In the future, the model will be used to optimize the bonding process of wind turbine blades, save weight and reduce the levelized cost of energy.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Manufacturing Engineering, LM Wind Power
Authors: Uzal, A. (Intern), Spangenberg, J. (Intern), W. Nielsen, M. (Ekstern), Sonne, M. R. (Intern), Hattel, J. H. (Intern)
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Numerical modelling of the erosion and deposition of sand inside a filter layer

This paper treats the numerical modelling of the behaviour of a sand core covered by rocks and exposed to waves. The associated displacement of the rock is also studied. A design that allows for erosion and deposition of the sand core beneath a rock layer in a coastal structure requires an accurate prediction method to assure that the amount of erosion remains within acceptable limits. This work presents a numerical model that is capable of describing the erosion and deposition patterns inside of an open filter of rock on top of sand. The hydraulic loading is that of incident irregular waves and the open filters are surface piercing. Due to the few experimental data sets on sediment transport inside of rock layers, a sediment transport formulation has been proposed based on a matching between the numerical model and experimental data on the profile deformation inside an open filter. The rock layer on top of a sand core introduces a correction term to the Exner equation (the continuity equation for sediment and change in bed level). The correction term originates from the fact that the sand can only be deposited in the pores of the filter material. The numerical model is validated against additional data sets on the erosion and deposition patterns inside of an open filter. A few cases are defined to study the effect of the sinking of the filter into the erosion hole. The numerical model is also applied to several application cases. The response of the core material (sand) to changes in the wave period and wave height is considered. The effect of different layouts of the filter is studied in order to investigate the effect of different filter profiles on the resulting erosion. Finally, it is studied how much the design of a hydraulically closed filter can be relaxed to obtain a reduction in the design requirements of the filter thickness, while the deformation to the sand core remains acceptably small.

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Authors: Jacobsen, N. G. (Ekstern), van Gent, M. R. A. (Ekstern), Fredsøe, J. (Intern)
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Numerical simulation of flow and compression of green sand

The focus of the industrial PhD project was concentrated on the production of the sand mold (green sand) which gives the cast component its final geometrical shape. In order to ensure a high quality of the cast component, it is important to control the manufacturing process of the mold itself so that it is homogeneous and stable. Therefore gaining a basic understanding of how the flow and deposition of green sand should be charactertized and modelled is important, so that it could be used for simulation of the manufacturing process of the sand mold.

The flowability of the green sand is important when the sand flows down through the hopper filling the chamber with sand during the sand shot. The flowability of green sand is mostly governed by the amount of water and bentonite which both decrease it. The flowability and the internal forces thus control how well you can fill a complex mold geometry in which shadowing from ribs and other geometric obstacles may be present. If the flow stops prematurely it might hinder the mould from being completely filled or result in too high variation in the material density which could influence the final surface of the cast part. The wet bridges created by the bentonite makes the sand grains stick together where the bentonite and water make the green sand very cohesive and by squeezing the mixture it obtains mechanical properties that stabilizes the mold to acquire a strong mold for the casting process. Therefore the green sand flowability is important during the sand shot for a proper filling of the chamber, and subsequently the solid mechanical proper-ties during the squeezing process are important for the final strength of the mold. This is problematic since these mechanical behaviours have an inverse relationship, e.g if the green sand is too dry then the green sand flowability will be very high and the strength of the mold will be low and vice versa at least for the wet green sand up to a certain water content level. Therefore, obtaining the correct green sand condition and improving the filling of the mold during the sand shot are of great importance.

The Discrete Element Method (DEM) was chosen as the numerical model since the discrete nature of the method simulates the granular structure of the green sand with good agreement. The DEM model uses a rolling resistance model to emulate the non-spherical quartz sand particles’ resistance to rolling as well as a cohesive model to emulate the binding of the quartz sand particles from the bentonite.

The green sand was characterized with a ring shear tester where the yield locus was found and a new way to define the flowability was suggested. The ring shear tester was used to obtain the static friction coefficients for the DEM model. A sand pile experiment was used to investigate the simple mechanical behaviour of green sand from the measured height. From this height the DEM model was also calibrated with respect to obtaining the values of the rolling resistance and obtaining the parameter in cohesive model.

The project dealt with the flow of the sand particles and the deposition of sand during the production of sand molds using the sand shot in the DISAMATIC process. The deposition of the green sand in the chamber was investigated with a special cavity design where air vents were placed inside the cavities. The air vents are used to transport the green sand with an airflow during the sand shot. By changing the air vents settings in the chamber and in the cavities it was possible to improve the filling in the narrow passages in the cavity design, thereby improving the final sand mold as well. The sand shot with the cavity design was simulated by the discrete element method (DEM) modelling the flow of the green sand combined with classical computational fluid dynamics (CFD) for modelling the airflow in the chamber and the airflow through the air vents. These experiments and simulations gave beneficial insights to the DISAMATIC process and how to improve it. Additionally fluidization properties of green sand were investigated with a fluidized bed and the newly developed Anton Paar Powder Cell was used to obtain the fluidized viscosity.

Commercial aspects

Knowledge was acquired about the filling of the mold chamber with green sand in a special designed cavity geometry. The settings of the air vents together with the air pressure initially applied in the air tank gave valuable ideas for improving the filling in the cavities thereby improving the final mold. Furthermore, it was possible to apply the commercial software of STAR-CCM+ using the combined CFD-DEM model to simulate the process with a 3-D slice representation of the geometry successfully. This makes it more feasible to develop a stand-alone code in the future for simulating the DISAMATIC process. The sand shot in the DISAMATIC process might also be modelled with a continuum model where the ring shear tester could give indications of the solid mechanical behaviour of the green sand and the Anton Paar Powder Cell could be used for obtaining the fluidized viscosities of the green sand.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Hovad, E. (Intern), Hattel, J. H. (Intern), Larsen, P. L. (Intern), Thorborg, J. (Intern)
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Numerical simulation of methane slip in dual fuel marine engines

The methane slip is the problematic issue for the engines using natural gas (NG). Because methane is more powerful greenhouse gas (GHG) than CO2, understanding of the methane slip during gas exchange process of the engines is essential. In this study, the influence of the gas pipe geometry and the valve timings on the methane slip was investigated. MAN L28/32DF engine was modeled to simulate the gas exchange process of the four stroke NG-diesel dual fuel engines. The mesh size of the model was decided based on the sensitivity study on the peak pressure of the cylinder and the fuel mass estimations. The simulations with various gas pipe geometries were conducted. It seemed that the effect of the change in injection direction is more dominant than the change in the gas hole configuration. The favorable injection direction for minimum amount of methane slip was discovered as the direction which helps developing the flow of methane far from the exhaust ports. The effects of various valve timing settings were also simulated. The advancement of the exhaust valve closing was more efficient than the retardation of the intake valve opening. A little retardation of the intake valve opening even resulted in the increase of the amount of methane slip.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Fluid Mechanics, Coastal and Maritime Engineering, Korean Advanced Institute of Science and Technology (KAIST)
Authors: Han, J. (Ekstern), Jensen, M. V. (Intern), Pang, K. M. (Intern), Walther, J. H. (Intern), Schramm, J. (Intern), Bae, C. (Ekstern)
Pages: 1475-1480
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Publisher: The Korean Society of Mechanical Engineers
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Conference: 2017 KSME Annual Meeting, Jeju, Korea, Republic of, 01/11/2017 - 01/11/2017
Methane Slip, CFD, 4 Stroke dual fuel marine engine, Natural gas, Gas pipe optimization, Valve timing, Un-burned methane emission
Source: PublicationPreSubmission
Source-ID: 141043842
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Numerical simulation of scour and backfilling processes around a circular pile in waves

This study continues the investigation of flow and scour around a vertical pile, reported by Roulund et al. (2005). Flow and scour/backfilling around a vertical pile exposed to waves are investigated by using a three-dimensional numerical model based on incompressible Reynolds averaged Navier–Stokes equations. The model incorporates (1) k-ω turbulence closure, (2) vortex shedding processes, (3) sediment transport (both bed and suspended load), as well as (4) bed morphology. The numerical simulations are carried out for a selected set of test conditions of the laboratory experiments of Sumer et al. (1997, 2013a), and the numerical results are compared with those of the latter experiments. The simulations are carried out for two kinds of beds: rigid bed, and sediment bed. The rigid-bed simulations indicate that the vortex shedding for waves around the pile occurs in a "one-cell" fashion with a uniform shedding frequency over the height of the cylinder, unlike the case for steady current where a two-cell structure prevails. The rigid-bed simulations further show that the horseshoe vortex flow also undergoes substantial changes in waves. The amplification of the bed shear stress around the pile (including the areas under the horseshoe vortex and the lee wake region) is obtained for various values of the Keulegan-Carpenter number, the principal parameter governing the flow around the pile in waves. The present model incorporated with the morphology component is applied to several scenarios of scour and backfilling around a pile exposed to waves. In the backfilling simulations, the initial scour hole is generated either by a steady current or by waves. The present simulations indicate that the scour and backfilling in waves are solely governed by the lee-wake flow, in agreement with observations. The numerical model has proven successful in predicting the backfilling of scour holes exposed to waves. The results of the numerical tests indicate that the equilibrium depth of scour holes is the same for both the scour and the backfilling for a given Keulegan-Carpenter number, in full agreement with observations.

General information
Numerical simulation of track settlement using a multibody dynamic software a holistic approach

The increase of train loads, axel loads and operational speeds, contribute to increased degradation processes of the track, particularly in critical sections such railway turnouts, leading to the initiation and development of damage mechanisms. The increased track degradation means that it is necessary to intensify the frequency and the amount of maintenance works in the critical track sections, resulting in increased costs for the infrastructure manager. The fundamental idea of this work is to create and implement a novel methodology to analyse the train/track dynamic interaction and its influence on the overall track settlement mechanism of any track section. This will be achieved by creating an iterative loop that makes possible to assess the condition of the track based on the vehicle forces. This concept enables firstly, to keep the computational advantages of multibody codes when contact behaviour between the wheel and the rail is assessed. The main contribution of this work rests on performing a track degradation analysis considering a regular stretch of railway track, in which the abovementioned methodology is implemented. In the first phase, a train/track interaction analysis is developed and assessed by evaluating the contact forces between the wheel and the rail. In a second phase, the forces at each particular support, beneath the rail, are extracted and transformed, by applying a degradation law at the ballast layer, into vertical displacements that in turn are applied as longitudinal level irregularities in the rail. The process is completed by including the updated geometry that enables the further calculations, in a loop mode, considering as many cycles as required. In light of the foregoing, this work presents an efficient and novel technique that enables a commercial MBS (Multibody Simulation Software) to iteratively predict the impact of the accumulated track settlement on the train/track interaction.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Norwegian University of Science and Technology, Banedanmark
Authors: Tejada, A. D. M. (Intern), Lau, A. (Ekstern), Santos, I. (Intern), Fongemie, R. (Ekstern)
Number of pages: 11
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Host publication information
Title of host publication: Proceedings of the XVII International Symposium on Dynamic Problems of Mechanics
Publisher: ABCM - Brazilian Society of Mechanical Sciences
Editors: Fleury, A. T., Rade, D. A., Kurka, P. R. G.
Main Research Area: Technical/natural sciences
Conference: XVII International Symposium on Dynamic Problems of Mechanics (DINAME 2017), São Sebastião, Brazil, 05/03/2017 - 05/03/2017
Multibody simulation, Train/track interaction, Track degradation, Ballast settlement, Railway turnouts
Source: PublicationPreSubmission
Source-ID: 142068677
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Numerical Simulations of Planar Extrusion and Fused Filament Fabrication of Non-Newtonian Fluids

In this study, the planar extrudatesswelling of power-law and Oldroyd-B fluidsare investigated. Our numerical predictions are in good agreement with the other resultsaavailable in the literature. In addition, a simplified two-dimensional model of fused filament fabrication that provides details of the flow in the gap between the printing head and the substrate is presented. Thenumerical simulations use the streamlinefunction/log-conformation and the volume-of-fluid methods.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Comminal, R. B. (Intern), Hattel, J. H. (Intern), Spangenberg, J. (Intern)
Pages: 263-270
On analysis and redesign of bolted L-flanged connections

In wind turbine towers, the preferred design is circular tubes that are connected by a bolted flange joint. The design is typically that of an L-flange, resulting in an eccentrically loaded bolted connection. The eccentricity results in a non-linear relationship between external load on the tower and the tensile force in the bolt. In the literature and also in standards, different models are presented for this important non-linear response. In the present paper, a simplified expression for the non-linear force response is presented based on finite element calculations using contact analysis. The L-flange connection is in essence a bad design because it leads to a non-optimal ratio between external force and bolt force. Furthermore, bolt bending results in an even higher bolt stress resulting in a reduction of strength. The present paper presents simple modifications of the L-flange design that considerably improves the connection strength.
On filter boundary conditions in topology optimization

Most research papers on topology optimization involve filters for regularization. Typically, boundary effects from the filters are ignored. Despite significant drawbacks the inappropriate homogeneous Neumann boundary conditions are used, probably because they are trivial to implement. In this paper we define three requirements that boundary conditions must fulfill in order to eliminate boundary effects. Previously suggested approaches are briefly reviewed in the light of these requirements. A new approach referred to as the “domain extension approach” is suggested. It effectively eliminates boundary effects and results in well performing designs. The approach is intuitive, simple and easy to implement.
On fully stressed design and p-norm measures in structural optimization

This brief note revisits the fully stressed design schemes and p-norm measures used in stress-based structural optimization. Two simple shape optimization cases are used to remind the reader that fully stressed designs only are optimal when unimpeded by geometrical restrictions and that high values of the stress norm are needed in order to achieve satisfactory designs.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Shanghai Jiao Tong University
Authors: Zhou, M. (Ekstern), Sigmund, O. (Intern)
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.14
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): CiteScore 1.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Web of Science (2008): Indexed yes
Web of Science (2007): Indexed yes
Web of Science (2006): Indexed yes
On phonons and water flow enhancement in carbon nanotubes

The intriguing physics of water transport through carbon nanotubes (CNTs) has motivated numerous studies, reporting flow rates higher than those estimated by continuum models. The quantification of water transport in CNTs remains unresolved, however, with flow rates reported by different experiments and simulations having discrepancies of over three orders of magnitude. Reports of ultrafast and more modest rates conflict with each other. Molecular dynamics (MD) simulations have been used to resolve this puzzle by helping to decipher how the CNT walls interact with water molecules.
On Shaft Fillet Stress Concentration

A shaft is typically loaded by three different load types: torsional, bending and normal load separately or more generally in combinations. In most cases the size of the shaft is controlled by the constraints on the maximum allowable deflection and/or rotation at e.g. the position of bearings or gears. But if care is not taken to limit the stress concentrations these will control the durability of the shaft. With the use of fillets we have stress concentration described by the stress concentration factor $K_t$ (theoretic stress concentration factor).

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, N. L. (Intern)
Number of pages: 1
Pages: 161
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Title of host publication: Proceedings of the 30th Nordic Seminar on Computational Mechanics (NSCM-30)
Editors: Hasberg, 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
Machine elements, Optimization, Bending, Torsion, Normal force, Harmonic FE
Electronic versions:
ON_SHAFT_FILLET_STRESS_CONCENTRATION.pdf
Publication: Research - peer-review » Conference abstract in proceedings – Annual report year: 2017

On-site Identification of Dynamic Annular Seal Forces in Turbo Machinery Using Active Magnetic Bearings - An Experimental Investigation

Significant dynamic forces can be generated by annular seals in rotordynamics and can under certain conditions destabilize the system leading to machine failure. Mathematical modelling of dynamic seal forces are still challenging, especially for multiphase fluids and for seals with complex geometries. This results in much uncertainty in the estimation of the dynamic seal forces which often leads to unexpected system behaviour. This paper presents the results of a method suitable for on-site identification of uncertain dynamic annular seal forces in rotodynamic systems supported by Active Magnetic Bearings (AMB). An excitation current is applied through the AMBs to obtain perturbation forces and a system response, from which, the seal coefficients are extracted by utilizing optimization and a-priori information about the mathematical model structure and its known system dynamics. As a study case, the method is applied to a full-scale test-facility supported by two radial AMBs interacting with one annular center mounted test-seal. Specifically, the dynamic behaviour of a smooth annular seal with high preswirl and large clearance is investigated in this study for different excitation frequencies and differential pressures across the seal. The seal coefficients are extracted and a global model on reduced state-space modal form are obtained using the identification process. The global model can be used to update the model based controller to improve the performance of the overall system. This could potentially be implemented in all rotodynamic systems supported by AMBs and subjected to seal forces or other fluid film forces.
On the Application of Replica Molding Technology for the Indirect Measurement of Surface and Geometry of Micromilled Components

The evaluation of micromilled parts quality requires detailed assessments of both geometry and surface topography. However, in many cases, the reduced accessibility caused by the complex geometry of the part makes it impossible to perform direct measurements. This problem can be solved by adopting the replica molding technology. The method consists of obtaining a replica of the feature that is inaccessible for standard measurement devices and performing its indirect measurement. This paper examines the performance of a commercial replication media applied to the indirect measurement of micromilled components. Two specifically designed micromilled benchmark samples were used to assess the accuracy in replicating both surface texture and geometry. A 3D confocal microscope and a focus variation instrument were employed and the associated uncertainties were evaluated. The replication method proved to be suitable for characterizing micromilled surface texture even though an average overestimation in the nano-metric level of the $S_a$ parameter was observed. On the other hand, the replicated geometry generally underestimated that of the master, often leading to a different measurement output considering the micrometric uncertainty.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Milano
Authors: Baruffi, F. (Intern), Parenti, P. (Ekstern), Cacciatore, F. (Ekstern), Annoni, M. (Ekstern), Tosello, G. (Intern)
Number of pages: 18
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Main Research Area: Technical/natural sciences

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ISSN (Print): 2072-666X
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Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 1.83 SJR 0.382 SNIP 0.766
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.438 SNIP 0.931 CiteScore 1.78
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 0.638 SNIP 1.384 CiteScore 2.1
Scopus rating (2013): SJR 0.479 SNIP 1.151 CiteScore 1.73
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.477 SNIP 1.34 CiteScore 1.28
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.226 SNIP 0.892
ISI indexed (2011): ISI indexed no
Original language: English
Replica technology, Roughness, Surface metrology, Dimensional micro metrology
Electronic versions:
DOIs:
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Source: PublicationPreSubmission
Source-ID: 133204059
Publication: Research - peer-review › Journal article – Annual report year: 2017
On the Controllability and Observability of Actively Lubricated Journal Bearings with Pads Featuring Different Nozzle-Pivot Configurations

The fundamental properties of an actively lubricated bearing (ALB) from a control viewpoint are investigated, i.e., the stability, controllability and observability. The ALB involves the addition of an oil injection system to the standard tilting-pad journal bearing (TPJB) to introduce constantly and/or actively high pressurized oil into the rotor-pad gap through, commonly, a single radial nozzle. For the work goal, a four degrees-of-freedom (DOFs) ALB system linking the mechanical with the hydraulic dynamics is presented and studied, comprising: (i) the vertical journal movement, (ii) the pad tilt angle, (iii) the vertical pad movement due to the pivot flexibility, and (iv) the controllable force as the hydraulic DOF. The test rig consists of a rigid rotor supported by a single rocker-pivoted rigid pad. A thorough parametric study is carried out by investigating the effects of: (a) nozzle-pivot offset, (b) pivot flexibility, and (c) bearing loading on these control basics in order to determine the pad with the best control characteristics. Different nozzle-pivot offsets can be set by varying the positioning of either the injection nozzle or the pivot line. The influence of the pivot compliance on the bearing dynamics is assessed by benchmarking the results obtained with the flexible pivot against the rigid pivot. Three different bearing loads are studied. According to the results, the proposed configurations, especially the offset-pivot pad with slight offsets, improve the bearing control characteristics by introducing an extra mechanism to access the system states. The loading condition modifies the stability, controllability, and observability, while the pivot flexibility highly affects the ALB dynamics.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Salazar, J. A. G. (Intern), Santos, I. (Intern)
Number of pages: 17
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Main Research Area: Technical/natural sciences

Publication information
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.76 SJR 0.733 SNIP 1.617
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.673 SNIP 1.267 CiteScore 1.27
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.857 SNIP 1.352 CiteScore 1.34
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.843 SNIP 1.292 CiteScore 1.14
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.897 SNIP 1.419 CiteScore 1.16
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.929 SNIP 1.277 CiteScore 1.08
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.997 SNIP 1.36
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.161 SNIP 1.802
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.25 SNIP 1.673
On the Effects of Atmospheric Particles Contamination and Humidity on Tin Corrosion

The effects of hygroscopic atmospheric particles are investigated in relation to the corrosion of tin. Surface insulation resistance test boards were directly contaminated both with ambient particles sampled in the field at Milan, Italy, and with pure saline particles generated in the laboratory. An innovative particle deposition device was used to uniformly coat circular spots on to the test board surfaces. Deliquescence and crystallization of the water-soluble compounds were detected by observing the impedance response to varying relative humidity (RH) conditions with a gradual and continuous ramps. The effects of the adsorption/desorption kinetics and of the temperature on the deliquescence and crystallization RH values were also investigated. Leakage current measurements at 5-V dc highlighted the ability of atmospheric particles to promote corrosion and electrochemical migration at RH levels far below condensing conditions (100% RH).

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, University of Milano Bicocca
Authors: D’Angelo, L. (Ekstern), Verdingovas, V. (Intern), Ferrero, L. (Ekstern), Bolzacchini, E. (Ekstern), Ambat, R. (Intern)
Pages: 746-757
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Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.78 SJR 0.478 SNIP 1.269
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.763 SNIP 1.432 CiteScore 2.16
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.85 SNIP 1.77 CiteScore 2.26
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
On the elusive crystal structure of expanded austenite

No consistent structural description exists for expanded austenite that accurately accounts for the hkl-dependent peak shifts and broadening observed in diffraction experiments. The best available description for homogeneous samples is a face-centered cubic lattice with stacking faults. Here Debye simulations of stacking fault effects were compared to experimental data for macro-stress free homogeneous expanded austenite to show that a faulted structure cannot explain the observed peak displacement anomalies. Instead it is argued that the shifts are the combined result of elastic and plastic anisotropy leading to (strongly) non-linear hkl-dependent elastic behavior during composition-induced plastic deformation on synthesis of expanded austenite.

General information

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Physics, Neutrons and X-rays for Materials Physics, Department of Chemistry, X-ray Crystallography
Authors: Brink, B. (Intern), Ståhl, K. (Intern), Christiansen, T. L. (Intern), Oddershede, J. (Intern), Winther, G. (Intern), Somers, M. A. J. (Intern)
Pages: 59-62
Publication date: 2017
Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 2
Crystal structure, Expanded austenite, Nitriding, Plastic deformation, X-ray diffraction (XRD)

DOIs:
10.1016/j.scriptamat.2017.01.006

Source: FindIt
Source-ID: 2351436166
On the Incorporation of Friction Into a Simultaneously Coupled Time Domain Model of a Rigid Rotor Supported by Air Foil Bearings

Despite decades of research, the dynamics of air foil bearings (AFBs) are not yet fully captured by any model, suggesting that the fundamental mechanisms of the AFB and their relative merits are not yet fully understood. The recent years have seen promising results from nonlinear time domain models, allowing the dynamic pressure–compliance interaction and the unsteady terms of the compressible Reynolds equation to be considered. By including the simple elastic foundation model (SEFM) in a fully coupled simultaneous time integration, the dynamics of a rotor supported by industrial AFBs have previously been modelled by the authors, leading to good agreement with experimental results. In this paper, the authors investigate the substitution of the SEFM for a new foil structure model which is based on directly measurable quantities and includes frictional energy dissipation in the foil structure. An important finding is that the incorporation of a friction model into the global model cannot be reconciled with a simultaneous time solution without the inclusion of the foil inertia. The resulting AFB model allows the effects of friction on AFB performance to be directly examined and leads to the questioning of friction’s role and its significance to the operation of AFBs.

On the performance of micro injection moulding process simulations of TPE micro rings

Micro injection moulding (μIM) process simulations can be used as powerful tool for the optimization of the design of mould, parts and process. However, numerous combined scale effects introduce relevant challenges in terms of both validation and accuracy of the simulations [1], [2]. In this study, a case study based on the micro injection moulding process of thermoplastic elastomer (TPE) micro rings (volume: 1.5 mm³, mass: 2.2 mg) for sensors application is treated. Injection moulding process simulations using Autodesk Moldflow Insight 2016® were applied with the aim of accomplishing two main tasks: the prediction of the main parts defects (weld lines and air traps) and of effects of the main injection moulding process parameters, namely mould temperature, melt temperature, injection speed and holding pressure, on the part geometrical accuracy. A three-dimensional multi-scale mesh was implemented to discretize the geometry of the parts and the feeding system. Mesh sizes of 500 μm, 250 μm and 50 μm were used for discretizing sprue, runners and parts respectively (see Figure 1). The outcomes of the simulations were directly compared to real moulded parts based on SEM inspections and focus variation measurements. The results show that the implemented model is capable of accurately capturing the position and the magnitude of the micro ring weld lines and air traps. It was therefore demonstrated that micro scaled defects can be successfully predicted using a suitable model. Finally, process simulations correctly predicted the effects of the four investigated process parameters on the part dimensions. In particular, the deviation between real parts measurements and simulations results was on average 2 μm, demonstrating that single digit micrometric simulation accuracy was successfully achieved (see Figure 2).
On the performance of micro injection moulding process simulations of TPE micro rings

Micro injection moulding (µIM) process simulations can be used as powerful tool for the optimization of the design of mould, part and process. However, numerous scale effects introduce relevant challenges in terms of both validation and accuracy of the simulations [1-2]. In this research, a case study based on µIM of thermoplastic elastomer (TPE) micro rings for sensor applications was treated. Injection moulding process simulations using Autodesk Moldflow Insight 2016® were applied with two main tasks: the first was the prediction of main parts defects. The second was the forecasting of the effects of the main injection moulding process parameters on the part geometrical accuracy. A 3D multi-scale mesh was used. The outcomes of the simulations were compared to real moulded parts based on SEM inspections and focus variation measurements. The results show that the model was capable of accurately capturing the position of the micro ring weld lines and air traps. Process simulations also correctly predicted the effects of the investigated process parameters on the part dimensions. The average deviation between real parts measurements and simulations results was 2 µm, demonstrating that single digit micrometric simulation accuracy was successfully achieved.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Baruffi, F. (Intern), Calaon, M. (Intern), Tosello, G. (Intern)
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Electronic versions:
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Open Issues In Design Informatics

In the past 50 years, digital technologies have transformed many aspects of our lives, especially our engineered products and systems. They continue to be an area of enormous interest as we consider the potential of cyber-physical systems, 'Big Data' and the Internet of Things. Digital technologies have also become deeply embedded in the processes by which we design and develop products and systems. Information is the lifeblood of design, and thus design informatics - the application of information technologies in design – has been a central focus in design research for many years. This paper considers the evolution of design informatics over the past 40 or so years and makes suggestions for the challenges that should be addressed as we move into the next phase of digitalisation. A central message of the paper is that we have always had very high ambitions for our computational tools, but these ambitious have not always been realised, at least not in the way we imagined they might be. What can we learn from the successes and failures of the past that might inform the choices we make in the future? As an example of the ambitions for our tools in the past, in 1982 Requicha and Voelcker wrote that "an informationally complete [geometric] representation would permit (at least in principle) any well-defined geometric property of any represented solid to be calculated automatically" (1), envisioning integration and automation of design tools around a geometric model. Today, in Industry 4.0 we envisage computer-based Product Lifecycle Management (PLM) as "a central source for all data regarding a product, from the initial idea and production to sales and marketing" (2) and we consider that we are close to achieving "digital twins" for example that are "ultrarealistic in geometric detail, including manufacturing anomalies, and in material detail, including the statistical microstructure level" (3). How well were Requicha and Voelcker's ambitions realised and how close are we to achieving today's goals?

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: McMahon, C. A. (Intern)
Number of pages: 6
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Editors: Pokojski, J., Zalewski, R.
Main Research Area: Technical/natural sciences
Conference: Methods & Tools for CAE - concepts and applications, Biesko-Biala, Poland, 18/10/2017 - 18/10/2017
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
Optimal design of a microgripper-type actuator based on AlN/Si heterogeneous bimorph

This work presents a systematic procedure to design piezoelectrically actuated microgrippers. Topology optimization combined with optimal design of electrodes is used to maximize the displacement at the output port of the gripper. The fabrication at the microscale leads us to overcome an important issue: the difficulty of placing a piezoelectric film on both top and bottom of the host layer. Due to the non-symmetric lamination of the structure, an out-of-plane bending spoils the behaviour of the gripper. Suppression of this out-of-plane deformation is the main novelty introduced. In addition, a robust formulation approach is used in order to control the length scale in the whole domain and to reduce sensitivity of the designs to small manufacturing errors.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Universidad de Castilla-La Mancha
Authors: Ruiz, D. P. (Ekstern), Díaz-Molina, A. (Ekstern), Sigmund, O. (Intern), Donoso, A. (Ekstern), Bellido, J. (Ekstern), Sánchez-Rojas, J. L. (Ekstern)
Number of pages: 10
Publication date: 2017

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Article number: 1024606

Optimal usage of low temperature heat sources to supply district heating by heat pumps

This paper presents a theoretical study on the optimal usage of different low temperature heat sources to supply district heating by heat pumps. The study is based on data for the Copenhagen region. The heat sources were prioritized based on the coefficient of performance calculated for each hour. Groundwater, seawater and air heat sources were compared with each other as well as to a scenario consisting of a combination of these heat sources. In addition, base load and peak load units were included. Characteristic parameters were the coefficient of performance, the number of full load hours and the covered demand of each heat source as well as required peak unit capacity. The results showed that heat pumps using different heat sources yield better performance than a heat pump based on a single one. The performance was influenced by the composition of the different heat sources. It was found that 78% groundwater, 22% seawater and 0% air resulted in highest COP of 3.33 for the given heat demand. Furthermore, the implementation of rule based short term storage made peak units redundant. The variation in base load capacity showed that heat pumps utilizing the analyzed heat sources could perform very efficiently without the presence of base load with a COP of 3.43.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Pieper, H. (Intern), Ommen, T. S. (Intern), Markussen, W. B. (Intern), Elmegaard, B. (Intern)
Number of pages: 16
Publication date: 2017

Host publication information
Optimization of a flexible multi-generation system based on wood chip gasification and methanol production

Flexible multi-generation systems (FMGs) consist of integrated and flexibly operated facilities that provide multiple links between the different sectors of the energy system. The present study treated the design optimization of a conceptual FMG which integrated a methanol-producing biorefinery with an existing combined heat and power (CHP) unit and industrial energy utility supply in the Danish city of Horsens. The objective was to optimize economic performance and minimize total CO₂ emission of the FMG while it was required to meet the local district heating demand plus the thermal utility demand of the butchery. The design optimization considered: Selection, dimensioning, location and integration of processes; operation optimization with respect to both hourly variations in operating conditions over the year as well as expected long term energy system development; and uncertainty analysis considering both investment costs and operating conditions. Applying a previously developed FMG design methodology, scalable models of the considered processes were developed and the system design was optimized with respect to hourly operation over the period 2015–2035. The optimal design with respect to both economic and environmental performance involved a maximum-sized biorefinery located next to local industry rather than in connection with the existing CHP unit. As the local industry energy demands were limited when compared to the biorefinery dimensions considered, process integration synergies were found to be marginal when compared to the economic and environmental impact of the biorefinery for the present case. Assessing the impact of uncertainties on the estimated FMG performances, the net present value (NPV) of the optimal design was estimated to vary within the range 252.5–1471.6 M€ in response to changes of ± 25% in investment costs and methanol price, and considering two different electricity price scenarios. In addition, a change in the interest rate from 5% to 20% was found to reduce the lower bound of the NPV to 181.3 M€ for reference operating conditions. The results suggest that the applied interest rate and operating conditions, in particular the methanol price, would have a much higher impact on the economic performance of the designs than corresponding uncertainties in investment costs. In addition, the study outcomes emphasize the importance of including systematic uncertainty analysis in the design optimization of FMG concepts.
Optimization of photonic crystal cavities

We present optimization of photonic crystal cavities. The optimization problem is formulated to maximize the Purcell factor of a photonic crystal cavity. Both topology optimization and air-hole-based shape optimization are utilized for the design process. Numerical results demonstrate that the Purcell factor of the photonic crystal cavity can be significantly improved through optimization.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Wang, F. (Intern), Sigmund, O. (Intern)

DOI: 10.1016/j.apenergy.2016.08.092
Publication: Research - peer-review › Journal article – Annual report year: 2016
Optimized constitutive distributions visualized by lamina formulas

For optimal design most parameters may be classified in size, shape, and topology, such as simple density variables and parameters for surface description. Density and surface can be rather directly visualized. Extending the design to material design in sense of design of distributions of constitutive matrices, a practical visualization is more complicated but may be based on classical laminate analysis. In rotational transformation of constitutive matrices, some practical quantities are often termed invariants, but the invariance relates to an unchanged reference direction. Rotating this reference direction, the practical quantities do change and this point is clarified with derived rotational transformation for these practical quantities. The theoretical and numerical background for design of optimal anisotropic constitutive matrices are presented. Then design results are applied in a 2D visualization of optimized constitutive matrices that are distributed in a finite element model where each element has a specific reference direction. The visualized distributions of physical quantities are stiffer material direction, material stiffer longitudinal constitutive component, level of anisotropy, absolute or relative shear stiffness, and test of orthotropy.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, P. (Intern), Pedersen, N. L. (Intern)
Number of pages: 7
Pages: 385-391
Publication date: 2017
Main Research Area: Technical/natural sciences

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Volume: 24
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.553 SNIP 0.783 CiteScore 1.15
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.485 SNIP 0.665 CiteScore 0.91
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.474 SNIP 0.623 CiteScore 0.85
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.644 SNIP 0.723 CiteScore 0.96
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.637 SNIP 0.821 CiteScore 0.83
Organic Rankine cycle unit for waste heat recovery on ships (PilotORC)

The project PilotORC was aimed at evaluating the technical and economic feasibility of the use of organic Rankine cycle (ORC) units to recover low-temperature waste heat sources (i.e. exhaust gases, scavenge air, engine cooling system, and lubricant oil system) on container vessels. The project included numerical simulations and experimental tests on a 125 kW demonstration ORC unit that utilizes the waste heat of the main engine cooling system on board one of Mærsk's container vessels.

During the design of the demonstration ORC unit, different alternatives for the condenser were analyzed in order to minimize the size of the heat exchanger area. Later on the ORC unit was successfully installed on board, and it has been working uninterruptedly since, demonstrating the maturity of the ORC technology for maritime applications. During the onboard testing, additional measuring devices were installed on the unit and experimental data at design and off-design conditions were collected.

Several simulation models were developed in order to evaluate alternative integrations of the ORC units with different sources and configurations. The developed models allowed for the study of different ORC configurations at design and off-design conditions, the simulation of radial-in-flow turbines, and the prediction of thermophysical properties of alternative working fluids. The models for the ORC unit were validated with the collected experimental data. The validated models were used to evaluate the retro-fitting potential of using ORC units for maritime applications, and the relevance of this technology for new-building projects. Firstly, an evaluation of the waste heat resources available on board Mærsk containers fleet, and an estimation of the potential energy recovery by means of the ORC technology was performed. The estimations showed that significant fuel savings can be achieved. It was found that integrating ORC units with the jacket cooling water within the service steam circuit could enable payback periods of approximately 5 years and high fuel savings. Conversely, if the heat from the exhaust gases was recovered, the total power production of the ORC unit could cover 10% of the main engine power. Larger energy savings, 10 - 15%, could be expected if advanced design methods are employed.
Overview of friction modelling in metal forming processes

In metal forming processes, friction between tool and workpiece is an important parameter influencing the material flow, surface quality and tool life. Theoretical models of friction in metal forming are based on analysis of the real contact area in tool-workpiece interfaces. Several research groups have studied and modelled the asperity flattening of workpiece material against tool surface in dry contact or in contact interfaces with only thin layers of lubrication with the aim to improve understanding of friction in metal forming. This paper aims at giving a review of the most important contributions during the last 80 years covering experimental techniques, upper bound solutions, slip-line analyses and numerical simulations. Each of the contributions shed light on the importance of the real contact area and the influencing parameters including the material properties, surface conditions, normal pressure, sliding length and speed, temperature changes, friction on the flattened plateaus and deformation of the underlying material. The review illustrates the development in the understanding of asperity flattening and the methods of analysis. Finally, the present paper discusses the necessary future work in order to advance further in modelling of real contact area in relation to implementation of frictional conditions existing finite element codes for simulation of metal forming processes.

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Overview of humidity driven reliability issues of electronics

Electronic control units, power modules, and consumer electronics are used today in a wide variety of varying climatic conditions. Varying external climatic conditions of temperature and humidity can cause an uncontrolled local climate inside the device enclosure. Uncontrolled humidity together with number of other factors including the presence of hygroscopic contamination resulting from the PCB A manufacturing process can introduce deviation from desired functionality or even intermittent or permanent failure of the device. Additional factors are the miniaturization and high density packing combined with the use of several materials, which can undergo electrochemical corrosion in presence of water film formed due to humidity exposure and bias conditions on the PCBA surface. Aim of this paper is to provide an overview of the humidity driven reliability issues on electronics.

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Ambat, R. (Intern)
Number of pages: 1
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Main Research Area: Technical/natural sciences
Conference: International Conference on Infocom Technologies and Unmanned Systems (ICTUS' 2017), Dubai International Academic City, United Arab Emirates, 18/12/2017 - 18/12/2017
Humidity, Reliability, Electronics, Materials
DOIs: 10.1109/ICTUS.2017.8285977
Source: Findit
Source-ID: 2396134093
Publication: Research - peer-review › Article in proceedings – Annual report year: 2018

Oxide nanoparticles in an Al-alloyed oxide dispersion strengthened steel: crystallographic structure and interface with ferrite matrix

Oxide nanoparticles are quintessential for ensuring the extraordinary properties of oxide dispersion strengthened (ODS) steels. In this study, the crystallographic structure of oxide nanoparticles, and their interface with the ferritic steel matrix in an Al-alloyed ODS steel, i.e. PM2000, were systematically investigated by high-resolution transmission electron microscopy. The majority of oxide nanoparticles were identified to be orthorhombic YAlO3. During hot consolidation and extrusion, they develop a coherent interface and a near cuboid-on-cube orientation relationship with the ferrite matrix in the material. After annealing at 1200 °C for 1 h, however, the orientation relationship between the oxide nanoparticles and the matrix becomes arbitrary, and their interface mostly incoherent. Annealing at 1300 °C leads to considerable coarsening of oxide nanoparticles, and a new orientation relationship of pseudo-cube-on-cube between oxide nanoparticles and ferrite matrix develops. The reason for the developing interfaces and orientation relationships between oxide nanoparticles and ferrite matrix under different conditions is discussed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, University of Manchester
Authors: Zhang, Z. (Ekstern), Pantleon, W. (Intern)
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Main Research Area: Technical/natural sciences

Publication information
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Issue number: 21
ISSN (Print): 1478-6435
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.34 SJR 0.735 SNIP 0.714
Parallel direct solver for finite element modeling of manufacturing processes

The central processing unit (CPU) time is of paramount importance in finite element modeling of manufacturing processes. Because the most significant part of the CPU time is consumed in solving the main system of equations resulting from finite element assemblies, different approaches have been developed to optimize solutions and reduce the overall computational costs of large finite element models.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Lisbon
Authors: Nielsen, C. V. (Intern), Martins, P. (Ekstern)
Pages: 1-30
Publication date: 2017
Perceptual Robust Design

The research presented in this PhD thesis has focused on a perceptual approach to robust design. The results of the research and the original contribution to knowledge is a preliminary framework for understanding, positioning, and applying perceptual robust design.

Product quality is a topic that have received much attention from the literature, and for good reason. Defining quality as the ability to fulfil product requirements, the cost of non-quality does not only cause poor product performance, it also imposes huge direct costs for companies. Prevention, appraisal, and product failures are just a few examples of cost drivers. In general, the earlier quality issues are addressed the less costs they impose. Robust design methodology seeks to anticipate many of these quality issues by making product designs less sensitive to variation. The approach was first introduced by Genichi Taguchi in the 1980s and has since been expanded and refined. In more recent contributions, the notion of visual robustness has been introduced to the field of design research. However, contributions have only addressed the visual domain and no underlying theory on which to position or understand these studies have been presented. Therefore, this study set out to contribute to the understanding and application of perceptual robust design.

To achieve this, a state-of-the-art and current practice review was performed. From the review two main research problems were identified. Firstly, a lack of tools for effectively communicating robustness information as part of product requirements. And secondly, the need for a framework to understand, position, and apply perceptual robust design.

The first research problem was addressed with the introduction of the robust design requirements specification method. The method merges quality loss functions, a well-established robust design tool, with requirements development. For preliminary validation of the applicability and usefulness of the method three case study examples were presented revealing a promising potential. The second research problem was addressed with the introduction of the perceptual robust design framework that merged robust design methodology with Psychophysics theory. To evaluate the applicability and usefulness of the framework a case study was performed showing that product requirements could be loosened by up to 14.74%. However, the optimum for perceptual robustness was found to overlap with the optimum for functional robustness and at most approximately 2.2% out of the 14.74% could be ascribed solely to the perceptual robustness optimisation.

In conclusion, the thesis have offered a new perspective on robust design by merging robust design methodology with theory from relevant scientific fields. Furthermore, this new perspective has been operationalised through a preliminary framework for understanding, positioning, and applying perceptual robust design.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Pedersen, S. N. (Intern), Howard, T. J. (Intern), Eifler, T. (Intern)
Number of pages: 126
Publication date: 2017
Performance analysis of different organic Rankine cycle configurations on board liquefied natural gas-fuelled vessels

Gas-fuelled shipping is expected to increase significantly in the coming years. Similarly, much effort is devoted to the study of waste heat recovery systems to be implemented on board ships. In this context, the organic Rankine cycle (ORC) technology is considered one of the most promising solutions. The ORC favorably compares to the steam Rankine cycle because of its simple layout and high efficiency, achievable by selecting a working fluid with desirable properties. This paper aims at assessing the fuel savings attainable by implementing ORC units on board vessels powered by liquefied natural gas (LNG). The study compares the performance of six different ORC configurations both in design and off-design operation, and provides guidelines with respect to the most promising heat sources and sinks to be utilized by an ORC unit in order to maximize the annual fuel savings. In addition, this paper describes a novel ORC layout rejecting heat to two heat sinks. The results indicate equivalent fuel savings up to 8.9 % when harvesting heat from the exhaust gases, and that the novel configuration ensures an increment of the ORC design power output up to 41 % when utilizing the jacket cooling water as heat source.

Performance of a Tilt Current Meter in the Surf Zone

Tilt Current Meters (TCM’s) are relatively simple and inexpensive instruments for measuring currents in rivers and in the sea. Their low cost and easy deployment means that a relatively large number of TCM’s can be deployed compared to more conventional current meters such as Acoustic Doppler Velocimeters (ADV’s) or Acoustic Doppler Current Profiler (ADCP’s). Although, the accuracy of the individual measurements may not be as good as conventional currentmeters, the possibility of deploying many instruments is a great advantage when studying spatial variations in flows. This is especially the case when data is later used for comparison with numerical models whose results are also associated with considerable uncertainty. Previous studies have mainly considered steady current or tidal flows in which velocities were relatively low and the importance of waves limited. The presence of waves adds a number of important challenges to the measurements as the hydrodynamic forcing changes and the oscillations of the TCM cannot necessarily be averaged out as for a steady current. This study addresses some of these challenges by analyzing the performance of a TCM in the surf zone where wave orbital motion is dominant.
Performance of ultra low temperature district heating systems with utility plant and booster heat pumps
The optimal integration of booster heat pumps in ultra low temperature district heating (ULTDH) was investigated and compared to the performance of low temperature district heating. Two possible heat production technologies for the DH networks were analysed, namely extraction combined heat and power (CHP) and central heat pumps (HPs). The analysis focussed on the characteristic heat demands of newly build multi-story buildings and the results were based on the ratio of the individual demands compared to the total. It was found that the optimal return temperature was dependent on the forward temperature and the heat consumption profile. For reference conditions, the optimal return of ULTDH varies between 21 °C and 27 °C. When using a central HP to supply the DH system, the resulting coefficient of system performance (COSP) was in the range of 3.9 (-) to 4.7 (-) for equipment with realistic component efficiencies and effectiveness, when including the relevant parameters such as DH system pressure and heat losses. By using ULTDH with booster HPs, performance improvements of 12% for the reference calculations case were found, if the system was supplied by central HPs. Opposite results were found for extraction CHP, were ULTDH with booster HPs resulted in decreasing COSP of 20%.
Performance Simulation and Verification of Vat Photopolymerization Based, Additively Manufactured Injection Molding Inserts with Micro-Features

Injection molding soft tooling inserts manufactured additively with vat photopolymerization represent a valid technology for prototyping and pilot production of polymer parts. However, a significant drawback is the low heat conductivity of photopolymers influencing cycle time and part quality. In this research, the thermal performance of a 20x20x2.7 mm³ injection molding insert was simulated. A thermal camera was used to assess the quality and accuracy of the simulation. Both, simulation and measurements showed that the temperature cycle during injection molding becomes stationary within 3 to 5 cycles. After 2800 injection molding cycles, the experiment was stopped and the insert was still intact.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Pages: 162-168
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ISBN (Electronic): 978-3-319-66866-6
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Additive Manufacturing in Products and Applications (AMPA 2017), Zürich, Switzerland, 13/09/2017 - 13/09/2017
Additive manufacturing, Micro injection molding, Soft tooling, Simulation
DOIs: 10.1007/978-3-319-66866-6 16
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Photogrammetry for Repositioning in Additive Manufacturing

In this preliminary work, we present our current status on how to use single camera photogrammetry to determine the orientation of an additively manufactured partly finished object that has been...
repositionedintheprintingchamber,fromasingleimagetakenwithacalibratedcamera,andcomparingthistotheCADmodeloftheobject.Wedescribehowthisknowledgecanbeusedtoupdatethemachinecodeoftheprintersuchthatprintingoftheobjectcanberesum edinthenewlocation. Thisopenspossibilitiesfor embeddingandassemblingforeignpartsintheadditivemanufacturingpipeline,addingananotherlayerofflexibilitytotheprocess. However,duetovariouserrorsourcesinestimatingtheorientationoftheobject,morereworkisneededbeforethisupdatecanbeapplied

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State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering
Number of pages: 3
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Repnositioning, Photogrammetry, Computervision, Additivemanufacturing
Source: PublicationPreSubmission
Source-ID: 139558095
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

**PicPrint: Embedding pictures in additive manufacturing**
Here we present PicPrint, a method and tool for producing an additively manufactured lithophane, enabling transferring and embedding 2D information into additively manufactured 3D objects. The method takes an input image and converts it to a corresponding height-map, indicating the material density required to achieve a brightness specified at any given location. Non-linear scattering properties are compensated for using predefined falloff profiles. Using the produced height-map, a watertight mesh is distorted to match the specified material densities, after which the mesh is ready for either direct print on an additive manufacturing system, or transfer to other geometries via Boolean mesh operations.

**General information**
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Additive manufacturing, 3D print, Lithophane, Projection slide, Embedding, Picture, Watermark
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**PIV measurements of breaking waves**

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Vested, M. H. (Intern)
Number of pages: 2
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:
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**Relations**
PIV measurements of velocities and accelerations under breaking waves on a slope

Understanding the physics of breaking waves is an ongoing research topic, not only due to human curiosity, but also due to the influence breaking waves have on offshore structures. In recent years, the development in experimental methods has facilitated a new insight into the physics of breaking waves. In this study, we have investigated the wave kinematics under steep and breaking waves on a laboratory beach with a slope of 1/25. The velocity field was measured by use of Particle Image Velocimetry (PIV) at a sample rate of 96Hz. The high sample rate allowed for the accelerations to be determined directly from the sampled velocities. It was found that both velocities and accelerations differ from the ones predicted from common wave theories such as streamfunction theory. This was especially evident at the top part of the wave close to the surface. This was not surprising, since the breaking event is a highly non-linear process. The results presented here may facilitate computations of the impact force on offshore structures and furthermore be used for validation of CFD models while altogether shedding light on the mechanisms behind breaking waves.

POD Mode Robustness for the Turbulent Jet Sampled with PIV

An important challenge in the description and simulation of turbulence is the large amount of information that is needed to describe even relatively simple flows in detail. The frequent disagreement between Reynolds averaged Navier–Stokes-based simulations and experiments is well known. Albeit, direct numerical simulations and in certain cases large eddy simulations tend to agree fairly well with experiments, their practical implementation introduces the problem of data storage. The experimentalist, however, experiences the same problem, using high-speed particle image velocimetry (PIV) systems and even high speed volumetric PIV systems providing fully three dimensional velocity fields. Another challenge is how do we verify simulations against experiments and ensure that we indeed have simulated the same flow that we have measured?
Pore Pressure Under A Gravity Based Structure Under The Influence Of Waves

The total wave load on a gravity based foundation for offshore wind turbines is influenced by the pore pressure from beneath the structure. The pore pressure is induced by the wave–structure-seabed interaction. Often the uplift force is included in a simplified way in the design of the gravity based foundation. This leads typically to very conservative designs in order to accommodate the uncertainties in the procedure. The experiments shall lead to better prediction models based on for instance CFD model’s with the direct calculation of pressure variations in the seabed and any erosion protection layer. Herewith, it will be possible to get a direct assessment of wave loads on the foundation, also under the seabed level. The study includes experiments as well as numerical analyses. A good agreement between the experimental results and the numerical analyses was found. In the numerical analyses, it was possible to investigate the effect of air content in the pores, which turned out to have an effect on the distribution of the pore pressure.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, NIRAS A/S, Rambøll Danmark A/S
Authors: Christensen, E. D. (Intern), Carstensen, S. (Intern), Madsen, M. T. (Ekstern), Allerød Hesselbjerg, P. (Ekstern), Nielsen, C. J. (Ekstern)
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Porous Media and Immersed Boundary Hybrid-Modelling for Simulating Flow in Stone Cover-Layers

In this paper we present a new numerical modelling approach for coastal and marine applications where a porous media conceptual model was combined with a free surface volume-of-fluid (VOF) model and an immersed boundary method (IBM). The immersed boundary model covers the method of describing a solid object in a simple computational mesh without resolving the object with a conventional body-fitted mesh. This model enables a detailed resolution of some parts of a stone cover layer for erosion protection with the IBM model while other parts are handled with the conceptual porosity model. In this paper, the model is applied to investigate two practical cases in terms of a cover layer of stones on a flat bed under oscillatory flow at different packing densities, and a rock toe structure at a breakwater.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Pennsylvania State University, DHI Hørsholm, DHI Denmark
Authors: Jensen, B. (Ekstern), Liu, X. (Ekstern), Christensen, E. D. (Intern), Rønby, J. (Ekstern)
Predicting intragranular misorientation distributions in polycrystalline metals using the viscoplastic self-consistent formulation

In a recent paper, we reported the methodology to calculate intragranular fluctuations in the instantaneous lattice rotation rates in polycrystalline materials within the mean-field viscoplastic self-consistent (VPSC) model. This paper is concerned with the time integration and subsequent use of these fluctuations to predict orientation-dependent misorientation distributions developing inside each grain representing the polycrystalline aggregate. To this end, we propose and assess two approaches to update the intragranular misorientation distribution within the VPSC framework. To illustrate both approaches, we calculate intragranular misorientations in face-centered cubic polycrystals deformed in tension and plane-strain compression. These predictions are tested by comparison with corresponding experiments for polycrystalline copper and aluminum, respectively, and with full-field calculations. It is observed that at sufficiently high strains some grains develop large misorientations that may lead to grain fragmentation and/or act as driving forces for recrystallization. The proposed VPSC-based prediction of intragranular misorientations enables modeling of grain fragmentation, as well as a more accurate modeling of texture using a computationally efficient mean-field approach, as opposed to computationally more expensive full-field approaches.

General information

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, University of New Hampshire, Los Alamos National Laboratory
Authors: Zecevic, M. (Ekstern), Pantleon, W. (Intern), Lebensohn, R. A. (Ekstern), McCabe, R. J. (Ekstern), Knezevic, M. (Ekstern)
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Main Research Area: Technical/natural sciences

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Scopus rating (2016): CiteScore 5.67 SJR 3.283 SNIP 2.674
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.542 SNIP 2.927 CiteScore 5.22
Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 4.045 SNIP 3.348 CiteScore 5.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 3.29 SNIP 2.709 CiteScore 4.37
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 3.409 SNIP 2.917 CiteScore 4.28
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
Predicting the onset of cracks in bulk metal forming by ductile damage criteria

Three different ductile damage criteria, Ayada, normalized Cockcroft and Latham and a new shear stress based criterion taking into account hydrostatic tension, are utilized for predicting the onset of cracks in various deformation processes. It is found that the Ayada criterion predicts well the onset of cracks when they originate from hydrostatic tension. The shear based criterion predicts cracks triggered by shear and the normalized Cockcroft and Latham criterion indicates the overall area of onset of cracks caused by either hydrostatic or shear stresses. However the prediction is not as accurate as the Ayada criterion for cracks caused by hydrostatic tension.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universidade de Lisboa
Authors: Christiansen, P. (Intern), Nielsen, C. V. (Intern), Martins, P. A. (Ekstern), Bay, N. O. (Intern)
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Ratings:
Prediction of properties of new halogenated olefins using two group contribution approaches

The increasingly restrictive regulations for substances with high ozone depletion and global warming potentials are driving the search for new sustainable fluids with low environmental impact. Recent research works have pointed out the great potential of fluorine- and chlorine-based olefins as refrigerants and solvents, due to their environmentally-friendly features. However, there is a lack of experimental data of their thermophysical properties. In this work, we present two models based on a group contribution method, using a classical approach and neural networks, to predict the critical temperature, critical pressure, normal boiling temperature, acentric factor, and ideal gas heat capacity of organic fluids containing chlorine and/or fluorine. The accuracy of the prediction capacity of the two models is analyzed, and compared with equivalent methods in the literature. The models showed an average reduction of the absolute relative deviation for all the studied properties of more than 50%, compared to other methods. In addition, it was observed that the neural-network-based model yielded a better accuracy than the classical approach in the prediction of all the properties, except for the acentric factor, due to the lack of experimental data for this property.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Chemical and Biochemical Engineering, CAPEC-PROCESS
Authors: Montagud, M. E. M. (Intern), Cignitti, S. (Intern), Abildskov, J. (Ekstern), Woodley, J. (Intern), Haglind, F. (Intern)
Pages: 79-96
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Fluid Phase Equilibria
Volume: 433
ISSN (Print): 0378-3812
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.33 SJR 0.869 SNIP 1.155
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 0.874 SNIP 0.998 CiteScore 1.99
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.982 SNIP 1.248 CiteScore 2.28
Web of Science (2014): Indexed yes
Preface to special issue of selected papers from Theoretical, Experimental, and Computational Mechanics (TECM)

We are pleased to introduce this special issue of the Applied Mathematical Modelling journal with highlights from the Theoretical, Experimental, and Computational Mechanics Symposium (TECM-2015). This special issue consists of four rigorously selected papers originally presented at TECM-2015 as a part of the 13th International Conference of Numerical Analysis and Applied Mathematics 2015 (ICNAAM 2015), which was held on 23-29 September 2015 in Rhodes, Greece. The symposium attracted a broad range of international and local leaders in theoretical, experimental, and computational mechanics across various fields and application.
The symposium did an excellent job of outlining the current landscape of computational mechanics and its capabilities in solving complex industrial problems in the process industries, and we agree with the editor-in-chief of the journal that it is certainly worthwhile recording this in the form of a special issue. The selected papers from the TECM-2015 for potential inclusion in this special issue were identified by the TECM-2015 Organizing Committee based on quality, relevance and scope.

All selected papers were significantly expanded in content by their authors, and were subjected to the rigorous APM review process. We wish to thank the authors for their hard work in turning the original conference papers into top quality full journal articles. We also wish to thank our international reviewers who kindly agreed to review the articles to ensure that the quality of the papers matches those of Applied Mathematical Modelling standards.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Warwick
Authors: Jabbari, M. (Ekstern), Sarlak Chivaee, H. (Intern), Hattel, J. H. (Intern)
Number of pages: 1
Pages: 205
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Applied Mathematical Modelling
Volume: 44
ISSN (Print): 0307-904X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.03 SJR 1.145 SNIP 1.748
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.212 SNIP 1.697 CiteScore 2.67
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.179 SNIP 1.923 CiteScore 2.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.096 SNIP 1.985 CiteScore 2.73
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.919 SNIP 1.856 CiteScore 2.22
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.871 SNIP 1.549 CiteScore 2.06
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.741 SNIP 1.51
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.622 SNIP 1.498
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.445 SNIP 1.213
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.348 SNIP 1.025
Scopus rating (2006): SJR 0.514 SNIP 1.064
Scopus rating (2005): SJR 0.511 SNIP 0.884
Scopus rating (2004): SJR 0.421 SNIP 1.252
Pre-oxidation and its effect on reducing high-temperature corrosion of superheater tubes during biomass firing

Superheater tubes in biomass-fired power plants experience high corrosion rates due to condensation of corrosive alkali chloride-rich deposits. To explore the possibility of reducing the corrosion attack by the formation of an initial protective oxide layer, the corrosion resistance of pre-oxidised Al and Ti-containing alloys (Kanthal APM and Nimonic 80A, respectively) was investigated under laboratory conditions mimicking biomass firing. The alloys were pre-oxidised at 900°C for 1 week. Afterwards, pre-oxidised samples, and virgin non-pre-oxidised samples as reference, were coated with a synthetic deposit of KCl and exposed at 560°C for 1 week to a gas mixture typical of biomass firing. Results show that pre-oxidation could hinder the corrosion attack; however, the relative success was different for the two alloys. While corrosion attack was observed on the pre-oxidised Kanthal APM, the pre-oxidised Nimonic 80A remained unaffected suggesting protection of the alloy from the corrosive environment.
Pressure-assisted forming of non-concentric tubular cross sections with solid medium

Pressure-assisted forming of tubes allows producing a wide variety of tubular components that are difficult or impossible to fabricate by means of conventional tube forming. In contrast to previous investigations in the field that were almost exclusively focused on the utilization of fluids (tube hydroforming) or elastomers (tube rubber forming) as pressuring medium, the subject matter of this article is centred in the utilization of low melting point, recyclable, metallic alloys as solid pressurizing medium. The aims and scope of the article are centred on the feasibility of forming straight carbon steel tubes into complex gooseneck geometries with non-concentric cross sections using lead as a solid pressing medium and employing a double-action cam-driven tool system. The presentation is focused on the tool system, on its adequacy to produce customized tubular components, on the required forming forces and on the typical modes of deformation that result from the different movements provided by the vertical and horizontal actuators of the double-action tool system. Results and observations confirm that the utilization of a double-action tool system with a solid pressurizing medium to assist plastic deformation and prevent collapse can be successfully and effectively employed to fabricate non-concentric tubular cross sections for prototypes and small batches of lightweight components.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universidade de Lisboa
Authors: Alves, L. M. (Ekstern), Silva, C. M. (Ekstern), Nielsen, C. V. (Intern), Martins, P. A. (Ekstern)
Pages: 2123–2132
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Pressurized reversible operation of a 30-cell solid oxide cell stack using carbonaceous gases

Recent theoretical studies show that reversible electrochemical conversion of H2O and CO2 to CH4 inside pressurized solid oxide cells (SOCs) combined with subsurface storage of the produced gases can facilitate seasonal electricity storage with a round-trip efficiency reaching 70-80% and a storage cost below 3 ¢/kWh. Here we show test results with a 30-cell SOFCMAN 301 stack operated with carbonaceous gases at 18.7 bar and 700 °C in both electrolysis and fuel cell mode. The CH4 content in the stack outlet gas increased from 0.22% at open circuit voltage (OCV) to 18% at -0.17 A cm-2 in electrolysis mode. The degradation rates in both fuel cell and electrolysis mode were comparable to previously reported SOFCMAN stack degradation rates measured at ambient pressure operation with H2/H2O gas mixtures.
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.

Printed Circuit Board Surface Finish and Effects of Chloride Contamination, Electric Field, and Humidity on Corrosion Reliability

Corrosion reliability is a serious issue today for electronic devices, components, and printed circuit boards (PCBs) due to factors such as miniaturization, globalization of manufacturing practices which can lead to process-related residues, and global usage effects such as bias voltage and unpredictable user environments. The investigation reported in this paper focuses on understanding the synergistic effect of such parameters, namely contamination, humidity, PCB surface finish, pitch...
Leakage currents were measured on interdigitated comb test patterns with three different types of surface finish typically used in the electronics industry, namely gold, copper, and tin. Susceptibility to electrochemical migration was studied under droplet conditions. The level of base leakage current (BLC) was similar for the different surface finishes and NaCl contamination levels up to relative humidity (RH) of 65%. A significant increase in leakage current was found for comb patterns contaminated with NaCl above 70% to 75% RH, close to the deliquescent RH of NaCl. Droplet tests on Cu comb patterns with varying pitch size showed that the initial BLC before dendrite formation increased with increasing NaCl contamination level, whereas electrochemical migration and the frequency of dendrite formation increased with bias voltage. The effect of different surface finishes on leakage current under humid conditions was not very prominent.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Conseil, H. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Number of pages: 9
Pages: 817–825
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Journal of Electronic Materials
Volume: 46
Issue number: 2
ISSN (Print): 0361-5235
Ratings:
- BFI (2018): BFI-level 1
- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 1
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 1
- Scopus rating (2016): CiteScore 1.49 SJR 0.487 SNIP 0.76
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 1
- Scopus rating (2015): SJR 0.586 SNIP 0.844 CiteScore 1.53
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 1
- Scopus rating (2014): SJR 0.69 SNIP 1.083 CiteScore 1.82
- BFI (2013): BFI-level 1
- Scopus rating (2013): SJR 0.713 SNIP 1.109 CiteScore 1.71
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 1
- Scopus rating (2012): SJR 0.866 SNIP 1.318 CiteScore 1.74
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 1
- Scopus rating (2011): SJR 0.841 SNIP 1.157 CiteScore 1.66
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 1
- Scopus rating (2010): SJR 0.777 SNIP 1.049
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 0.927 SNIP 1.148
- BFI (2008): BFI-level 1
- Scopus rating (2008): SJR 0.875 SNIP 0.961
- Scopus rating (2007): SJR 0.897 SNIP 1.067
This paper aims to introduce a process chain for fabrication of anisotropic optical functional surfaces on polymer products. The surface features under investigation are composed of micro serrated ridges. The scope was to maximize the visible
contrast between horizontally orthogonal textured surfaces from a certain viewing angle. The process chain comprised three steps: tooling, replication, and quality assurance. Tooling was achieved by precision micro milling. Replication processes such as injection moulding, hot embossing, blow moulding, etc. were employed according to the specific type of product. In order to implement the traceability of the manufacturing process, the geometry and dimension of the micro structure on the tool and the replica were assessed via metrological methods. The functionality of the anisotropic surfaces on the polymer replicas were evaluated by a gonioreflectometer and image processing. Eventually, according to the function evaluation of polymer products, the process chain steps will be optimized by tuning the tooling and moulding processes.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Danish Meteorological Institute
Authors: Li, D. (Intern), Zhang, Y. (Intern), Regi, F. (Intern), Tosello, G. (Intern), Madsen, M. H. (Ekstern), Nielsen, J. B. (Intern), Aanæs, H. (Intern), Frisvad, J. R. (Intern)
Pages: 305-306
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 17th International Conference of the European Society for Precision Engineering and Nanotechnology
Publisher: The European Society for Precision Engineering and Nanotechnology
ISBN (Electronic): 978-0-9957751-0-7
Main Research Area: Technical/natural sciences
Conference: 17th euspen International Conference & Exhibition, Hannover, Germany, 29/05/2017 - 29/05/2017
Micro structures, Anisotropic surfaces, Process chain, Moulding, Milling, DOE
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Product portfolio optimization based on substitution
The development of production capabilities has led to proliferation of the product variety offered to the customer. Yet this fact does not directly imply increase of manufacturers' profitability, nor customers' satisfaction. Consequently, recent research focuses on portfolio optimization through substitution and standardization techniques. However, when re-defining the strategic market decisions are characterized by uncertainty due to several parameters. In this study, by using a GAMS optimization model we present a method for supporting strategic decisions on substitution, by quantifying the impact of those parameters. Empirical evidence supplements the research, where a case study from an industry company producing construction material demonstrates the results.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Operations Management, Department of Mechanical Engineering, Engineering Design and Product Development, Technical University of Denmark
Authors: Myrodia, A. (Intern), Moseley, A. (Ekstern), Hvam, L. (Intern)
Pages: 1651-1655
Publication date: 2017

Host publication information
Title of host publication: Proceedings of 2017 IEEE International Conference on Industrial Engineering and Engineering Management (IEEM)
Publisher: IEEE
ISBN (Electronic): 978-1-5386-0948-4
Main Research Area: Technical/natural sciences
Conference: 2017 International Conference on Industrial Engineering and Engineering Management (IEEM), Suntec City, Singapore, 10/12/2017 - 10/12/2017
DOIs:
10.1109/IEEM.2017.8290173
Source: FindIt
Source-ID: 2396146437
Publication: Research › Article in proceedings – Annual report year: 2018

Product/Service-System Origins and Trajectories: A Systematic Literature Review of PSS Definitions and their Characteristics
Literature provides multiple definitions on Product/Service-Systems (PSS), and as the field develops, certain trajectories emerge. The purpose of this article is to provide an overview of the stabilization of PSS definitions within PSS research, by presenting the most prominent PSS definitions and their interrelationships. As the result of a strict protocol, the paper identifies 52 prominent definitions related to PSS, where the citation relations between the prominent definitions are studied and graphically illustrated. The definitions are furthermore analyzed to identify common PSS definition...
characteristics and eleven different characteristics identified. Descriptive analysis is carried out on the identified PSS definition characteristics, to determine commonalities and differences in the field. Even though the literature provides many different variations of PSS definitions, there is certain convergence regarding key characteristics of PSS, including Product and Services as well as Customer Needs.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Technical University of Denmark
Authors: Haase, R. P. (Ekstern), Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
Pages: 157-162
Publication date: 2017
Main Research Area: Technical/natural sciences

**Publication information**
Journal: Procedia C I R P
Volume: 64
ISSN (Print): 2212-8271
Ratings:
Scopus rating (2016): CiteScore 1.6 SNIP 1.297
Scopus rating (2015): SJR 0.572 SNIP 1.012
Scopus rating (2014): SJR 0.736 SNIP 1.419
Scopus rating (2013): SJR 0.515 SNIP 1.163
ISI indexed (2013): ISI indexed no
Original language: English
Product/Service-Systems (PSS), Definitions, Systematic Literature Review
Electronic versions:
1_s2.0_S2212827117301993_main.pdf
DOI:
10.1016/j.procir.2017.03.053

**Bibliographical note**
Copyright: 2017 The Authors. This is an open access article under the CC BY-NC-ND license
Source: Findit
Source-ID: 2371045227
Publication: Research - peer-review › Conference article – Annual report year: 2017

**Prospects of the use of nanofluids as working fluids for organic Rankine cycle power systems**
The search of novel working fluids for organic Rankine cycle power systems is driven by the recent regulations imposing additional phase-out schedules for substances with adverse environmental characteristics. Recently, nanofluids (i.e. colloidal suspensions of nanoparticles in fluids) have been suggested as potential working fluids for organic Rankine cycle power systems due to their enhanced thermal properties, potentially giving advantages with respect to the design of the components and the cycle performance. Nevertheless, a number of challenges concerning the use of nanofluids must be investigated prior to their practical use. Among other things, the trade-off between enhanced heat transfer and increased pressure drop in heat exchangers, and the impact of the nanoparticles on the working fluid thermophysical properties, must be carefully analyzed. This paper is aimed at evaluating the prospects of using nanofluids as working fluids for organic Rankine cycle power systems. As a preliminary study, nanofluids consisting of a homogenous and stable mixture of different nanoparticles types and a selected organic fluid are simulated on a case study organic Rankine cycle unit for waste heat recovery. The impact of the nanoparticle type and concentration on the heat exchangers size, with respect to the reference case, is analyzed. The results indicate that the heat exchanger area requirements in the boiler decrease around 4 % for a nanoparticle volume concentration of 1 %, without significant differences among nanoparticle types. The pressure drop in the boiler increases up to 18 % for the same nanoparticle concentration, but this is not found to impact negatively the pump power consumption.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Chemical and Biochemical Engineering, CERE – Center for Energy Ressources Engineering, KT Consortium, Technical University of Denmark, Fondazione Politecnico di Milano
Authors: Mondejar, M. E. (Intern), Andreasen, J. G. (Intern), Regidor, M. (Ekstern), Riva, S. (Ekstern), Kontogeorgis, G. (Intern), Persico, G. (Ekstern), Haglind, F. (Intern)
Pages: 160-167
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Energy Procedia
Volume: 129
ISSN (Print): 1876-6102
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.467 SNIP 0.586
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.365 SNIP 0.561 CiteScore 0.92
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.433 SNIP 0.81 CiteScore 1.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.425 SNIP 0.785 CiteScore 1.02
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 0.425 SNIP 0.563 CiteScore 1.08
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 0.918 SNIP 1.505 CiteScore 2.42
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 0.433 SNIP 0.957
Web of Science (2009): Indexed yes
Original language: English
Nanofluids, Organic Rankine cycle, Working fluids
Electronic versions:
Mondejar_et_al_2017.pdf
DOIs:
10.1016/j.egypro.2017.09.098

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Open Access
Source: Scopus
Source-ID: 85029757570
Publication: Research - peer-review › Conference article – Annual report year: 2017

Publisher's note: "Topology optimized gold nanostrips for enhanced near-infrared photon upconversion" [Appl. Phys. Lett. 111, 133102 (2017)]
This article was originally published online on 25 September 2017. Due to a production error, in the originally published version the heading of the third column of Table I appeared as "φ/º" (i.e., with an open circle). The correct expression is "φ/º" (i.e., with a degree sign). AIP Publishing apologizes for this error. All online versions of the article were corrected on 29 September 2017 and it appears correctly in print.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Aarhus University
Authors: Vester-Petersen, J. (Ekstern), Christiansen, R. E. (Intern), Julsgaard, B. (Ekstern), Balling, P. (Ekstern), Sigmund, O. (Intern), Madsen, S. P. (Ekstern)
Number of pages: 1
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Volume: 111
Issue number: 15
Quantification of deformation microstructure at ultra-low tensile strain in pure Al prepared by spark plasma sintering

A sample of Al with grain size of 5.1 μm, prepared by spark plasma sintering, was deformed to a nominal strain of 0.35% under exposure to X-ray synchrotron radiation, allowing spatially resolved orientation measurements to be made during loading by use of a micro-diffraction technique. A significant heterogeneity in the deformation pattern between grains was observed. A statistical analysis shows that grain deformation depends more on crystallographic orientation than on grain size, with grains with tensile axis lying towards the <001>-<101> border of the unit triangle tending to undergo larger deformation. Other possible reasons for the different deformation behaviour between individual grains are briefly discussed.

General information
State: Published
Organisations: Department of Wind Energy, Materials science and characterization, Department of Mechanical Engineering, Manufacturing Engineering, Tsinghua University, Chongqing University, Argonne National Laboratory
Number of pages: 6
Publication date: 2017
Conference: 38th Risø International Symposium on Materials Science, Roskilde, Denmark, 04/09/2017 - 04/09/2017
Main Research Area: Technical/natural sciences

Quantifying the robustness of process manufacturing concept – A medical product case study

Product robustness refers to the consistency of performance of all of the units produced. It is often the case that process manufactured products are not designed concurrently, so by the end of the product design phase the Process Manufacturing Concept (PMC) has yet to be decided. Allocating process capable tolerances to the product during the
The design phase is therefore not possible. The robustness of the concept (how capable it is to achieve the product specification), only becomes clear at this late stage and thus after testing and iteration. In this article, a method for calculating the unit-to-unit robustness of an early-stage for a PMC is proposed. The method uses variability and adjustability information from the manufacturing concept in combination with sensitivity information from products' design to predict its functional performance variation. A Technology maturation factor for addressing varied process capability confidence was applied. A four-step process of Define, Connect, Map and Quantify was proposed for calculating PMC robustness and was tested for a wound-care product. The results show that the method was applicable and enabled PMC selection based on quantified robustness. The case also demonstrates that higher robustness is possible even at higher parameter variability with suitable measurements and adjustability.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, ProInvent A/S  
Authors: Boorla, S. M. (Intern), Troldtoft, M. (Ekstern), Eifler, T. (Intern), Howard, T. J. (Intern)  
Pages: 127-138  
Publication date: 2017  
Main Research Area: Technical/natural sciences

**Publication information**

Journal: Advances in Production Engineering & Management  
Volume: 12  
Issue number: 2  
ISSN (Print): 1854-6250  
Ratings:  
Web of Science (2018): Indexed yes  
Web of Science (2017): Indexed Yes  
Scopus rating (2016): CiteScore 1.28 SJR 0.277 SNIP 0.788  
Web of Science (2016): Indexed yes  
Scopus rating (2015): SJR 0.154 SNIP 0.352  
Original language: English  
Product robustness, Process manufacturing concept, Smart process manufacturing, Variation compensation, Industry 4.0  
DOIs:  
10.14743/apem.2017.2.245  
Source: FindIt  
Source-ID: 2370890168  
Publication: Research - peer-review › Journal article – Annual report year: 2017

**Quasi-Static Condensation of Aeroelastic Suspension Bridge Model**

For long span bridges the wind-induced dynamic response is a design driving factor and therefore continuously a subject for detailed analysis. Traditionally both buffeting and stability calculations have been considered in the frequency domain. However, this yields a limitation in accounting for turbulence when considering the stability limit and further it is not possible to account for non-linear effects. These limitations suggest to do simulations of the aeroelastic response of long span bridges in the time domain. For this it is of interest to have an efficient model while still maintaining sufficient accuracy. This contribution is on quasi-static reduction of an aeroelastic finite element model of a 3000m suspension bridge proposed for crossing Sulafjorden in Norway. The model is intended for stability limit calculation where the representation of higher modes is of less importance. The present contribution demonstrates the application of quasi-static condensation to long suspension bridges as well as introduces an extension of the method to include the full aeroelastic system. This includes considerations on reduction of external wind loading as well as motion-induced forces.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Solid Mechanics, Rambøll Danmark A/S  
Authors: Møller, R. N. (Ekstern), Krenk, S. (Intern), N. Svendsen, M. (Ekstern)  
Pages: 129-132  
Publication date: 2017

**Host publication information**

Title of host publication: Proceedings of the 30th Nordic Seminar on Computational Mechanics (NSCM-30)  
Editors: Høgberg, J., Pedersen, N. L.  
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  
Structural Dynamics, Quasi-static Condensation, Aerodynamic Stability, Long Span Bridges  
Electronic versions:
An existing one-dimensional vertical (1DV) turbulence-closure flow model, coupled with sediment transport capabilities, is extended to incorporate graded sediment mixtures. The hydrodynamic model solves the horizontal component of the incompressible Reynolds-averaged Navier–Stokes (RANS) equations coupled with k–ω turbulence closure. In addition to standard bed and suspended load descriptions, the sediment transport model incorporates so-called high-concentration effects (turbulence damping and hindered settling velocities). The sediment transport model treats the bed and suspended load individually for each grain fraction within a mixture, and includes effects associated with increased exposure of larger particles within a mixture. The model also makes use of a modified reference concentration approach, with reference concentrations computed individually for each fraction, and then translated to a common level, which conveniently enables use of a single computational grid for the simulation of suspended sediments. Parametric study shows that these effects combine to help alleviate an otherwise systematic tendency towards over- and under- predicted transport rates for fine and coarse sand fractions, respectively. The sediment transport model is validated against experimental sheet-flow measurements conducted in oscillatory tunnels beneath velocity-skewed wave signals, and demonstrates similar accuracy (predicted transport rates generally within a factor of two of measurements) for both graded mixtures and uniform sands.
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<td>SJR 1.785 SNIP 2.123 CiteScore 2.55</td>
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Original language: English

Sediment transport, Graded sediments, Non-uniform sediment mixtures, Wave boundary layer, k-ω model

DOIs:
Reliability of electronics to humidity-related failures

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Joshy, S. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Number of pages: 1
Publication date: 2017

Host publication information
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Publisher: Technical University of Denmark (DTU)
Article number: E-8
Main Research Area: Technical/natural sciences
Conference: Sustain 2017, Kgs. Lyngby, Denmark, 06/12/2017 - 06/12/2017
Electronic versions:
SustainAbstracts2017c.compressed_48.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Replication assessment of surface texture at sub-micrometre scale

Precision molding and micro injection molding (µIM) have been the main replication technologies allowing for a rapid reduction of the dimensions of the products and, consequently, for the realization of new advanced micro and nano systems. Such miniaturization in the manufacture of polymer micro-parts and parts with micro and nano surfaces is still in progress and requires new specially developed solutions in all the steps of injection molding processes [1]. The achievement of a full surface replication of the tool insert component, when molding the polymer melt, is essential in advanced µIM technology [2]. A replication process requires reproducing a master geometry by conveying it to a substrate material. It is typically induced by means of different energy sources (usually heat and force) and a direct physical contact between the master and the substrate. Furthermore, concepts of advanced products may be founded on combined processes and process chains, including large variety of materials (mainly polymers, glass or metals) and different dimensional scales. Hence, it is particularly critical when dealing with increasingly small dimensions in micro and nanostructured surfaces. In addition, because of the replication nature of molding processes, the required specifications for the manufacture of micro molded components must be ensured by means of a metrological approach to surface replication and dimensional control of both master geometry and replicated substrate [3]-[4]. Therefore, a detailed knowledge is necessary of not only absolute dimensions and geometrical quantities, but also of the measurement uncertainty, which is a decisive parameter to deal with the quality assurance of micro and nano manufactured components [5]. In this context, the quality of the achieved surface texture replication was assessed by the replication fidelity, i.e., comparing the produced parts with the tool used to replicate the geometry. Furthermore, the uncertainty of the replication fidelity was achieved by propagating the uncertainties evaluated for both masters and replicas. Finally, despite the specimens investigated were made of thermoplastic polymers, the techniques employed are general and can be used to describe any kind of material of the replicated substrate.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Quagliotti, D. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 6
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Main Research Area: Technical/natural sciences
Conference: 32nd Annual Meeting of the American Society for Precision Engineering, Charlotte, United States, 29/10/2017 - 29/10/2017
Source: PublicationPreSubmission
Source-ID: 141908948
Publication: Research - peer-review › Conference in proceedings – Annual report year: 2017

Replication of micro and nano-features on iPP by injection molding with fast cavity surface temperature evolution

The production of polymeric components with functional structures in the micrometer and sub-micrometer range is a complex challenge for the injection molding process, since it suffers the use of low cavity surface temperatures that induce the fast formation of a frozen layer, thus preventing accurate replication of micro and nano-features.
In this work, a thin heating device allowed reaching and maintaining the desired temperature on the cavity surface, by joule effect. A nickel insert with micro and nano-features in relief was located on the cavity surface, and the replication by isotactic polypropylene of the features was analyzed, by Atomic Force Microscopy, under several process parameters. The increase of holding pressure enhanced the replication, but accurate replication was achieved only increasing the cavity surface temperature. A heating time comparable with cavity filling time was sufficient to obtain accurate replication, with adequate surface temperatures.

In the case of nano-features, the replication accuracy was affected by the morphology developed on the molding surface, that is aligned along the flow direction with dimensions comparable with the dimension of the nano-features. Therefore, their formation on the surface reduced the accuracy of replication in the direction orthogonal to the flow front.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Salerno
Authors: Speranzaa, V. (Ekstern), Liparatia, S. (Ekstern), Calaon, M. (Intern), Tosello, G. (Intern), Pantania, R. (Ekstern), Titomanlio, G. (Ekstern)
Pages: 559-569
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.885 SNIP 2.654 CiteScore 4.51
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.045 SNIP 3.269 CiteScore 3.8
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.988 SNIP 3.212 CiteScore 3.31
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.406 SNIP 2.521 CiteScore 2.63
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.822
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.93 SNIP 1.81
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.973 SNIP 1.361
Scopus rating (2007): SJR 0.846 SNIP 1.68
Scopus rating (2006): SJR 0.666 SNIP 1.415
Scopus rating (2005): SJR 0.739 SNIP 1.373
Replication quality assessment and uncertainty evaluation of a polymer precision injection moulded component

Among all the recently born manufacturing technologies, precision injection moulding holds a central role, being the only replication process currently capable of accurately producing complex shaped polymer parts integrating micrometric features on a mass scale. In this scenario, a study on the replication quality of a polymer injection moulded precision component for telecommunication applications is presented. The effects of the process parameters on the component dimensional variation have been investigated using a statistical approach. Replication fidelity of produced parts has been assessed using a focus variation microscope with sub-micrometric resolution. Measurement uncertainty has then been evaluated, according to the GUM considering contributions from different process settings combinations and mould geometries. The analysis showed that the injection moulding manufacturing process and the utilized measurement chain are indeed capable of providing the high precision needed for the production. The calculated uncertainties are compatible with the imposed part requirements.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Alicona Imaging GmbH, Flann Microwave Limited
Authors: Baruffi, F. (Intern), Calaon, M. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern), Prantl, M. (Ekstern), Miller, N. (Ekstern)
Pages: 495-496
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Main Research Area: Technical/natural sciences
Conference: 17th euspen International Conference & Exhibition, Hannover, Germany, 29/05/2017 - 29/05/2017
Precision injection moulding, Uncertainty budget, Optical micro metrology, Polymer replication
Source: PublicationPreSubmission
Source-ID: 132847452
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Replication quality assessment and uncertainty evaluation of a polymer precision injection moulded component

Precision injection moulding holds a central role in manufacturing as only replication process currently capable of accurately producing complex shaped polymer parts integrating micrometric features on a mass scale production. In this scenario, a study on the replication quality of a polymer injection moulded precision component for telecommunication applications is presented. The effects of the process parameters on the component dimensional variation have been investigated using a statistical approach. Replication fidelity of produced parts has been assessed using a focus variation microscope with sub-micrometric resolution. Measurement uncertainty has then been evaluated, according to the GUM considering contributions from different process settings combinations and mould geometries. The analysis showed that the injection moulding manufacturing process and the utilized measurement chain are indeed capable of providing the high precision needed for the production. The calculated uncertainties are compatible with the imposed part requirements.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Alicona Imaging GmbH, Flann Microwave Limited
Authors: Baruffi, F. (Intern), Calaon, M. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern), Prantl, M. (Ekstern), Miller, N. (Ekstern)
Number of pages: 2
Reproducing the hierarchy of disorder for Morpho-inspired, broad-angle color reflection

The scales of Morpho butterflies are covered with intricate, hierarchical ridge structures that produce a bright, blue reflection that remains stable across wide viewing angles. This effect has been researched extensively, and much understanding has been achieved using modeling that has focused on the positional disorder among the identical, multilayered ridges as the critical factor for producing angular independent color. Realizing such positional disorder of identical nanostructures is difficult, which in turn has limited experimental verification of different physical mechanisms that have been proposed. In this paper, we suggest an alternative model of inter-structural disorder that can achieve the same broad-angle color reflection, and is applicable to wafer-scale fabrication using conventional thin film technologies. Fabrication of a thin film that produces pure, stable blue across a viewing angle of more than 120 ° is demonstrated, together with a robust, conformal color coating.
Response surface modelling of tool electrode wear rate and material removal rate in micro electrical discharge machining of Inconel 718

Inconel 718 is a corrosion-resistant and high strength nickel-based alloy with wide range of applications including components for cryogenic tankage, liquid fueled rockets and casings for aircraft engines. The material is characterized by high hardness, high temperature strength, low thermal conductivity and high strength causing it extremely difficult to machine. Micro-Electrical Discharge Machining (Micro-EDM) is a non-conventional method that has a potential to overcome these restrictions for machining of Inconel 718. Response Surface Method (RSM) was used for modelling the tool Electrode Wear Rate (EWR) and Material Removal Rate (MRR) with the input factors such as voltage (V), peak current (I on) and pulse on-time (T on). The RSM analysis of variance results show that the main input factors’ pulse off-time and peak voltage are significant in controlling the tool electrode wear rate at 95% confidence level. An increase in voltage from 30 to 45 V and pulse on-time from 1 to 3 μs causes a linear decrease in EWR by 35%. Using response surface modeling, a 3 minimum EWR of 12.3184 μm/min and a maximum MRR of 37.2151 μm/min is obtained at a current of 1.07 A, pulse ontime of 4.44 μs, pulse off-time of 4.06 μs and voltage of 60 V.
to investigate the escape of lubricant from the pocket by means of Micro Plasto HydroDynamic Lubrication and MicroPlasto HydroStatic Lubrication. For the investigation on Micro Plasto HydroStatic Lubrication, the friction along the tool–workpiece contact interface and the back tension are taken as parameters, and the backward escape Micro PlastoHydroDynamic Lubrication is investigated by variations in lubricant viscosity by means of a combined numerical and analytical model, and by variations in drawing speed. Good agreement is found with the experimental observations.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universidade de Lisboa
Authors: Üstünyagiz, E. (Intern), Christiansen, P. (Intern), Nielsen, C. V. (Intern), Bay, N. O. (Intern), Martins, P. A. (Ekstern)
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.18 SJR 0.634 SNIP 0.819
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.61 SNIP 0.858 CiteScore 0.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.581 SNIP 0.917 CiteScore 0.89
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.666 SNIP 1.034 CiteScore 0.83
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.658 SNIP 0.957 CiteScore 0.72
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.685 SNIP 1.174 CiteScore 0.8
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.607 SNIP 1
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.574 SNIP 0.68
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.55 SNIP 0.793
Scopus rating (2007): SJR 0.79 SNIP 1.138
Scopus rating (2006): SJR 0.541 SNIP 0.943
Scopus rating (2005): SJR 0.675 SNIP 1.115
Scopus rating (2004): SJR 0.834 SNIP 1.093
Scopus rating (2003): SJR 1.734 SNIP 1.557
Web of Science (2003): Indexed yes
Rheology of high melt strength polypropylene for additive manufacturing

Rheological measurements of high melt strength polypropylene (HMS-PP) were used in order to generate master curves describing the shear-dependent viscosity in comparison to acrylonitrile butadiene styrene copolymer (ABS). The latter material showed specific disadvantages in terms of thermal stability, whereas HMS-PP showed a more stable behavior at the investigated temperatures. Hereafter, the material was used in a fused deposition modeling additive manufacturing process, focusing on the investigation of possible improvements of HMS-PP over ABS. Based on the extrusion parameters for ABS, adapted parameters for HMS-PP were determined using a fused deposition modeling test bench. The rheological survey clearly showed changes in the melt viscosity of both ABS and HMS-PP due to thermal degradation. However, the comparison of rheological data of the virgin materials with those of printed material showed negligible changes. This leads to the conclusion that the thermal degradation of HMS-PP and ABS during the fused deposition modeling process is negligible, due to the short exposure time to elevated temperatures. Copyright © 2017 VBRI Press.

Robust Return Algorithm for Anisotropic Plasticity Models

Plasticity models can be defined by an energy potential, a plastic flow potential and a yield surface. The energy potential defines the relation between the observable elastic strains \( \Upsilon_e \) and the energy conjugate stresses \( \Upsilon_e \) and between the non-observable internal strains \( i \) and the energy conjugate internal stresses \( \Upsilon_i \), where the internal stresses control the various hardening mechanisms.
Sample Applications of the Second Generation Intact Stability Criteria – Robustness and Consistency Analysis

A new Intact Stability Code, the so-called Second Generation of Intact Stability Criteria, is currently under development and validation by the International Maritime Organization (IMO). The criteria are separated into five failure modes, each of which is analyzed by two vulnerability levels and, if needed, a direct numerical simulation. The present paper summarizes results testing the vulnerability levels in these new stability criteria. The calculations are carried out for 17 ships using the full matrix of operational draughts, trims and GM values. Each failure mode criterion is examined individually regarding construction of a GM limit curve for the full range of operational draughts. The consistency of the outcomes has been analyzed, and finally examined whether the new criteria tend to be more or less conservative compared to the present rules by evaluating approved loading conditions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Knud E. Hansen A/S, HOK Marineconsult ApS, OSK-ShipTech, Odense Maritime Technology A/S, DFDS, University of Southern Denmark, Lloyd’s Register EMEA
Authors: Schrøter, C. (Ekstern), Lützen, M. (Forskerdatabase), Erichsen, H. (Ekstern), Jensen, J. J. (Intern), Kristensen, H. O. (Ekstern), Hagelskjær Lauridsen, P. (Ekstern), Tuncan, O. (Forskerdatabase), Baltsersen, J. P. (Ekstern)
Pages: 9-13
Publication date: 2017
Selecting the optimum engineering model for the frequency response of fcc nanowire resonators

The full potential of the nanoelectromechanical systems, NEMS, as one of the leading examples among the new-generation sensing technologies, is yet to be realized. One of the main challenges on the road is the mechanical modeling of their core elements, the tiny mechanical building blocks such as the nanowire resonators. The success of the engineering design of such miniaturized systems will depend heavily on the availability of accurate mechanistic models with the least possible computational cost. Although a variety of models are available for this purpose, the boundaries between their admissible domains remain rather vague. For example, analytical approaches including Euler–Bernoulli and Timoshenko beam theories provide closed-form solutions and work reasonably well for moderate nanowire geometries, and hence, they are frequently utilized in the literature. However, their validity in the case of extreme surface-to-volume ratios remains questionable. Classical finite element method can partially be used to address these deficiencies. On the other hand, molecular dynamics provide accurate results, while nanowire geometries studied with this computationally demanding technique usually remain confined to dimensions below those of practical interest. To address these issues, a benchmarking study among analytical and numerical techniques is carried out, where Surface Cauchy–Born theory serves as the reference. Using gold nanowires with different dimensions and boundary conditions, it is observed that analytical models are applicable within a length-to-thickness ratio range of 7–11 in the fixed–fixed configuration, whereas they can be used safely within a length-to-thickness ratio range of less than 25 in the fixed–free configuration. Deviations as high as 50% are encountered for length-to-thickness ratios exceeding 11 for both the analytical approach and the classical finite element method in the fixed–fixed structure. The deviations are quantitatively linked to the dominance of the surface effect through the use of the Surface Cauchy–Born model. For length-to-thickness ratios less than 7, the lack of cross-sectional deformations in analytical treatment is also observed to lead to high deviations for the fixed–fixed configuration through the comparison with higher-order beam theories. Results are verified with silver nanowires as well. The work provides a guideline for selecting the optimum mechanical model given the nanowire resonator dimensions and boundary conditions.
Selection of cooling fluid for an organic Rankine cycle unit recovering heat on a container ship sailing in the Arctic region

As Arctic sea ice coverage declines it is expected that marine traffic could increase in this northern region due to shorter routes. Navigating in the Arctic offers opportunities and challenges for waste heat recovery systems (WHRS). Lower temperatures require larger heating power on board, hence a larger demand for waste heat usage, to cover services and maintaining on board spaces temperatures. However, a lower heat rejection temperature increases the WHRS thermal efficiency. The air temperature for the Arctic route selected is colder than that of the seawater, opening the opportunity of having air as coolant. This paper explores the use of two different coolants, air and seawater, for an organic Rankine cycle (ORC) unit using the available waste heat in the scavenging air system of a container ship navigating in Arctic Circle. Using a two-step single objective optimisation process, detailed models of air and seawater heat exchangers are evaluated as the WHRS condensers. The results suggest that an ORC unit using R1233zd(E) as its working fluid coupled with seawater as its coolant is the preferable option to reduce CO2 emissions. Using the ambient air as the coolant while a less effective option could be cheaper to install.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, University College London
Authors: Suárez de la Fuente, S. (Ekstern), Larsen, U. (Intern), Pierobon, L. (Intern), Kærn, M. R. (Intern), Haglind, F. (Intern), Greig, A. (Ekstern)
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Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798
Sensing and Rating of Vehicle–Railroad Bridge Collision

Overhead collisions of trucks with low-clearance railway bridges cause more than half of the railway traffic interruptions over bridges in the United States. Railroad owners are required to characterize the damage caused by such events and assess the safety of subsequent train crossings. However, damage characterization is currently visual (subjective) and becomes difficult in remote locations where collisions are not reported and inspections are not performed following the impact. To mitigate these shortcomings, this paper presents a new impact definition and rating strategy for automatically and remotely quantify damage. This research proposes an impact rating strategy based on the information that best
describes the consequences of vehicle-railway bridge collisions. A series of representative impacts were simulated using numerical finite element models of a steel railway bridge. Railway owners provided information about the bridge and impact characterization based on railway industry experience. The resulting nonlinear dynamic responses were evaluated with the proposed rating strategy to assess the effect of these impacts. In addition, a neural network methodology was implemented on a simplified numerical model to identify spatial characteristics of the impact damage.

**General information**
**State:** Published  
**Organisations:** Department of Mechanical Engineering, Solid Mechanics, University of New Mexico, Institute of Disaster Prevention, Rice University, Sandia National Laboratories  
**Authors:** Vemuganti, S. (Ekstern), Ozdagli, A. I. (Ekstern), Liu, B. (Ekstern), Bajric, A. (Intern), Moreu, F. (Ekstern), Brake, M. (Ekstern), Troyer, K. (Ekstern)  
**Pages:** 227-234  
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**Volume:** 2  
**Publisher:** Springer  
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**ISBN (Electronic):** 978-3-319-54777-0  
**Series:** Conference Proceedings of the Society for Experimental Mechanics Series  
**ISSN:** 2191-5644  
**Main Research Area:** Technical/natural sciences  
**Conference:** 35th Conference and Exposition on Structural Dynamics (IMAC 2017), Garden Grove, United States, 30/01/2017 - 30/01/2017  
**Railway bridges, Structural health monitoring, Finite element model, Impact detection, Neural networks**

**Shear and foundation effects on crack root rotation and mode-mixity in moment- and force-loaded single cantilever beam sandwich specimen**

Foundation effects play a crucial role in sandwich fracture specimens with a soft core. Accurate estimation of deformation characteristics at the crack front is vital in understanding compliance, energy release rate and mode-mixity in fracture test specimens. Beam on elastic foundation analysis of moment- and force-loaded single cantilever beam sandwich fracture specimens is presented here. In addition, finite element analysis of the single cantilever beam specimen is conducted to determine displacements, rotations, energy release rate and mode-mixity. Based on finite element analysis, a foundation modulus is proposed that closely agrees with the numerical compliance and energy release rate results for all cases considered. An analytical expression for crack root rotation of the loaded upper face sheet provides consistent results for both loading configurations. For the force-loaded single cantilever beam specimen (in contrast to themoment-loaded case), it was found that the crack length normalized energy release rate and the mode-mixity phase angle increase strongly as the crack length decreases, a result of increased dominance of shear loading.

**General information**
**State:** Accepted/In press  
**Organisations:** Department of Mechanical Engineering, Solid Mechanics, Florida Atlantic University  
**Authors:** Saseendran, V. (Intern), Carlsson, L. A. (Ekstern), Berggreen, C. (Intern)  
**Number of pages:** 11  
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**Web of Science (2017):** Indexed Yes
Shot peening speed measurements using lidar technology

The shot peening technique is used for the surface modification of metallic components that are part of wind turbines, such as gears, bolts and blade coatings to prevent erosion. An important parameter of this technique is the dynamic energy of emitted shots. In this context the objective of this project is to present a proof of concept measurement method for the evaluation of the speed of the shots. A remote sensing laser anemometer was selected as a probing instrument of the peening shots’ speed since it avoids any disturbances to the flow from the presence of an in-situ instrument. Furthermore, the risk of damaging the peening machine by installing an instrument inside the chamber during operation is eliminated by this approach. Laser anemometers are being researched and developed in the department of Wind Energy, mainly in the framework of the WindScanner.dk infrastructure project [1], but also validated and used in monitoring the wind conditions around wind turbines (wake and inflow), over complex terrain as well as offshore.
Simulation-Based Business Case for PSS: A System Dynamics Framework

Many potential business benefits have been widely associated with the implementation of PSS. Still, several significant challenges for transitioning to PSS persist, especially in regards to materializing the business benefits. To tackle such difficulty, this paper suggests a theory-driven concept of a business case for PSS implementation and management, based on a System Dynamics simulation framework. With a maturity-oriented theoretical perspective and the associated capability concepts, the study provides insights into how the development of PSS capabilities can potentially affect corporate performance over time. The paper’s preliminary results identify the potential for managers and other decision-makers to use the business case simulator to assessing PSS-related business benefits and responding to multiple implementations scenarios and strategies.
Simultaneous measurement of temperature and humidity with microstructured polymer optical fiber Bragg gratings
A microstructured polymer optical fiber (mPOF) Bragg grating sensor system for the simultaneous measurement of temperature and relative humidity (RH) has been developed and characterized. The sensing head is based on two in-line fiber Bragg gratings recorded in a mPOF. The sensor system has a root mean square deviation of 1.04 % RH and 0.8 °C in the range 10 to 90% RH and 20 to 80 °C. The proposed sensor system is easy to fabricate, cheap and compact.

General information
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Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Chemical and Biochemical Engineering, CHEC Research Centre, The Hempel Foundation Coatings Science and Technology Centre (CoaST), Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Pedersen, J. K. M. (Intern), Fasano, A. (Intern), Nielsen, K. (Intern), Markos, C. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Number of pages: 4
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Main Research Area: Technical/natural sciences
Conference: 25th International Conference on Optical Fiber Sensors, Jeju, Korea, Republic of, 24/04/2017 - 24/04/2017
Polymer waveguides, Fiber Bragg gratings, Fiber optics sensors, Humidity, Temperature
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Slip divergence of water flow in graphene nanochannels: the role of chirality
Graphene has attracted considerable attention due to its characteristics as a 2D material and its fascinating properties, providing a potential building block for nanofabrication. In nanochannels the solid-liquid interface plays a non-negligible role in determining the fluid dynamics. Therefore, for an optimal design of nanofluidic devices, a comprehensive understanding of the slippage in a water flow confined between graphene walls is important. In nanoconfinement, experimental and computational studies have found the slip length to increase nonlinearly when the shear rate is larger than a critical value. Here, by conducting molecular dynamics simulations, we study the influence of the graphene crystallographic orientation on the slip boundary conditions inside a nanoslit channel. The flow in channels with heights of 2.0, 2.4 and 2.8 nm is driven parallel to the zig-zag and arm-chair crystallographic directions. We extract flow rates, velocity profiles, slip velocities and slip lengths. The slip velocity displays a linear relationship to the shear stress up to a critical value, which is not size dependent. Moreover, the slip length is found to be shear stress dependent above a critical shear stress value of 0.4 MPa. Furthermore, our results indicate that after this critical shear stress is reached, the flow rates are significantly influenced (up to 10%) by the particular orientation of the graphene topology.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
Authors: Wagemann, E. (Ekstern), Oyarzua, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. A. (Ekstern)
Pages: 8646-8652
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Main Research Area: Technical/natural sciences

Publication information
Journal: Physical Chemistry Chemical Physics
Volume: 19
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Solution-Mediated Annealing of Polymer Optical Fiber Bragg Gratings at Room Temperature

In this letter, we investigate the response of poly(methylmethacrylate) (PMMA) microstructured polymer optical fiber Bragg gratings (POFBGs) after immersion in methanol/water solutions at room temperature. As the glass transition temperature of solution-equilibrated PMMA differs from the one of solvent-free PMMA, different concentrations of methanol and water lead to various degrees of frozen-in stress relaxation in the fiber. After solvent evaporation, we observe a permanent blue-shift in the grating resonance wavelength. The main contribution in the resonance wavelength shift arises from a permanent change in the size of the fiber. The results are compared with conventional annealing. The proposed methodology is cost-effective as it does not require a climate chamber. Furthermore, it enables an easy-to-control tuning of the resonance wavelength of POFBGs.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Janting, J. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 687-690
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Main Research Area: Technical/natural sciences

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Journal: I E E E Photonics Technology Letters
Volume: 29
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.52 SJR 1.018 SNIP 1.279
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.263 SNIP 1.327 CiteScore 2.62
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.461 SNIP 1.614 CiteScore 2.78
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.487 SNIP 1.547 CiteScore 2.95
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.623 SNIP 1.706 CiteScore 2.46
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.51 SNIP 2.012 CiteScore 2.48
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.474 SNIP 1.623
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.775 SNIP 1.804
Web of Science (2009): Indexed yes
Solving the linearized forward-speed radiation problem using a high-order finite difference method on overlapping grids

The linearized potential flow approximation for the forward speed radiation problem is solved in the time domain using a high-order finite difference method. The finite-difference discretization is developed on overlapping, curvilinear body-fitted grids. To ensure numerical stability, the convective derivatives in the free-surface boundary conditions are treated using an upwind-biased stencil. Instead of solving for the radiation impulse response functions, a pseudo-impulsive Gaussian type displacement is employed in order to tailor the frequency-content to the discrete spatial resolution. Frequency-domain results are then obtained from a Fourier transform of the force and motion signals. In order to make a robust Fourier transform, and capture the response around the critical frequency, the tail of the force signal is asymptotically extrapolated assuming a linear decay rate. Fourth-order convergence of the calculations on simple geometries is demonstrated, along with a nearly linear scaling of the solution effort with increasing grid resolution. The code is validated by comparison with analytical and semi-analytical solutions using submerged and floating closed-form geometries. Calculations are also made for a modern bulk carrier, and good agreement is found with experimental measurements.
During the injection of a fluid in a tissue model, the fluid might be affected by the needle tip configuration and the number of channels. Thus, the objective of the present work is to observe the influence of different needle tips and number of channels on the spread of a fluid. Fluid distribution data were obtained after injecting 0.3 mL of fluid into a foamed polymer model with a velocity of 2 mm/s. The spread area and the depth were determined for 3 different types of hypodermic needles: Single channel needles with bevel tip and blunt tip and a needle with conical tip and 3 internal channels. The bevel tip provides a higher spread in the direction where the bevel points and reaches larger depths than the other two needles. The spread for the blunt tip and the polymer needle is equally distributed on both sides of the needle. The largest horizontal area around the tip is achieved by the 3-channel needle. The tip configuration and number of channels have an influence on the distribution of fluid. The bevelled needle directs the fluid and reaches larger depths compared with the 3-channel needle that gets more horizontal spread.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Technical University of Denmark
Authors: Gomes, S. (Ekstern), Drakidis, A. D. (Intern), Silva, P. (Ekstern), Lenau, T. A. (Intern)
Fluid distribution, Hypodermic needle, Multi-channel needles, Tip configurations

Start-up performance of parabolic trough concentrating solar power plants

Concentrating solar power plants, even though they can be integrated with thermal energy storage, are still subjected to cyclic start-up and shut-downs. As a consequence, in order to maximize their profitability and performance, the flexibility with respect to transient operations is essential. In this regard, two of the key components identified are the steam generation system and steam turbine. In general it is desirable to have fast ramp-up rates during the start-up of a power plant. However ramp-up rates are limited by, among other things, thermal stresses, which if high enough can compromise the life of the components. Moreover, from an operability perspective it might not be optimal to have designs for the highest heating rates, as there may be other components limiting the power plant start-up. Therefore, it is important to look at the interaction between the steam turbine and steam generator to determine the optimal ramp rates. This paper presents a methodology to account for thermal stresses limitations during the power plant start up, aiming at identifying
which components limit the ramp rates. A detailed dynamic model of a parabolic trough power plant was developed and integrated with a control strategy to account for the start-up limitations of both the turbine and steam generator. The models have been introduced in an existing techno-economic tool developed by the authors (DYEOPT). The results indicated that for each application, an optimal heating rates range can be identified. For the specific case presented in the paper, an optimal range of 7-10 K/min of evaporator heating rate can result in a 1.7-2.1% increase in electricity production compared to a slower component (4 K/min).

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, KTH - Royal Institute of Technology
Authors: Ferruzza, D. (Intern), Topel, M. (Ekstern), Basaran, I. (Ekstern), Laumert, B. (Ekstern), Haglind, F. (Intern)
Number of pages: 10
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BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.21 SJR 0.163 SNIP 0.236
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.179 SNIP 0.217 CiteScore 0.18
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.165 SNIP 0.191 CiteScore 0.17
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.16 SNIP 0.173 CiteScore 0.16
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.17 SNIP 0.176 CiteScore 0.14
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.153 SNIP 0.141 CiteScore 0.12
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.16 SNIP 0.144
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.157 SNIP 0.137
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.162 SNIP 0.112
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.157 SNIP 0.125
Scopus rating (2006): SJR 0.157 SNIP 0.121
Scopus rating (2005): SJR 0.157 SNIP 0.187
Scopus rating (2004): SJR 0.122 SNIP 0
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.416 SNIP 0.765
Scopus rating (2002): SJR 2.677 SNIP 1.594
Web of Science (2001): Indexed yes
Original language: English
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State-of-the-art of fiber-reinforced polymers in additive manufacturing technologies

Additive manufacturing technologies have received a lot of attention in recent years for their use in multiple materials such as metals, ceramics, and polymers. The aim of this review article is to analyze the technology of fiber-reinforced polymers and its implementation with additive manufacturing. This article reviews recent developments, ideas, and state-of-the-art technologies in this field. Moreover, it gives an overview of the materials currently available for fiber-reinforced material technology.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Hofstätter, T. (Intern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 13
Pages: 1061-1073
Publication date: 2017
Main Research Area: Technical/natural sciences

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Journal: Journal of Reinforced Plastics & Composites
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BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.24 SJR 0.418 SNIP 0.648
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.489 SNIP 0.846 CiteScore 1.32
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.686 SNIP 1.021 CiteScore 1.58
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.6 SNIP 1.027 CiteScore 1.35
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.53 SNIP 0.872 CiteScore 1
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.415 SNIP 0.768 CiteScore 0.86
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.421 SNIP 0.91
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.508 SNIP 0.857
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.477 SNIP 0.724
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.358 SNIP 0.765
Scopus rating (2006): SJR 0.328 SNIP 0.682
Scopus rating (2005): SJR 0.312 SNIP 0.601
Scopus rating (2004): SJR 0.363 SNIP 0.658
State-of-the-art on Computed Tomography and assembly verification

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Stolfi, A. (Intern)
Number of pages: 53
Publication date: 2017

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Original language: English
Main Research Area: Technical/natural sciences

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The report is confidential.
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Publication: Research › Report – Annual report year: 2017

Statistical prediction of parametric roll using FORM

Previous research has shown that the First Order Reliability Method (FORM) can be an efficient method for estimation of outcrossing rates and extreme value statistics for stationary stochastic processes. This is so also for bifurcation type of processes like parametric roll of ships. The present paper discusses this solution procedure with a focus on the computational efficiency of FORM as compared with Monte Carlo Simulation (MCS).

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Jensen, J. J. (Intern), Choi, J. (Intern), Nielsen, U. D. (Intern)
Pages: 235–242
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Ocean Engineering
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46 SJR 1.315 SNIP 2.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.172 SNIP 1.989 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Steady-state crack growth in single crystals under Mode I loading

The active plastic zone that surrounds the tip of a sharp crack growing under plane strain Mode I loading conditions at a constant velocity in a single crystal is studied. Both the characteristics of the plastic zone and its effect on the macroscopic toughness is investigated in terms of crack tip shielding due to plasticity (quantified by employing the Suo, Shih, and Varias set-up). Three single crystals (FCC, BCC, HCP) are modelled in a steady-state elastic visco-plastic framework, with emphasis on the influence of rate-sensitivity and crystal structures. Distinct velocity discontinuities at the crack tip predicted by Rice [Rice J.R., 1987. Tensile crack tip fields in elastic-ideally plastic crystals. Mech. Mater. 6, pp. 317–335] for quasi-static crack growth are confirmed through the numerical simulations and highly refined details are revealed. Through a detailed study, it is demonstrated that the largest shielding effect develops in HCP crystals, while the lowest shielding exists for FCC crystals. Rate-sensitivity is found to affect the plastic zone size, but the characteristics overall remain similar for each individual crystal structure. An increasing rate-sensitivity at low crack velocities monotonically increases the crack tip shielding, whereas the opposite behaviour is observed at high velocities. This observation leads to the existence of a characteristic velocity at which the crack tip shielding becomes independent of the rate-sensitivity.

General information
State: Published
Steady-state, elastic-plastic growth of slanted cracks in symmetrically loaded plates

Elastic and elastic-plastic results are obtained for a semi-infinite slanted through-crack propagating in a symmetrically loaded plate strip with the aim of providing theoretical background to commonly observed plate tearing behavior. Were it not for the slant of the crack through the thickness of the plate, the problem would be mode I, but due to the slant the local conditions along the crack front are a combination of mode I and mode III. A three-dimensional formulation for steady-state crack propagation is employed to generate distributions of effective stress, stress triaxiality and Lode parameter through the plate in the plastic zone at the crack tip. The distribution of the mode I and mode III stress intensity factors along the crack front are obtained for the elastic problem. The out-of-plane bending constraint imposed on the plate significantly influences the mixed mode behavior along the crack front. The solution is examined for clues as to why propagating slant cracks sometimes undergo a transition and flip about 90° to propagate with the opposite slant orientation.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Harvard University
Authors: Nielsen, K. L. (Intern), Hutchinson, J. W. (Ekstern)
Number of pages: 9
Pages: 286-294
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Main Research Area: Technical/natural sciences

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Journal: International Journal of Impact Engineering
Volume: 108
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.3 SJR 1.509 SNIP 2.137
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.878 SNIP 3.054 CiteScore 3.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.015 SNIP 3.653 CiteScore 3.07
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 2.21 SNIP 3.744 CiteScore 2.98
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.751 SNIP 3.687 CiteScore 2.48
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.593 SNIP 3.124 CiteScore 2.44
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.409 SNIP 2.453
Steady-state numerical modeling of size effects in micron scale wire drawing

Wire drawing processes at the micron scale have received increased interest as micro wires are increasingly required in electrical components. It is well-established that size effects due to large strain gradient effects play an important role at this scale and the present study aims to quantify these effects for the wire drawing process. Focus will be on investigating the impact of size effects on the most favourable tool geometry (in terms of minimizing the drawing force) for various conditions between the wire/tool interface. The numerical analysis is based on a steady-state framework that enables convergence without dealing with the transient regime, but still fully accounts for the history dependence as well as the elastic unloading. Thus, it forms the basis for a comprehensive parameter study. During the deformation process in wire drawing, large plastic strain gradients evolve in the contact region. This creates a need for a higher order plasticity theory to accurately predict the material behaviour across the multiple scales involved. The present study reveals that the contribution from an energetic (recoverable) length parameter is limited, while the corresponding dissipative contribution dominates and tends to shift the drawing force to a higher level. As a direct consequence, the strain gradient hardening effect reduces the most favourable tool angle of a sharp tool with up to 50% (in terms of the required drawing force), whereas a circular shaped tool is proven less sensitive to scaling effects. By considering the contact force profile between tool and material it becomes clear that the strain gradients have a smoothing effect and both the magnitude and position of the peak pressure are affected significantly. A round tool is found to reduce the peak force, while the location of the peak is found to move from outlet to inlet depending on the tool geometry.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Juul, K. J. (Intern), Nielsen, K. L. (Intern), Niordson, C. F. (Intern)
Pages: 163-171
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Main Research Area: Technical/natural sciences

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Journal: Journal of Manufacturing Processes
Volume: 25
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Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed yes
Scopus rating (2016): CiteScore 2.47 SJR 0.984 SNIP 1.686
Scopus rating (2015): SJR 0.993 SNIP 1.91 CiteScore 2.26
Scopus rating (2014): SJR 1.021 SNIP 1.963 CiteScore 1.77
Scopus rating (2013): SJR 0.872 SNIP 1.521 CiteScore 1.74
Scopus rating (2012): SJR 0.978 SNIP 1.814 CiteScore 1.72
Steam based conversion coating on AA6060 alloy: Effect of sodium silicate chemistry and corrosion performance

Surface treatment of aluminium alloy AA6060 using an industrially applicable pilot steam jet system with and without silicate chemistry has been investigated. Treatment using steam alone and steam with silicate, resulted in an oxide layer formation with thickness ~425 nm and ~160 nm, respectively. Moreover, the use of sodium silicate resulted in the formation of distinct microstructure and incorporation of silicate into the oxide film. These oxide films reduced the anodic activity 4 times, while the corrosion protection by silicate containing oxide was the function of its concentration. Further, in acid salt spray and filiform corrosion tests, oxide layer containing silicate exhibited two times higher corrosion resistance.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Danish Technological Institute
Authors: Din, R. U. (Intern), Bordo, K. (Intern), Tabrizian, N. (Ekstern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Pages: 78-89
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Main Research Area: Technical/natural sciences

Publication information
Journal: Applied Surface Science
Volume: 423
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.37 SJR 0.951 SNIP 1.225
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.914 SNIP 1.3 CiteScore 3.13
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.958 SNIP 1.477 CiteScore 2.96
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.965 SNIP 1.488 CiteScore 2.78
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Stress and Strain Gradients in a Low Carbon Steel Deformed under Heavy Sliding

A recent study [1] has shown that a microstructure can be refined to a record low of 5 nm and that dislocation glide is still a controlling mechanism at this length scale. In this study, by heavy rotatory sliding of a low carbon steel a gradient structure has been produced extending to about 2.5 mm below the surface reducing the structural scale to the nanometer dimension and increasing the strength to extreme values by dislocation and boundary strengthening. The microstructure and texture gradient are analyzed and stress and strain gradients produced by plastic deformation are evaluated based on the deformation microstructure using the classic stress-structure relationship. Computational and materials modelling has been advanced from bulk to gradient structures leading to dissemination of constitutive stress-strain equations in gradient structures.

General information
State: Published
Organisations: Department of Mechanical Engineering, Department of Wind Energy, Manufacturing Engineering, Materials science and characterization, Materials and Surface Engineering
Authors: Zhang, X. (Intern), Hansen, N. (Intern), Huang, X. (Intern)
Publication date: 2017
Event: Abstract from TMS 2017, San Diego, United States.
Main Research Area: Technical/natural sciences
Superhydrophobic hierarchical structures produced with extrusion coating

General information
State: Published
Organisations: Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Department of Mechanical Engineering
Authors: Okulova, N. (Intern), Okulov, V. (Intern), Taboryski, R. J. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences
Electronic versions:

Suspended particle transport through constriction channel with Brownian motion
It is well known that translocation events of a polymer or rod through pores or narrower parts of micro- and nanochannels have a stochastic nature due to the Brownian motion. However, it is not clear whether the objects of interest need to have a larger size than the entrance to exhibit the deviation from the dynamics of the surrounding fluid. We show by numerical analysis that the particle injection into the narrower part of the channel is affected by thermal fluctuation, where the particles have spherical symmetry and are smaller than the height of the constriction. The Péclet number (Pe) is the order parameter that governs the phenomena, which clarifies the spatio-temporal significance of Brownian motion compared to hydrodynamics. Furthermore, we find that there exists an optimal condition of Pe to attain the highest flow rate of particles relative to the dispersant fluid flow. Our finding is important in science and technology from nanopore DNA sequencers and lab-on-a-chip devices to filtration by porous materials and chromatography.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Tokyo University of Agriculture and Technology
Authors: Hanasaki, I. (Ekstern), Walther, J. H. (Intern)
Number of pages: 8
Publication date: 2017
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.95 SJR 0.993 SNIP 0.896
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.047 SNIP 0.978 CiteScore 1.89
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.22 SNIP 1.123 CiteScore 2.05
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Synchrotron measurements of local microstructure and residual strains in ductile cast iron

The local microstructure and distribution of thermally induced residual strains in ferrite matrix grains around an individual spherical graphite nodule in ductile cast iron (DCI) were measured using a synchrotron X-ray micro-diffraction technique. It is found that the matrix grains are deformed, containing dislocations and dislocation boundaries. Each of the residual strain components in the matrix grains exhibits a complex pattern along the circumferential direction of the nodule. Along the radial direction of the nodule, strain gradients from the interface to the grain interior are seen for some strain components, but only in some matrix grains. The observed residual strain patterns have been analysed by finite element modelling, and a comparison between the simulation and experiments is given. The present study of local residual stress by both experimental characterization and simulation provide much needed information for understanding the mechanical properties of DCI, and represent an important contribution for the microstructural design of new DCI materials.

General information
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.
Techno-economic analysis of expander-based configurations for natural gas liquefaction

The use of liquefied natural gas (LNG) as a marine fuel is rapidly growing because of the possible economic advantages over conventional fuels and stricter environmental regulations. Production of LNG is energy-intensive because of the required temperature level of around -160°C. Three main types of refrigeration cycles have been developed. The present work focuses on the comparison of six expander-based configurations, which in spite of the higher power consumption are more compact, flexible and easier to operate. They are optimised from a thermodynamic perspective: the exergetic efficiency ranges between 15.5 % and 30 % for a specific power consumption from 2570 kJ/kg down to 1340 kJ/kg. Multi-objective optimisations are performed to simultaneously minimise the net power consumption and the heat transfer conductance as an indicator of the required heat transfer area. The latter ranges between 50 kW/K and 275 kW/K. A trade-off between the power consumption and heat transfer area is found, which justifies a further economic analysis. A simplified economic analysis is set based on a discounted cash flow model. The unitary profit ranges between 0.3 and 0.85 DKK per kg of produced LNG. The most profitable expander-based configuration is the dual-refrigerant cycle with nitrogen in the bottoming cycle. Finally, the influence of the cost correlations on the economic outcome is assessed: the compressors represent the major costs, which leads to the coincidence of the thermodynamic and economic optima.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Burmeister & Wain Scandinavian Contractor A/S, Università degli Studi di Padova
Authors: Nagy, M. (Ekstern), Nguyen, T. (Intern), Elmegaard, B. (Intern), Lazzaretto, A. (Ekstern)
Number of pages: 20
Publication date: 2017

Host publication information
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Testing of bearing materials for large two-stroke marine diesel engines

In large two-stroke marine diesel engines, bearings are designed to last the lifetime of the engine. The design has shown very good service experiences. The design parameters of the main bearings are, among others, based on the average maximum specific load which the bearing should operate under. In general, the frictional loss is less than 1% of the nominal power of the engine but is still a target for optimization. Fatigue mechanisms of bearing lining material are not fully understood and the design limits with regards to minimum oil film thickness, max oil film pressure and oil film pressure gradient are not established. Large two-stroke journal bearings are not suitable for fatigue test due to the size, the low rotational speed and the complexity of such a test-rig. The disc fatigue test rig was designed with the purpose to test white metal coatings under realistic bearing conditions, in a confined time-frame. The test-rig simulates a scale model of a thrust bearing, in contrary to standard design, the bearing lining material is applied to the rotating collar. Parameters, such as bearing load, rotational speed, oil temperature, oil contamination is controlled/monitored in order to achieve repeatability and a systematic approach to the experiments. Test performed on the test-rig shows good correlation on the fatigue
cracks with those experienced on large two-stroke journal bearings.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, MAN Diesel and Turbo SE
Authors: Vølund, A. (Ekstern), Klit, P. (Intern), Persson, S. (Ekstern)
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Scopus rating (2004): SJR 0.834 SNIP 1.093
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The collapse of Tacoma Narrows Bridge: a piece to the puzzle
On Nov. 7th 1940 the newly constructed Tacoma Narrows Bridge collapsed due to excessive torsional oscillations caused by the formation and shedding of large coherent vortices. The subsequent wind tunnel tests conducted on both section- and full bridge models concluded that the bridge should have collapsed at a wind speed corresponding to approximately half of the wind speed at the day of the collapse. This discrepancy questions our understanding of the phenomena responsible for the failure of the bridge. The present study aims at clarifying this "mystery" by considering historical records made available by the US coast guards, and by performing wind tunnel tests and detailed numerical ow simulations. Our findings indicate that the discrepancy is caused by an until now unnoticed yawed wind direction relative to the bridge, which was present at the day of the collapse.

The development of a computational platform to design and simulate on-board hydrogen storage systems
A computational platform is developed in the Modelica® language within the Dymola™ environment to provide a tool for the design and performance comparison of on-board hydrogen storage systems. The platform has been coupled with an open source library for hydrogen fueling stations to investigate the vehicular tank within the frame of a complete refueling system. The two technologies that are integrated in the platform are solid-state hydrogen storage in the form of metal hydrides and compressed gas systems. In this work the computational platform is used to compare the storage performance of two tank designs based on the tubular tank configuration with Ti1.1CrMn as the absorbing alloy. Results show that a shell and tube layout with metal hydride tubes of 2 mm inner diameter achieves the desired refueling time of 3 min and store a maximum of 3.1 kg of hydrogen in a 126 L tank, corresponding to a storage capacity four times larger than a tube-in-tube solution of the same size. The volumetric and gravimetric densities of the shell and tube are 2.46% and 1.25% respectively. The dehydriding ability of this solution is proven to withstand intense discharging conditions.
The effect of saturation on resin flow in injection pultrusion: a preliminary numerical study

In this study, a 2-D Darcy's law based numerical model is developed in order to investigate the effect of saturation on the propagation of the resin in the die chamber of a pultrusion line. The numerical model is established using the finite volume method and alternating direction implicit scheme. The implemented saturation and relative permeability curves are adopted from relationships presented in the literature. The results of the numerical model highlights the importance of accurately determining the saturation curve when included in a numerical solver that is used to predict the resin flow in injection pultrusion. Further research is planned within this field in order to identify realistic saturation curves for fiber saturated materials.
reinforcements used in resin injection pultrusion.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark, Fiberline Composites A/S
Authors: Spangenberg, J. (Intern), Larsen, M. (Ekstern), R. Rodríguez, R. (Ekstern), M. M. Sánchez, P. (Ekstern), Rasmussen, F. S. (Ekstern), Sonne, M. R. (Intern), Hattel, J. H. (Intern)
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The emergent role of digital technologies in the Circular Economy: A review
Digital technologies have enabled the formulation of multiple Product Service-Systems (PSS) with considerable economic, environmental and societal benefits. One of the most promising paradigms, which is inspired by business models and value propositions that have already been described in the PSS literature, is the concept of Circular Economy. Circular Economy is characterized as an economy that is restorative and regenerative by design and is attracting significant attention from researchers and policy makers alike. In light of the recent proliferation of digital technologies such as Big Data and the Internet of Things, this article attempts to identify how can digital technologies support the transition to Circular Economy. This article conducted a systematic review of the literature based on a review protocol, in an effort to evaluate the application of key digital technologies in Circular Economy. The study concludes by identifying research gaps, reflecting on the application of digital technologies in the field of PSS and proposing suggestions for future research.

**General information**
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Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Pagoropoulos, A. (Intern), Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
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The impact of tool wear on the functionality of replicated polymer surface with micro structures
Wear happened frequently in the tooling process of mold for polymer production. The scope of this paper is to understand how the wear of the milling tool affected the function of the replicated polymer surface. This study is part of the process chain of fabrication of optical functional surfaces on polymer components. The aiming function of the surfaces is to
maximize the reflectance from a certain viewing angle and direction, and minimize from its horizontally orthogonal position, i.e. to maximize the contrast between two horizontally orthogonal view positions at the same inclination. A five-axis micro milling machine was employed to pattern the surface of a steel insert for subsequent polymer replication. In order to conduct the study, 1200 pixels (0.8 x 0.8 mm²) was machined on the surface of a steel insert using the same mill tool (Φ0.5 mm, ARNO®); each of the pixels contains 16 ridges which is illustrated in figure 1 (a). The obtained surface structures were replicated using liquid silicon rubber (LSR). The mill tool was inspected by scanning electron microscope (SEM) before and after the machining. Noticeable wear was observed. The weight of the studied tool was measured before and after machining for comparison. The obtained surface features on the insert and the LSR replica were measured using a confocal 3D laser scanner. The reflectance of the surfaces on the LSR replica was evaluated using a gonioreflectometer[1]. The gonioreflectometer captured the images of every 100th pixel from all the viewing angles by rotating the sample holder and tilting the objective lens. The reflectance for each configuration were obtained via image processing tools. Results in this study include: 1. Tool wear was visualized by SEM images, which is shown in figure 1 (b). 2. However, the weight decrease could not be detected due to lack of precision in the measurement. 3. The number of defects on the obtained surface structures increased significantly along with the process. 4. The reflectance of these pixels on the LSR replica decreased from the first machined one to the last one. As a conclusion, the tool (Φ 0.5 mm, ARNO®) used in this study worn after machining for approximately 100 pixels, considering the function loss of replica surface. Future work will be dedicated to the methods that can prolong the tool life.

The influence of costs and benefits' analysis on service strategy formulation: Learnings from the shipping industry

Although servitization as a transformation process is being recognized by an increasing number of firms as a source of competitive advantage, the role of economic evaluations in service strategy formulation has so far attracted limited attention—and predominantly from the manufacturer perspective. This paper assesses how the analysis of costs and benefits of Product-Service Systems (PSS) as servitized offerings influences the formulation of service strategies in the shipping industry. The study examines both the manufacturer and customer perspectives using two case studies from the shipping sector. Life Cycle Costing (LCC) was used as a tool to assess the associated costs and benefits of two proposed PSS. Based on the results of the LCC, the drivers and barriers of the actual transformation processes were explored through workshops and interviews served to map the perspectives of both manufacturers and customers. For both case studies the LCC revealed that, while the PSS resulted in a decrease in life cycle costs and a possible revenue opportunity, there was also a lack of fundamental demand for PSS that could complicate the formulation of service strategies. Towards formulating service strategies, the analysis of costs and benefits highlighted the importance of the abilities of both the customer and the manufacturer to deliver and implement a PSS. Moreover, the customer perspective highlighted the importance of internal functions and capabilities that allowed the customer to implement and benefit from service strategies.
The influence of solder mask and hygroscopic flux residues on water layer formation on PCBA surface and corrosion reliability of electronics

The presence of solder flux residue on the Printed Circuit Board Assembly (PCBA) surface compromises the corrosion reliability of electronics under humid conditions and can lead to degradation of the device's lifetime. In this work, the effect of solder mask morphology and hygroscopic residues were studied towards assessment of their influence on the water film formation on the PCBA surface. The in-situ observations of water layer build-up was studied on the solder mask substrates as a function of surface finish and residue type (adipic and glutaric acids). The effect of solder flux residues was described in terms of their varying hygroscopicity defined by chemical structure and test temperature. The climatic testing of two acids was performed under relative humidity (RH) conditions varying from 30% to ~99% at 25˚C and 40˚C using gravimetric water vapour sorption/desorption and electrochemical impedance methods. The corrosivity of WOAs was evaluated via leakage current measurements using surface insulation resistance (SIR) comb patterns. The corrosion studies were correlated with the hygroscopicity studies. The results show that the water layer formation depends on the PCBA surface topography and the type of post-production residue present on the surface. Moreover, the hygroscopic nature of typical flux residue depends on its chemical structure and temperature. An increase of temperature shifts the critical RH level for water vapour absorption towards lower RH range accelerating the formation of well-conductive electrolyte and the occurrence of ionic-induced electrochemical migration (ECM).

General information
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Authors: Piotrowska, K. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
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roughness on the plateaus, but also local workpiece material pick-up on the tool plateaus. Large lubricant viscosity results in higher sheet plateau roughness, but also prevents pick-up and galling.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Sulaiman, M. H. B. (Intern), Christiansen, P. (Intern), Bay, N. O. (Intern)
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Relations
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The Particle-Matrix model: limitations and further improvements needed
According to the Particle-Matrix Model (PMM) philosophy, the workability of concrete dependson the properties of two phases and the volumetric ratio between them: the fluid matrix phase (≤0.125 mm) and the solid particle phase (> 0.125 mm). The model has been successfully applied to predict concrete workability for different types of concrete, but has also indicated that some potential cases exist when its application is limited. The paper presents recent studies on improving the method by analysing how the PMM one-point flow parameter λQ can be expressed by rheological models (Bingham and Herschel-Bulkley).

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Norwegian University of Science and Technology
Authors: Cepuritis, R. (Ekstern), Jacobsen, S. (Ekstern), Spangenberg, J. (Intern)
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Thermal decomposition of solder flux activators under simulated wave soldering conditions

Purpose: The aim of this work is to investigate the decomposition behaviour of the activator species commonly used in the wave solder no-clean flux systems and to estimate the residue amount left after subjecting the samples to simulated wave soldering conditions.

Design/methodology/approach: Changes in the chemical structure of the activators were studied using Fourier transform infrared spectroscopy technique and were correlated to the exposure temperatures within the range of wave soldering process. The amount of residue left on the surface was estimated using standardized acid-base titration method as a function of temperature, time of exposure and the substrate material used.

Findings: The study shows that there is a possibility of anhydride-like species formation during the thermal treatment of fluxes containing weak organic acids (WOAs) as activators (succinic and DL-malic). The decomposition patterns of solder flux activators depend on their chemical nature, time of heat exposure and substrate materials. Evaporation of the residue from the surface of different materials (laminate with solder mask, copper surface or glass surface) was found to be more pronounced for succinic-based solutions at highest test temperatures than for adipic acid. Less left residue was found on the laminate surface with solder mask (~5-20 per cent of initial amount at 350°C) and poorest acid evaporation was noted for glass substrates (~15-90 per cent).

Practical implications: The findings are attributed to the chemistry of WOAs typically used as solder flux activators. The results show the importance WOA type in relation to its melting/boiling points and the impact on the residual amount of contamination left after soldering process.

Originality/value: The results show that the evaporation of the flux residues takes place only at significantly high temperatures and longer exposure times are needed compared to the temperature range used for the wave soldering process. The extended time of thermal treatment and careful choice of fluxing technology would ensure obtaining more climatically reliable product.

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ISI indexed (2011): ISI indexed yes
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Thermally activated martensite formation in ferrous alloys

Magnetometry was applied to investigate the formation of α/α’ martensite in 13 ferrous alloys during immersion in boiling nitrogen and during re-heating to room temperature at controlled heating rates in the range 0.0083-0.83 K s⁻¹. Data show that in 3 of the alloys, those that form {5 5 7}γ martensite, no martensite develops during cooling. For all investigated alloys, irrespective of the type of martensite forming, thermally activated martensite develops during heating. The activation energy for thermally activated martensite formation is in the range 8–27 kJ mol⁻¹ and increases with the fraction of interstitial solutes in the alloy.

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Authors: Villa, M. (Intern), Somers, M. A. J. (Intern)
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Scopus rating (2014): SJR 2.744 SNIP 2.124 CiteScore 3.55
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Thermal modelling of extrusion based additive manufacturing of composite materials

One of the hottest topics regarding manufacturing these years is additive manufacturing (AM). AM is a young branch of manufacturing techniques, which by nature is disruptive due to its completely different manufacturing approach, wherein material is added instead of removed. By adding material layer by layer, mould and customised tooling requirements from the conventional manufacturing are reduced or removed, which leads to increased customisation options and enables new part complexities without increasing the manufacturing cost. AM hence enables customised small volume productions of composite parts not feasible by conventional manufacturing techniques. This sets up new requirements to the part verification and validation, while conventional destructive tests become too expensive. This initial study aims to investigate alternative options to this destructive testing by increasing process knowledge, and validating the generated toolpaths before the real manufacturing process takes place: Hence removing time consuming and expensive trial-and-error processes for new products. This study applies a 2D restricted finite volume model aimed to describe thermoplastic Acrylonitrile-butadiene-styrene (ABS) and thermosetting polyurethane (PU) material extrusion processes. During the experimental evaluation of the produced models it is found that some critical material properties needs to be further investigated to increase the precision of the model. It is however also found that even with only sparse material property information, the simulations show quite accurate temperature simulations when compared to the experimental results.
Additionally it is during the thermoplastic experiments seen that the temperature characteristic of the simulations is in good agreement with the ones obtained from the experiments. Moreover it is found that the thermosetting experiments show increased reaction rate at higher catalyst concentrations which is in good agreement with the conducted simulation.

**Thermochemical Surface Engineering: A Playground for Science and Innovation**

Surface engineering by thermochemical processing is the intentional change of the composition of a material at elevated temperature with the purpose to improve materials performance. In thermochemical processing components from the starting material are essential in the development of the phases at the surface. Current research and innovation activities are used to exemplify thermochemical surface engineering and the interplay of science and innovation. The examples given encompass aspects of the synthesis of extremely porous materials, low temperature surface hardening of stainless steel, surface hardening of titanium alloys, as well as thermo-reactive diffusion for extreme wear resistance.

**Thermodynamic analysis of oil and gas platforms over various production profiles and feed compositions**

Oil and gas platforms present similar structural designs but process fluids with different thermo-physical and chemical properties. In addition, the field properties, such as the gas-to-oil and water-to-oil ratios, change significantly over time. It is therefore not possible to suggest a standard flow diagram of these facilities. Different processes and operating modes may be implemented to maximise the petroleum production and improve the overall system performance. The present work evaluates, in a first step, the variations of the heating, cooling and power demands over time, in terms of energy and exergy. Feed compositions and production profiles, which correspond to data from actual fields, are used for calibrating the simulations. In a second step, the minimum energy and exergy losses of the platform are assessed by performing thermodynamic analyses, assuming an ideal scenario in which all processes are run at their design points. This approach proves to be useful for evaluating consistently different options for oil and gas production, and for determining, in a further step, the most promising solutions for minimising the energy use over a field lifetime.
Thermodynamic comparison of three small-scale gas liquefaction systems

Natural gas liquefaction systems are based on refrigeration cycles, which can be subdivided into the cascade, mixed refrigerant and expander-based processes. They differ by their configurations, components and working fluids, and have therefore various operating conditions and equipment inventory. The present work investigates three configurations suitable for small-scale applications because of their simplicity and compactness: the single-mixed refrigerant, single and dual reverse Brayton cycles. The impact of different feed compositions and refrigerant properties is analysed. A detailed assessment of the energy and exergy flows is conducted, and the most promising cycle layouts are identified by performing multi-objective optimisation procedures. The findings illustrate the resulting trade-offs between the system performance and size indifferent operating conditions. Mixed-refrigerant processes prove to be more efficient (1000-2000 kJ/kgLNG) than expander-based ones (2500-5000 kJ/kgLNG) over larger ranges of operating conditions, at the expense of a greater system complexity and higher thermal conductance (250-500 kW/K against 80-160 kW/K). The results show that the use of different thermodynamic models leads to relative deviations of up to 1% for the power consumption and 20% for the network conductance. Particular caution should thus be exercised when extrapolating the results of process models to the design of actual gas liquefaction systems.
Thermodynamic investigation of a shared cogeneration system with electrical cars for northern Europe climate

Transition to alternative energy systems is indicated by EU Commission as a suitable path to energy efficiency and energy saving in the next years. The aims are to decrease greenhouses gases emissions, relevance of fossil fuels in energy production and energy dependence on extra-EU countries. These goals can be achieved increasing renewable energy sources and/or efficiency on energy production processes. In this paper an innovative micro-cogeneration system for household application is presented: it covers heating, domestic hot water and electricity demands for a residential user. Solid oxide fuel cells, heat pump and Stirling engine are utilised as a system to achieve high energy conversion efficiency. A transition from traditional petrol cars to electric mobility is also considered and simulated here. Different types of fuel are considered to demonstrate the high versatility of the simulated cogeneration system by changing the pre-reformer of the fuel cell. Thermodynamic analysis is performed to prove high efficiency with the different fuels.

General information
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Organisations: Department of Mechanical Engineering, Thermal Energy, University of Padova
Authors: Vialetto, G. (Ekstern), Noro, M. (Ekstern), Rokni, M. (Intern)
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Thermoeconomic diagnosis and entropy generation paradox

In the entropy generation paradox, the entropy generation number, as a function of heat exchanger effectiveness, counter-intuitively approaches zero in two limits symmetrically from a single maximum. In thermoeconomic diagnosis, namely in the characteristic curve method, the exergy destruction is proposed as the dependent variable, along with a set of independent variables, to locate the actual cause of malfunction. We examine the behaviour of the diagnosis method with regards to the entropy generation paradox, as a decreased heat exchanger effectiveness (as in the case of an operation anomaly in the component) can counter-intuitively result in decreased exergy destruction rate of the component. Therefore, along with an improper selection of independent variables, the heat exchanger can be deduced to be working more effectively from the resulting indicator, when it is actually degraded. From an extensive analysis of the diagnosis method an alternative dependent variable was proposed in the form of exergy destruction rate normalised with the exergy fuel rate, which strictly increases in case of an operation anomaly in a component. The normalised exergy destruction rate as the dependent variable therefore resolves the relation of the characteristic curve method with the entropy generation paradox.

Thermo-economic optimization of secondary distribution network of low temperature district heating network under local conditions of South Korea

A secondary distribution network of a low temperature district heating system is designed and optimized for a residential apartment complex under the local conditions of South Korea in the TRNSYS simulation environment. The residential apartment complex is a typical example of Korean residential apartment. The apartment complex has 15 floors, 4 apartments on each floor and each apartment has heating surface area of 85 m². The supply temperature of the hot water is reduced from 65 °C to 45 °C and the temperature difference between supply and return line is varied from 18 °C to 27 °C. The corresponding heat loss from secondary network, pumping power and area of domestic hot water heat exchanger unit for each supply temperature and temperature difference for required heating load of the apartment complex are calculated. Results indicate that when supply temperature is decreased from 65 °C to 45 °C, area of heat exchanger is increased by 68.2%, pumping power is also increased by 9.8% and heat loss is reduced by 15.6%. These results correspond to a temperature difference of 20 °C, the standard temperature difference in South Korea residential heating system. Economic assessment of the secondary distribution network shows that the supply temperature of 55 °C and 60 °C are economically more feasible than 65 °C and 45 °C.
Thermo-Electrical Mathematical Model for Prediction of Ni-Cr Hot-Wire Temperature in Free Air and Inside Small Circular Cavities

A one-dimensional thermo-electrical mathematical model describing the heating and cooling of thin Ni-Cr20% wires is presented. The model is applied for wires in a free air environment and to wires placed in small circular cavities formed by expanded polystyrene material. The basis of the model is a semicoupled solution of the heat conduction equation and the electrical diffusion equation in a one-dimensional (1-D) control volume finite-difference framework. A study on the available natural convection correlations for thin metal wires for Rayleigh numbers in the range of $10^{-3}$-$10^{1}$ is carried out in order to select an appropriate heat transfer coefficient for the time-dependent heating and cooling of a wire. The model is tested against experimental data and is found to be in a good agreement with previous investigations. Based on the findings, expressions for the heat transfer coefficient of a hot wire inside a small circular cavity are suggested.
Thermofluid topology optimization of heat sinks

General information
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Organisations: Department of Energy Conversion and Storage, Electrofunctional materials, Department of Mechanical Engineering, Solid Mechanics
Authors: Haertel, J. H. K. (Intern), Lei, T. (Intern), Alexandersen, J. (Intern), Engelbrecht, K. (Intern), Lazarov, B. S. (Intern), Sigmund, O. (Intern)
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Event: Poster session presented at Danish Days on Caloric Materials and Devices, Roskilde, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
Poster_Haertel_et_al_2017.pdf
Publication: Research › Poster – Annual report year: 2017

Thermophoretic transport of water nanodroplets confined in carbon nanotubes: the role of friction
The development of efficient nanofluidic devices requires driving mechanisms that provide controlled transport of fluids through nanoconduits. Temperature gradients have been proposed as a mechanism to drive particles, fullerenes and nanodroplets inside carbon nanotubes (CNTs). In this work, molecular dynamics (MD) simulations are conducted to study thermophoresis of water nanodroplets inside CNTs. To gain insight into the interplay between the thermophoretic force acting on the droplet and the retarding liquid-solid friction, sets of constrained and unconstrained MD simulations are conducted. The results indicate that the thermophoretic motion of a nanodroplet displays two kinetic regimes: an initial regime characterized by a decreasing acceleration and afterwards a terminal regime with constant velocity. During the initial regime, the magnitude of the friction force increases linearly with the droplet velocity whereas the thermophoretic force has a constant magnitude defined by the magnitude of the thermal gradient and the droplet size. Subsequently, in the terminal regime, the droplet moves at constant velocity due to a dynamic balance between the thermophoretic force and the retarding friction force.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
Authors: Oyarzua, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. (Ekstern)
Number of pages: 1
Publication date: 2017
Event: Abstract from 70th Annual Meeting of the American Physical Society Division of Fluid Dynamics (DFD17), Denver, United States.
Main Research Area: Technical/natural sciences
Electronic versions:
MWS_DFD17_2017_000061.pdf
The ternary Fe-C-N system: Homogeneous distributions of nitrogen and carbon

Porous iron foils were used for synthesizing homogeneous samples of iron carbidites and (carbo)nitrides. Homogeneous distributions of interstitial nitrogen and carbon were obtained without long treatment times due to limited required diffusion distances in the porous material. By adjustments of the nitriding and carburizing potentials, tailored nitrogen and carbon contents can be achieved, which allows assessment of a phase stability diagram for the Fe-N-C system, for which available experimental data is limited. Thermal decomposition sequences were established for the various iron carbidites and (carbo)nitrides using in situ synchrotron X-ray diffraction. Hägg carbide (χ) and ε-carbonitride, Fe2(N,C)1-z, with high carbon content decompose to cementite (θ) above 850 K, while ferrite (α) forms above 950 K and austenite (γ) above 1025 K. For high nitrogen contents, ζ-Fe2(N,C) is transformed to ε from 680 to 770 K, which decomposes to γ′-Fe4(N,C)1+z between 795 and 900 K as nitrogen is released as N2. Ferrite forms above 850 K while austenite may be briefly formed around 900 K. The two iron carbidites, cementite and Hägg carbide, exhibit different coefficients of thermal expansion. Below approximately 480 K, cementite is ferromagnetic and a volumetric thermal expansion coefficient of αV = 1.5 × 10^{-5} K^{-1} is obtained. The average value in the paramagnetic state is αV = 4.3 (3) × 10^{-5} K^{-1}. For Hägg carbide the average value is αV = 3.8 (5) × 10^{-5} K^{-1} and only a minor change in unit cell volume is observed at the magnetic transition temperature.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Chemistry, X-ray Crystallography
Authors: Brink, B. (Intern), Ståhl, K. (Intern), Christiansen, T. L. (Intern), Somers, M. A. J. (Intern)
Pages: 431-437
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
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Volume: 690
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.05 SJR 0.961 SNIP 1.321
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.987 SNIP 1.43 CiteScore 3.03
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.135 SNIP 1.66 CiteScore 3.13
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.064 SNIP 1.597 CiteScore 2.73
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.249 SNIP 1.584 CiteScore 2.43
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.166 SNIP 1.479 CiteScore 2.41
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.07 SNIP 1.221
The transition between undiluted and oligomer-diluted states of nearly monodisperse polystyrenes in extensional flow

We have measured the startup and steady extensional viscosity of two narrow molar mass distributed (NMMD) polystyrenes, a 910 kg/mole and a 545 kg/mole, diluted in a NMMD 4.29 kg/mole styrene oligomer, with a wide concentration range from 90 down to 17%. The constant interchain pressure model, proposed by Rasmussen and Huang (Rheol Acta 53(3):199–208 (2014a)), predicts the extensional viscosity well for the dilutions with lower concentrations. However, for the 70 and 90% 545 kg/mole samples which represent the transition between the diluted and undiluted states, the model predictions are less satisfactory. Another concept based on interchain pressure, proposed by Wagner (Rheol Acta 53(10):765–777 (2014)), also shows agreement with the measured data.
The variation management framework (VMF): A unifying graphical representation of robust design
In this article a framework for robust design and variation management is proposed by combining central models to Robust Design, namely, the Quality Loss Function, the Transfer Function, and the Domains of Axiomatic Design. The Variation Management Framework (VMF) shows how variation can be mapped from production variation right through to the quality loss perceived by the customer for a single characteristic chain. Seven levers which can be activated to increase product quality are described and positioned on the VMF and variation metrics are proposed.
Thin Glass Coatings for the Corrosion Protection of Metals

This dissertation presents the research work aimed at developing functional submicrometer thick SiOₓ barrier coatings for the corrosion protection of stainless steel substrates in chloride containing media, which may enable the use of stainless steels as plate material for marine heat exchangers, and thus lower the component cost with respect to incumbent materials such as titanium alloys. The technology is of particular interest for the application on heat exchanger plates and components, since the thin coating films are expected to serve as efficient ionic barrier coatings, which prevent issues with localized corrosion and do not impact the heat transfer or the component performance.

The herein presented approach focuses primarily on the formation of SiOₓ-like thin films from Hydrogen Silsesquioxane (HSQ) –based “spin-on-glass” (SOG) precursor. The technology is well known for the deposition of dielectric films in microelectronic applications and has been recently introduced as industrial surface finish for molding tools due to its ability to form stable surface films with excellent levelling. Within conventional SOG processing, a liquid precursor is deposited on the substrate and subsequently cured to form a continuous polymeric surface film. It is the aim of this work to transfer the existing technology to stainless steel substrates and establish an understanding of the effect of the curing conditions, the performance and failure mechanisms of SOG coatings on stainless steel substrates in corrosion sensitive applications. Since the deposition of SiOₓ thin films is a well-established technology, the SOG technology was directly benchmarked to PVD-based SiO₂ coatings. The coating adhesion was assessed by cross cut testing and increasing load scratch testing and the efficiency of the sub-micrometer thick coatings was assessed by potentiodynamic anodic polarization measurements, EIS and neutral salt spray testing. Further, localized coating failures were investigated by the SVET and spot testing and the coating microstructure was investigated by (FIB-) SEM and a variety of analytical TEM methods. The coating chemistry was studied by FT-IR and XPS and the coating properties were characterized by water contact angle measurements, nanoindentation and AFM.

Overall, the results indicated that SOG deposition may yield well adherent coatings with excellent coverage and substrate levelling. The process yielded highly resistive coatings; however, all coatings allowed penetration of electrolyte to the substrate and no ideal barrier behavior was observed. Further, the results stress the particular importance of the interaction between the coating and the substrate for the coating performance: Oxidative curing led to pronounced interface oxidation, and thus to de-alloying of the substrate surface. As a consequence, the pitting resistance of the coated systems was found decreased or void formation between the coating and the substrate was observed. While interface oxidation can be suppressed by curing in non-oxidizing atmosphere, void formation due to coating delamination may induce critical coating defects, leading to the stabilization of growing pits. In consequence, it was shown that use of a bright surface finish minimizes the risk of coating failure. Moreover, it was shown that the degree of coating polymerization is crucial for the chemical stability of the coatings and that coating imperfections lead to significant coating dissolution in near-neutral aqueous media.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Elplatek A/S
Authors: Lampert, F. (Intern), Møller, P. (Intern), Boye Rasmussen, J. (Ekstern)
Number of pages: 218
Publication date: 2017

Publication information
Place of publication: Kgs. Lyngby
Publisher: Technical University of Denmark (DTU)
Original language: English
Main Research Area: Technical/natural sciences
Electronic versions:
Thesis_print.pdf

Relations
Projects:
Thin Glass Coatings for the Corrosion Protection of Metals
Publication: Research › Ph.D. thesis – Annual report year: 2018

Three-Dimensional X-Ray Diffraction Technique for Metals Science
The three-dimensional X-ray diffraction (3DXRD) is a new, advanced technique for materials characterization. This technique utilizes high-energy synchrotron X-rays to characterize the 3D crystallographic structure and strain/stress state of bulk materials. As the measurement is non-destructive, the microstructural evolution as a function of time can be followed, i.e. it allows 4D (x, y, z characterizations, t). The high brilliance of synchrotron X-rays ensures that diffraction signals from volumes of micrometer scale can be quickly detected and distinguished from the background noise, i.e. its spatial resolution can be micrometer scale and the measurement can be conducted within a reasonable time frame (a few hours). The 3DXRD microscope has originally been developed in cooperation between former RisÅ, National Laboratory and the European Synchrotron Radiation Facility. Currently, this technique has been implemented in several large synchrotron facilities, e.g. the Advanced Photon Source (APS) in USA and the Spring-8 in Japan. Another family of
The 3DXRD technique that utilizes white beam synchrotron X-rays has also been developed in parallel in cooperation between Oak Ridge National Laboratory and APS. This article reviews the 3DXRD technique. The content includes the idea behind the technique, the principle and specification (spatial, angular, temporal resolutions and sample environment etc.) of the technique. Several applications of the techniques in metallurgy are given, including: grain-scaled stress analysis during tensile deformation, recrystallization growth kinetics, recrystallization nucleation, growth of individual recrystallized grain, grain growth after recrystallization, and local residual strain/stress analysis. The recent development of the 3DXRD technique and its potential use for materials science in the future will be briefly discussed at the end.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials science and characterization, Harbin Institute of Technology
Authors: Zhang, Y. (Intern), Fan, G. (Intern)
Pages: 181-187
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Materials China
Volume: 36
Issue number: 3
ISSN (Print): 1674-3962
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Scopus rating (2015): CiteScore 0.21
Scopus rating (2014): CiteScore 0.11
Original language: English
DOIs: 10.7502/j.issn.1674-3962.2017.03.04
Source: FindIt
Source-ID: 2394694169
Publication: Research - peer-review › Journal article – Annual report year: 2017

Tolerance analysis in manufacturing using process capability ratio with measurement uncertainty
Tolerance analysis provides valuable information regarding performance of manufacturing process. It allows determining the maximum possible variation of a quality feature in production. Previous researches have focused on application of tolerance analysis to the design of mechanical assemblies. In this paper, a new statistical analysis was applied to manufactured products to assess achieved tolerances when the process is known while using capability ratio and expanded uncertainty. The analysis has benefits for process planning, determining actual precision limits, process optimization, troubleshoot malfunctioning existing part. The capability measure is based on a number of measurements performed on part’s quality variable. Since the ratio relies on measurements, elimination of any possible error has notable negative impact on results. Therefore, measurement uncertainty was used in combination with process capability ratio to determine conformity and nonconformity to requirements for quality characteristic of a population of workpieces. A case study of sheared billets was described where proposed technique was implemented. The use of ratio was addressed to draw conclusions about non-conforming billet’s weight expressed in parts per million (ppm) associated with measurement uncertainty and tolerance limits. The results showed significant reduction of conformance zone due to the measurement uncertainty.

General information
State: Accepted/In press
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Isfahan
Authors: Mahshid, R. (Intern), Mansourvar, Z. (Ekstern), Hansen, H. N. (Intern)
Publication date: 2017
Main Research Area: Technical/natural sciences

Publication information
Journal: Precision Engineering
Article number: 41
ISSN (Print): 0141-6359
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
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
**Topology optimization and lattice Boltzmann methods**

This thesis demonstrates the application of the lattice Boltzmann method for topology optimization problems. Specifically, the focus is on problems in which time-dependent flow dynamics have significant impact on the performance of the devices to be optimized. The thesis introduces two topology optimization problems for both isothermal and thermal flows, and it is demonstrated that topology optimization can account for unsteady flow effects during the optimization process.

The introduced optimization problems are solved using a gradient-based approach, and the design sensitivities are computed using a discrete adjoint approach. To handle the complexity of the discrete adjoint approach more easily, a method for computing it based on automatic differentiation is introduced, which can be adapted to any lattice Boltzmann type method. For example, while it is derived in the context of an isothermal lattice Boltzmann model, it is shown that the method can be easily extended to a thermal model as well.

Finally, the predicted behavior of an optimized design is compared to the equivalent prediction from a commercial finite element solver. It is found that the weakly compressible nature of the lattice Boltzmann method leads to a discrepancy in the predicted outcomes. Further research is required to determine which prediction is more accurate, and what implications the discrepancy has for the optimized designs.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Energy Conversion and Storage, Electrofunctional materials
Authors: Nørgaard, S. A. (Intern), Sigmund, O. (Intern), Lazarov, B. S. (Intern), Engelbrecht, K. (Intern)
Number of pages: 134
Publication date: 2017

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Series: DCAMM Special Report
Number: S230
ISSN: 0903-1685
Main Research Area: Technical/natural sciences

**Relations**

Projects:

**Topology optimization and lattice Boltzmann methods**
Publication: Research › Ph.D. thesis – Annual report year: 2018

**Topology optimization for optical microlithography with partially coherent illumination**

This article revisits a topology optimization design approach for micro-manufacturing and extends it to optical microlithography with partially coherent illumination. The solution is based on a combination of two technologies, the topology optimization and the proximity error correction in microlithography/nanolithography. The key steps include (i) modeling the physical inputs of the fabrication process, including the ultraviolet light illumination source and the mask, as the design variables in optimization and (ii) applying physical filtering and heaviside projection for topology optimization, which corresponds to the aerial image formulation and the pattern development processes, respectively. The proposed approach results in an effective source and a binary design mask, which can be sent directly to fabrication without additional post-processing steps for proximity error correction. Meanwhile, the performance of the device is optimized and robust with respect to process variations, such as dose/photo-resist variations and lens defocus. A compliant micro-gripper design example is considered to demonstrate the applicability of this approach.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Zhou, M. (Intern), Lazarov, B. S. (Intern), Sigmund, O. (Intern)
Pages: 631–647
Topology optimization for reduction of thermo-elastic dissipation in MEMS resonators

This paper presents a topology optimization approach for reducing thermo-elastic dissipation (TED) in MEMS resonators. This algorithm is applied to a clamped-clamped resonant beam to maximize the quality factor (Q). Optimal designs have a Q ten times higher than a solid beam and are 75% higher than previously optimized devices. Furthermore, new designs have intuitive topologies. Beams are fabricated in <111> silicon wafers and experimental measurements of Q agree well with simulation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Stanford University, University of California at Santa Barbara
Pages: 794-797
Publication date: 2017

Host publication information
Title of host publication: The proceedings of 19th International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS)
Publisher: IEEE
ISBN (Electronic): 978-1-5386-2732-7
Main Research Area: Technical/natural sciences
Conference: 19th International Conference on Solid-State Sensors, Actuators and Microsystems (TRANSDUCERS), Kaohsiung, Taiwan, Province of China, 18/06/2017 - 18/06/2017
DOIs: 10.1109/TRANSDUCERS.2017.7994168
Source: FindIt
Source-ID: 2372620389
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 hearing aids.

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)
Topology optimization of 3D shell structures with porous infill

This paper presents a 3D topology optimization approach for designing shell structures with a porous or void interior. It is shown that the resulting structures are significantly more robust towards load perturbations than completely solid structures optimized under the same conditions. The study indicates that the potential benefit of using porous structures is higher for lower total volume fractions. Compared to earlier work dealing with 2D topology optimization, we found several new effects in 3D problems. Most notably, the opportunity for designing closed shells significantly improves the performance of porous structures due to the sandwich effect. Furthermore, the paper introduces improved filter boundary conditions to ensure a completely uniform coating thickness at the design domain boundary.
Topology Optimization of Active Transport Flows

Fluid flows with particle transport are common in many industrial processes and components. The design of components for addition or removal of particles as well as mixing or stratification is of great importance in the specific processes. This work presents a methodology to apply topology optimization to the design of multiphase flow components. The work is a natural extension of the density based topology optimization procedure applied to design of passive mixers and coolers where the transported matter is not influencing the properties of the governing fluid flow model. In this work the effective properties of the fluid is changing with concentration. In this work a multiphase fluid flow model is combined with a Brinkman penalization in order to introduce the design of the fluid component. Gradient based optimization is applied in order to optimize the performance of flow components. The paper presents the design and optimization of a particle separator and the important interpolation for modeling both solids, fluids and particles with a monolithic problem formulation. The interplay with the physics behind the model are discussed and the influence of parameters are demonstrated.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Andreasen, C. S. (Intern)
Number of pages: 1
Pages: 41
Publication date: 2017

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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, Multiphase flow, Particles, FEM
Electronic versions:
TOPOLOGY_OPTIMIZATION.pdf
Publication: Research - peer-review › Conference abstract in proceedings – Annual report year: 2017

Topology optimization of heat exchangers and heat sinks

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Electrofunctional materials, Department of Mechanical Engineering, Solid Mechanics
Authors: Haertel, J. H. K. (Intern), Lei, T. (Intern), Alexandersen, J. (Intern), Engelbrecht, K. (Intern), Lazarov, B. S. (Intern), Sigmund, O. (Intern)
Number of pages: 1
Topology optimization of inertia driven dosing units

This paper presents a methodology for optimizing inertia driven dosing units, sometimes referred to as eductors, for use in small scale flow applications. The unit is assumed to operate at low to moderate Reynolds numbers and under steady state conditions. By applying topology optimization to the Brinkman penalized Navier-Stokes equation the design of the dosing units can be optimized with respect to dosing capability without initial design assumptions. The influence of flow resistance and speed is investigated to assess design performance under varying operating conditions.
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

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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.64 SJR 1.743 SNIP 1.566
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.912 SNIP 1.689 CiteScore 2.67
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.935 SNIP 1.927 CiteScore 2.73
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.415 SNIP 1.894 CiteScore 2.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
Microwave waveguides, Topology optimization, Metallic design interpolation, Electromagnetic waves, Finite elements

DOIs:
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Source: FindIt
Source-ID: 2357172803
Publication: Research - peer-review › Journal article – Annual report year: 2017

Topology optimization of nanoparticles for localized electromagnetic field enhancement
We consider the design of individual and periodic arrangements of metal or semiconductor nanoparticles for localized electromagnetic field enhancement utilizing a topology optimization based numerical framework as the design tool. We aim at maximizing a function of the electromagnetic field amplitude in a region of space through the introduction of nanoparticles in and/or near the region.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Aarhus University
Authors: Christiansen, R. E. (Intern), Vester-Petersen, J. (Forskerdatabase), Madsen, S. P. (Forskerdatabase), Sigmund, O. (Intern)
Pages: 3-4
Publication date: 2017

Host publication information
Title of host publication: Proceedings of the 2017 International Conference on Numerical Simulation of Optoelectronic Devices (NUSOD)
This letter presents a topology optimization study of metal nanostructures optimized for electric-field enhancement in the infrared spectrum. Coupling of such nanostructures with suitable ions allows for an increased photon-upconversion yield, with one application being an increased solar-cell efficiency by exploiting the long-wavelength part of the solar spectrum. In this work, topology optimization is used to design a periodic array of two-dimensional gold nanostrips for electric-field enhancements in a thin film doped with upconverting erbium ions. The infrared absorption band of erbium is utilized by simultaneously optimizing for two polarizations, up to three wavelengths, and three incident angles. Geometric robustness towards manufacturing variations is implemented considering three different design realizations simultaneously in the optimization. The polarization-averaged field enhancement for each design is evaluated over an 80 nm wavelength range and a ±15-degree incident angle span. The highest polarization-averaged field enhancement is 42.2 varying by maximally 2% under ±5 nm near-uniform design perturbations at three different wavelengths (1480 nm, 1520 nm, and 1560 nm). The proposed method is generally applicable to many optical systems and is therefore not limited to enhancing photon upconversion.
Topology optimized nanoparticles for near-infrared enhanced photon upconversion

This work is a part of the SunTune project which addresses efficiency improvements of solar modules by manipulating the spectrum of sunlight to better match the range of efficient current generation in silicon solar cells. Photons with energies below the band gap energy of silicon (<1.1eV) are (up)converted into photons with higher energies through absorption in rare earth ions (Er$^{3+}$) followed by radiative decay. This process converts otherwise non-absorbed long wavelength photos to shorter wavelength photons able to bridge the band gap energy and contribute to the energy generation of the solar modules.

The upconversion process is naturally inefficient, and without any enhancement of the incident light, the process is negligible. The probability for upconversion can be increased by focusing the incident light into areas doped with Er$^{3+}$ ions, using optimized nanoparticles placed into or near these areas. Studies have shown that the intensity of the upconverted light is proportional to the intensity of the incident light raised to some power, n, [1]. Experimentally n is found to be 1.5 and the light intensity is proportional to the square of the electric field norm, |E|$^2$. 

Original language: English

DOIs: 10.1063/1.4998552
Source: FindIt
Source-ID: 2390432243
Publication: Research - peer-review › Journal article – Annual report year: 2017
We aim to enhance the incident light using topology optimized nanoparticles. Here, the distribution of nanoparticle material is optimized to enhance $|E|^3$ in a thin Er$^{3+}$ doped TiO$_2$ film. Topology optimization has previously proven successful for optimizing wave propagation in acoustics [2] and electromagnetics [3,4]. The governing physics is modeled classically using Maxwell equations in the frequency domain. The model is excited by an incoming plane wave with a wave length, within the near-infrared absorption band of Er$^{3+}$ (1480nm -1560nm).

**General information**
- **State:** Published
- **Organisations:** Department of Mechanical Engineering, Solid Mechanics, Aarhus University
- **Authors:** Vester-Petersen, J. (Ekstern), Christiansen, R. E. (Intern), Julsgaard, B. (Ekstern), Balling, P. (Forskerdatabase), Sigmund, O. (Intern), Madsen, S. P. (Ekstern)
- **Number of pages:** 1
- **Publication date:** 2017
- **Event:** Abstract from Nanotech France 2017 Conference and Exhibition, Paris, France.
- **Main Research Area:** Technical/natural sciences
- **Topology optimization, Nanooptics, Photovoltaics, Plasmonics, Light enhancement**

**Electronic versions:**
- [2017_02_24_Nanotech_France_2017_Abstract.pdf](#)
- **Publication:** Research - peer-review › Conference abstract for conference – Annual report year: 2018

**Topology Optimized Nanostrips for Electric Field Enhancements**

This work addresses efficiency improvements of solar cells by manipulating the spectrum of sunlight to bettermatch the range of efficient current generation. The intrinsic transmission losses in crystalline silicon can effectively be reduced using photon upconversion in erbium ions in which low energy photons are converted to higher energy photons able to bridge the band gap energy and contribute the energy generation. The upconversion process in erbium is inefficient under the natural solar irradiation, and without any electric field enhancements of the incident light, the process is negligible for photo-voltaic applications. However, the probability for upconversion can be increased by focusing the incident light onto the erbium ions using optimized metal nanostructures[1, 2, 3].

The aim of this work is to increase the photon upconversion yield by optimizing the design of metallic or dielectric nanostructures placed on top of an erbium doped thin film. To achieve this goal, topology optimization[4] is used to create 2D cross-sectional designs of nanostraps able to focus the incident light into the film. The infrared absorption band of erbium is sought utilized by optimizing for multiple excitation wavelengths while also including production inaccuracies directly within the optimization process[5]. The governing physics is modeled using Maxwell equations in a finite spatial domain truncated using periodic or scattering boundary conditions.

**General information**
- **State:** Published
- **Organisations:** Department of Mechanical Engineering, Solid Mechanics, Aarhus University
- **Authors:** Vester-Petersen, J. (Ekstern), Christiansen, R. E. (Intern), Julsgaard, B. (Ekstern), Balling, P. (Ekstern), Sigmund, O. (Intern), Madsen, S. P. (Ekstern)
- **Number of pages:** 1
- **Publication date:** 2017
- **Event:** Abstract from 2017 E-MRS Fall Meeting and Exhibit, Warsaw, Poland.
- **Main Research Area:** Technical/natural sciences
- **Electronic versions:**
  - [2017_29_05_EMRS_Fall_Meeting_2017_Abstract.pdf](#)
- **Publication:** Research - peer-review › Conference abstract for conference – Annual report year: 2018

**Towards prioritizing flexibility in the design and construction of concentrating solar power plants**

In the operation and maintenance of concentrating solar power plants, high operational flexibility is required in order to withstand the variability from the inherent solar fluctuations. However, during the development phases of a solar thermal plant, this important objective is overlooked as a relevant factor for cost reduction in the long term. This paper will show the value of including flexibility aspects in the design of a concentrating solar power plant by breaking down their potential favorable impact on the levelized cost of electricity (LCOE) calculations. For this, three scenarios to include flexibility as a design objective are analyzed and their potential impact on the LCOE is quantified. The scenarios were modeled and analyzed using a techno-economic model of a direct steam generation solar tower power plant. Sensitivity studies were carried out for each scenario, in which the level of improvement due to each scenario was compared to the base case. Then, the results obtained for each scenario were compared for similar levels of LCOE and flexibility improvements. In general, all scenarios were beneficial on power plant performance. Improvements on the LCOE in the range of 3-4% were obtained with different distributions of costs and annual electricity for each case.

**General information**
- **State:** Published
- **Organisations:** Department of Mechanical Engineering, Thermal Energy, KTH - Royal Institute of Technology
This paper concerns an investigation of the accuracy of Computed Tomography (CT) measurements using four industry-inspired workpieces. A total of 16 measurands were selected and calibrated using CMMs. CT measurements on industry-inspired workpieces were carried out using two CTs having different metrological performance. Different scanning strategies and parameters were selected between two CTs in order to better understand the impact of the operator. The quantification of the measurement uncertainty for CT measurements was also achieved using two different approaches. Metrological compatibility between CTs and between CTs and CMMs was finally assessed using the En value concept.
Transformation of a wave energy spectrum from encounter to absolute domain when observing from an advancing ship

The article presents a practical approach to transform a wave energy spectrum from encounter domain to absolute domain. This problem has its specific relevance, when shipboard sea state estimation is conducted by the buoy analogy; notably for some particular implementation solving for the sea state directly in the encounter domain. The encounter domain is that observed from a ship when it advances in a seaway, whereas the absolute domain is that corresponding to making observations from a fixed point in the inertial frame. Spectrum transformation can be uniquely carried out if the ship sails "against" the waves (beam to head sea) but in following sea conditions there exists no unique solution to the problem. Instead, a reasonable approach valid for practical engineering must be applied, and the article outlines one viable solution that can be used to transform a wave spectrum from encounter to absolute domain. Specifically, two pseudo algorithms are presented, and good performance is achieved with both algorithms when they are tested at different operational scenarios.
Transient and steady state behaviour of elasto–aerodynamic air foil bearings, considering bump foil compliance and top foil inertia and flexibility: A numerical investigation

This work gives a theoretical contribution to the problem of modelling air foil bearings considering large sagging effects in the calculation of the non-linear transient and steady state response of a rigid rotor. This paper consists of two parts: the development of a multiphysics model of the air foil bearing, and a numerical parameter study of a rigid journal supported in an air foil bearing with a partially supported top foil. The mathematical model of the air foil bearing is centred around the finite element models of both the air film and the top foil structure. These finite element models utilise two types of eight-node isoparametric elements. The rotor is modelled as a rigid body without rotational inertia, i.e. as a journal. The bump foil is included via a bilinear version of the simple elastic foundation model. This paper introduces the bilinear simple elastic foundation model, which combined with the top foil structure model, enables a separation of the top foil and the bump foil. A phenomenon associated within areas of the top foil is where the aerodynamic pressure is sub-ambient. The parameter study investigates the performance of three air foil bearings with partially supported top foils and one air foil bearing with a fully supported top foil. The steady state responses of a journal supported by these air foil bearings are investigated for varied rotational speeds and journal unbalances as well as the top foil sagging in the unsupported area. The study reveals that sub-harmonic vibrations associated with a large journal unbalance can be eliminated by a proper design layout of the bump foil, i.e. placement of the unsupported area. The positive effect is attributed to 'equivalent shallow pockets' formed by the sagging top foil.
Tsunami Induced Scour Around Monopile Foundations

A fully-coupled (hydrodynamic and morphologic) numerical model is presented, and utilized for the simulation of tsunami-induced scour around a monopile structure, representative of those commonly utilized as offshore wind turbine foundations at moderate depths i.e. for depths less than 30 m. The model is based on solutions to Reynolds-averaged Navier-Stokes equations, coupled with two-equation $k$–$\omega$ turbulence closure, with additional bed and suspended load descriptions forming the basis for sea bed morphology. The model is first validated for flow, bed shear stresses, and scour...
within a steady current, where a generally excellent match with experimentally-based results is found. A methodology for maintaining and assessing hydrodynamic and morphologic similarity between field and (laboratory) model-scale tsunami events is then presented, combining diameter-based Froude number similarity with that based on the dimensionless wave boundary layer thickness-to-monopile diameter ratio. This methodology is utilized directly in the selection of governing tsunami wave parameters (i.e. velocity magnitude and period) used for subsequent simulation within the numerical model, with the tsunami-induced flow modelled as a long sinusoidally-varying current. The flow, sediment transport, and scour processes beneath up to ten tsunami waves are simulated in succession. These illustrate a generally accumulative scour process i.e. a relatively rapid scour induced by the leading wave, with an additional build-up of the scour depth during additional trailing waves. The resulting scour seems to approach an equilibrium value after sufficient time duration, which corresponds reasonably to that predicted by existing steady-current scour depth expressions, after accounting for the finite boundary layer thickness induced by the unsteady tsunami wave, i.e. it is important to incorporate both current-like, as well as wave-like aspects of the long tsunami event. Based on the simulated results, a simple methodology for predicting the tsunami-induced scour depth in engineering practice is finally developed. This methodology is demonstrated to match the predicted scour development for all of the simulated flows considered, ranging from the series of transient tsunami waves to the steady-current limit.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Middle East Technical University
Authors: Eltard-Larsen, B. (Intern), Fuhrman, D. R. (Intern), Baykal, C. (Ekstern), Sumer, B. M. (Intern)
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 3.44 SJR 1.98 SNIP 2.252
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.925 SNIP 2.097 CiteScore 2.9
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.785 SNIP 2.123 CiteScore 2.55
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.727 SNIP 2.264 CiteScore 2.58
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.912 SNIP 2.226 CiteScore 2.21
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.616 SNIP 2.502 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.898 SNIP 2.332
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.067 SNIP 2.454
Two-Photon Polymerization lithography for three-dimensional micro polymer parts manufacturing evaluation

Two-photon polymerization (2PP) technique is one of the common techniques to realize the fabrication of high-quality 3D microstructures. The combination between the laser power, the printing strategy, and the printed feature size are not completely assessed. This study characterizes the additive manufacturing processes by Direct Laser Writing (DLW) for fabrication of 3D microstructures. The printing samples were selected from a certified calibrated set with different sizes consisting of five boxes ranging from 8 μm to 200 μm. The laser power was selected as a variable parameter in order to find out the effect of various powers in printing size and strategy. Six different powers were selected from 0.6 mW to 1.6 mW for each set of the structure. The results show the importance of choosing the right power value, otherwise the structures would be burned for too high power or not completely polymerised for too low one. In addition, they show the importance of a good scaffolding, especially for bigger structures where the geometry can be distorted.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Plasmonics and Metamaterials, DTU Danchip, Programmable Phase Optics
Authors: Davoudinejad, A. (Intern), Malureanu, R. (Intern), Palima, D. (Intern), Tosello, G. (Intern)
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Additive manufacturing, Two - Photon Polymerization, Micro manufacturing, Polymer components, Precision
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017
In order to investigate options for improving the maintenance protocol of commercial refrigeration plants, two thermoeconomic diagnosis methods were evaluated on a state-of-the-art refrigeration plant. A common relative indicator was proposed for the two methods in order to directly compare the quality of malfunction identification. Both methods were applicable to locate and categorise the malfunctions when using steady state data without measurement uncertainties. By introduction of measurement uncertainty, the categorisation of malfunctions became increasingly difficult, though depending on the magnitude of the uncertainties. Two different uncertainty scenarios were evaluated, as the use of repeated measurements yields a lower magnitude of uncertainty. The two methods show similar performance in the presented study for both of the considered measurement uncertainty scenarios. However, only in the low measurement uncertainty scenario, both methods are applicable to locate the causes of the malfunctions. For both the scenarios an outlier limit was found, which determines if it was possible to reject a high relative indicator based on measurement uncertainty. For high uncertainties, the threshold value of the relative indicator was 35, whereas for low uncertainties one of the methods resulted in a threshold at 8. Additionally, the contribution of different measuring instruments to the relative indicator in two central components was analysed. It shows that the contribution was component dependent.

General information
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Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Ommen, T. S. (Intern), Sigthorsson, O. (Intern), Elmegaard, B. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.87 SJR 0.584 SNIP 1.065
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.557 SNIP 1.166 CiteScore 1.99
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.51 SNIP 1.169 CiteScore 1.69
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.488 SNIP 1.347 CiteScore 1.8
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.409 SNIP 1.04 CiteScore 1.41
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.47 SNIP 1.109 CiteScore 1.29
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.394 SNIP 1.056
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.358 SNIP 0.612
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.325 SNIP 0.604
Scopus rating (2007): SJR 0.574 SNIP 0.925
Scopus rating (2006): SJR 0.35 SNIP 0.644
Scopus rating (2005): SJR 0.299 SNIP 0.382
Understanding group design behaviour in engineering design education

Observations in industry show that engineers’ perceptions of design activity tend towards positivistic, rational problem-solving, which is at odds with the nuanced, situated, constructivist nature of observed design behaviour. This paradigmatic mismatch appears to inhibit the ability of engineers to reflect ‘on’ reflecting ‘in’ action, and is apparently formed during engineering design education which, within the UK and commonly elsewhere, is heavily influenced by a positivistic ‘engineering science’ doctrine. In this research natural group design behaviour in engineering design education was explored through detailed observation of undergraduate group-project activity. An analytic framework was formed by three sensitising concepts: design as the resolution of paradoxes, designerly ways of knowing, and design as talk. Key findings conceptualise natural design activity in this setting as a form of constructivist inquiry akin to case study research. Five core activity themes emerged; collecting data, analyzing and interpreting data, identifying themes, theory-building and testing, and telling the story. Students engaged spontaneously in these core activities. Findings were sense-checked from an ontological and epistemological viewpoint, and found to be well-grounded if design is considered from a complexity perspective. Implications are that a radically different pedagogy may be appropriate for engineering design education. Students could significantly benefit from understanding their own design activity as constructivist inquiry, rather than rational problem-solving. Set within a broader education in the ‘philosophy of design’, rooted in a complexity paradigm, students could be better enabled to reflect on their own experiential learning of design. Thus resolving the paradigmatic conflict between perception and practice.

Understanding the formation process of the liquid slug in a hilly-terrain wet natural gas pipeline

In the present work, the liquid slug formation in a hilly-terrain pipeline is simulated using the Volume of Fluid model and RNG k-ε turbulence model. The numerical model is validated by the experimental data of the horizontal slug flow. The influence of the pipe geometric structure and flow condition on the liquid slug formation is discussed including pipe diameter, inclination angle, gas superficial velocity and liquid holdup. The results show that the pipe is blocked by the
liquid slug at the moment of slug formed. The pipe pressure suddenly increases, and then decreases gradually in the process of liquid slug formation and motion. The pipe pressure drop and liquid holdup decrease along with the increasing inclination angle of ascending pipe. On the contrary, they rise with the increase of the inclination angle of descending pipe. Higher gas superficial velocity and liquid holdup result in a larger pressure drop in the formation of a liquid slug, and correspondingly induces a slug flow more rapidly in the hilly-terrain pipelines.

Usage Frequency of Product Configuration Systems Relative to Integrations and Fields of Application
Product Configuration Systems (PCS) are automatic solutions that can support and facilitate the sales and engineering processes. PCSs have recently attracted increased attention both from the researchers and practitioners. There are variety of challenges reported in the literature as consequences of using PCS, which reduces the usage frequency of the system. To address those challenges, IT integrations can be an effective solution to reduce the number of manual tasks and complexity inside PCSs and make PCSs more user-friendly. However, the influence of integrating PCS to different IT systems on usage frequency has not been addressed in the literature. This paper aims to study the relationship of PCS usage frequency in terms of (1) different application area of the PCSs, and (2) integrations to different IT systems. The research method adopted in the paper is survey-based conducted in one company where the unit of analysis is operating PCS.
Using Group Drawings Activities to Facilitate the Understanding of Systemic Aspects of Projects

In this article, we present our findings regarding promoting group drawing activities in order to facilitate the learning of systemic aspects of projects. We discuss the approach we used to engage the students and foster learning in our classes. We used group drawing activities in two project management undergraduate courses. The courses, which involved 41 students, took place during the second semester of 2016 in a public university in Brazil. We conducted qualitative research, using qualitative observation and focus group interviews. In order to gauge the effects of the use of this educational technique, we followed the five-phased qualitative analysis method, combined with a systems analysis of the data obtained from observation. Five recurrent themes emerged: 1) Making drawings in groups helps content retention and facilitates connections between the concepts explained by the professor; 2) Making drawings in groups promotes knowledge sharing among team members; 3) Making drawings in group fosters creativity and communication between students; 4) Drawing in groups reduces the students’ boredom, makes the lecture more dynamic and interesting; 5) Drawing in groups reinforces bonds between students. Our systems analysis suggests that group drawing improves student participation in classroom activities, strengthens bonds between students, and enhances learning.

Validation of Vibro-Impact Force Models by Numerical Simulation, Perturbation Methods and Experiments

The frequency response of a single degree of freedom vibro-impact oscillator is analyzed using Harmonic Linearization, Averaging and Numeric Simulation, considering three different impact force models: one given by a piecewise-linear function (Kelvin-Voigt model), another by a high-order power function, and a third one combining the advantages of the other two. Experimental validation is carried out using control-based continuation to obtain the experimental frequency response, including its unstable branch.
Vibration-based testing of bolted joints

In recent pilot studies we have started investigating how to possibly use measured flexural (i.e. transverse/bending) vibrations, induced by bolt-tapping, to estimate bolt tightness. Some of the vibration features we investigated showed strong correlation with bolt tightness. For example, the lowest natural frequency, as estimated from the vibration signal, is close to being proportional to bolt tension, except at very low tensions (Fig. 1(d)). To obtain an estimate of bolt tightness this way only requires a period of time of the order of a second where the user taps the bolt with a light hammer, which triggers measurement and data processing. However, experimental results revealed that this technique encounters two problems, for it to be presently useful in real applications: First the variability in results is too large, about twice that for a torque wrench. Figure 2(a) shows that the slope of the curves varies for separate experiments with similar increasing bolt tension, which suggests that the quantity ω/β is an unreliable feature for estimating bolt tension. A second fundamental problem is that the relative change in natural frequency is approximately proportional not only to bolt tension, but also to slenderness ratio. Thus, if only the natural frequency feature were to be used for estimating bolt tension, accuracy will drop off for the short and thick bolts that are often used in critical joints.

Vibration Control in Periodic Structures

Within the framework of periodic structures, the calibration of RL shunted piezoelectric inclusions is investigated with respect to maximum damping of a particular wave form. A finite element setting is assumed, with local shunted inclusions inside the unit cell. The effect of the shunts is represented for a targeted wave form, characterized by its short-circuited eigenvalue problem and two correction coefficients, representing the influence from residual modes, not addressed by the supplemental damping. Calibration formulae are finally derived for the shunt inductance L and resistance R. The presentation contains dispersion diagrams and vibration amplitude curves for the optimally calibrated RL shunt system in a 1-D periodic structure with local piezoelectric inclusions.
Void coalescence mechanism for combined tension and large amplitude cyclic shearing

Void coalescence at severe shear deformation has been studied intensively under monotonic loading conditions, and the sequence of micro-mechanisms that governs failure has been demonstrated to involve collapse, rotation, and elongation of existing voids. Under intense shearing, the voids are flattened, such that the void volume diminishes, whereafter the flattened crack-like voids rotate and elongate until interaction with neighboring micro-voids dominates the material response and coalescence sets in. Eventually, this leads to a complete loss of load carrying capacity. The severe shear loading, imposed at the far boundary, is in an early state of the deformation associated with significant stretching of parts of the void surface, while other parts remain practically un-deformed. A largely uneven distribution of the strain hardening, therefore, evolves along the void circumference and, thus, one cannot expect the void to return to its original shape in the case where the far-field loading is reversed. The present numerical work aims to investigate the evolution of micro-voids subject to constant tension and large amplitude cyclic shearing. The far-field loading, the void shape, and the void growth are monitored, and the calculations are pushed to coalescence and complete loss of load carrying capacity. The initially circular cylindrical voids are predicted to develop protrusions in the shearing plane with normal in the direction of the applied tensile load. These protrusions evolve during repeated cyclic shearing and spread towards neighboring voids - eventually being responsible for void coalescence.
Wake structure and thrust generation of a flapping foil in two-dimensional flow

We present a combined numerical (particle vortex method) and experimental (soap film tunnel) study of a symmetric foil undergoing prescribed oscillations in a two-dimensional free stream. We explore pure pitching and pure heaving, and contrast these two generic types of kinematics. We compare measurements and simulations when the foil is forced with pitching oscillations, and we find a close correspondence between flow visualisations using thickness variations in the soap film and the numerically determined vortex structures. Numerically, we determine wake maps spanned by oscillation frequency and amplitude, and we find qualitatively similar maps for pitching and heaving. We determine the drag–thrust transition for both pitching and heaving numerically, and we discuss it in relation to changes in wake structure. For heaving with low oscillation frequency and high amplitude, we find that the drag–thrust transition occurs in a parameter region with wakes in which two vortex pairs are formed per oscillation period, in contrast to the common transition scenario in regions with inverted von Kármán wakes.

General information
State: Published
Organisations: Department of Physics, Biophysics and Fluids, Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Andersen, A. P. (Intern), Bohr, T. (Intern), Schnipper, T. (Intern), Walther, J. H. (Intern)
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Wave propagation in axially moving periodic strings

The paper deals with analytically studying transverse waves propagation in an axially moving string with periodically modulated cross section. The structure effectively models various relevant technological systems, e.g. belts, thread lines, band saws, etc., and, in particular, roller chain drives for diesel engines by capturing both their spatial periodicity and axial motion. The Method of Varying Amplitudes is employed in the analysis. It is shown that the compound wave traveling in the axially moving periodic string comprises many components with different frequencies and wavenumbers. This is in contrast to non-moving periodic structures, for which all components of the corresponding compound wave feature the same frequency. Due to this "multi-frequency" character of the wave motion, the conventional notion of frequency band-gaps appears to be not applicable for the moving periodic strings. Thus, for such structures, by frequency band-gaps it is proposed to understand frequency ranges in which the primary component of the compound wave attenuates. Such frequency band-gaps can be present for a moving periodic string, but only if its axial velocity is lower than the transverse wave speed, and, the higher the axial velocity, the narrower the frequency band-gaps. The revealed effects could be of potential importance for applications, e.g. they indicate that due to spatial inhomogeneity, oscillations of axially moving periodic chains always involve a multitude of frequencies.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Russian Academy of Sciences
Authors: Sorokin, V. S. (Ekstern), Thomsen, J. J. (Intern)
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BFI (2014): BFI-level 2
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Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
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Scopus rating (2012): SJR 1.495 SNIP 2.992 CiteScore 2.3
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Zeonex microstructured polymer optical fiber: fabrication friendly fibers for high temperature and humidity insensitive Bragg grating sensing

In the quest of finding the ideal polymer optical fiber (POF) for Bragg grating sensing, we have fabricated and characterized an endlessly single mode microstructured POF (mPOF). This fiber is made from cyclo-olefin homopolymer Zeonex grade 480R which has a very high glass transition temperature of 138 °C and is humidity insensitive. It represents a significant improvement with respect to the also humidity insensitive Topas core fibers, in that Zeonex fibers are easier to manufacture, have better transmittance, higher sensitivity to temperature and better mechanical stability at high temperature. Furthermore, Zeonex has very good compatibility with PMMA in terms of dilatation coefficients for co-drawing applications. The Zeonex mPOF has a core and cladding diameter of 8.8 µm and 150 µm, respectively, with a hole to pitch ratio of 0.4 and a minimum propagation loss of 2.34 ± 0.39 dB/m at 690.78 nm. We have also inscribed and characterized fiber Bragg gratings (FBGs) in Zeonex mPOFs in the low loss 850 nm spectral band.

General information
State: Published
Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Fasano, A. (Intern), Markos, C. (Intern), Stefani, A. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Number of pages: 1
Zeonex-PMMA microstructured polymer optical FBGs for simultaneous humidity and temperature sensing

In this Letter, we report for the first time, to the best of our knowledge, the fabrication and characterization of a Zeonex/PMMA microstructured polymer optical fiber (mPOF) Bragg grating sensor for simultaneous monitoring of relative humidity (RH) and temperature. The sensing element (probe) is based on two separate in-line fiber Bragg gratings (FBGs) inscribed in the fabricated mPOF. A root mean square deviation of 0.8% RH and 0.6°C in the range of 10%-90% RH and 20°C-80°C was found. The developed mPOFBG sensor constitutes an efficient route toward low-cost, easy-to-fabricate and compact multi-parameter sensing solutions.

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Organisations: Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Woyessa, G. (Intern), Pedersen, J. K. M. (Intern), Fasano, A. (Intern), Nielsen, K. (Intern), Markos, C. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 1161-1164
Publication date: 2017
Main Research Area: Technical/natural sciences
Complexity Management - A multiple case study analysis on control and reduction of complexity costs
Complexity tends to be arguably the biggest challenge of manufacturing companies. The motivation of further studying complexity is a combination between the existing literature and the practical experiences from the industry. Based on the latest trend companies are trying to supply a growing mix of products, with features more custom-made to cover individual needs, both regarding characteristics of products and support services. This necessity leads to a considerable increase of the complexity in the company, which affects the product portfolio, production and supply chain, market segments, IT systems, and business processes. In order to identify and eliminate complexity, several approaches are used, both by researchers and practitioners. The purpose of this thesis is to contribute to the existing knowledge of complexity management theory. This research focuses on the relationship between product and process complexity. The possible factors for describing this correlation are identified and defined as complexity cost factors (CCFs). By identifying the CCFs this research intends to analyze the most relevant processes where the complexity and cost are directly related to the complexity of products. In this way, it will be possible to quantify the exact cost impact on those processes for each product variant. Furthermore, initiatives regarding complexity reduction are investigated. Standardization in product design, increased reusability of components, postponement of the customer order decoupling point (CODP) and utilization of configuration systems are further examined in terms of their complexity reduction effects. The research is supplemented with empirical evidence from several manufacturing companies. Finally, the evaluation of the obtained results indicates a strong managerial and theoretical potential for the control and reduction of complexity in manufacturing industries and pinpoints areas for further investigation.

General information
State: Published
Organisations: Department of Management Engineering, Management Science, Operations Management, Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Myrodia, A. (Intern), Hvam, L. (Intern), Mortensen, N. H. (Intern)
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3D artefact for concurrent scale calibration in Computed Tomography
A novel artefact for calibration of the scale in 3D X-ray Computed Tomography (CT) is presented. The artefact comprises a carbon fibre tubular structure on which a number of reference ruby spheres are glued. The artefact is positioned and scanned together with the workpiece inside the CT scanner providing a reference system for measurement. The artefact allows a considerable reduction of time by compressing the full process of calibration, scanning, measurement, and re-calibration, into a single process. The method allows a considerable reduction of the amount of data generated from CT scanning. A prototype was calibrated and its applicability demonstrated.

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Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
3D Lagrangian VPM: simulations of the near-wake of an actuator disc and horizontal axis wind turbine

The application of a 3-dimensional Lagrangian vortex particle method has been assessed for modelling the near-wake of an axisymmetrical actuator disc and 3-bladed horizontal axis wind turbine with prescribed circulation from the MEXICO (Model EXperiments InCOntrolled conditions) experiment. The method was developed in the framework of the open-source Parallel Particle-Mesh library for handling the efficient data-parallelism on a CPU (Central Processing Unit) cluster, and utilized a O(N log N)-type fast multipole method for computational acceleration. Simulations with the actuator disc resulted in a wake expansion, velocity deficit profile, and induction factor that showed a close agreement with theoretical, numerical, and experimental results from literature. Also the shear layer expansion was present; the Kelvin-Helmholtz instability in the shear layer was triggered due to the round-off limitations of a numerical method, but this instability was delayed to beyond 1 diameter downstream due to the particle smoothing. Simulations with the 3-bladed turbine demonstrated that a purely 3-dimensional flow representation is challenging to model with particles. The manifestation of local complex flow structures of highly stretched vortices made the simulation unstable, but this was successfully counteracted by the application of a particle strength exchange scheme. The axial and radial velocity profile over the near wake have been compared to that of the original MEXICO experiment, which showed close agreement between results.

General information
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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Delft University of Technology
Authors: Berdowski, T. (Ekstern), Ferreira, C. M. D. (Ekstern), Walther, J. H. (Intern)
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Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
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Scopus rating (2012): SJR 0.28 SNIP 0.354 CiteScore 0.33
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.292 SNIP 0.352 CiteScore 0.43
ISI indexed (2011): ISI indexed no
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.288 SNIP 0.344
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
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Scopus rating (2008): SJR 0.265 SNIP 0.294
Web of Science (2008): Indexed yes
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Web of Science (2007): Indexed yes
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3D-printed PMMA Preform for Hollow-core POF Drawing
In this paper we report the first, to our knowledge, 3D-printed hollow-core poly(methyl methacrylate) (PMMA) preform for polymer optical fibre drawing. It was printed of commercial PMMA by means of fused deposition modelling technique. The preform was drawn to cane, proving good enough quality of drawing process and the PMMA molecular weight to be appropriate for drawing. This ascertains that the manufacturing process provides preforms suitable for hollow-core fibre drawing. The paper focuses on maximisation of transparency of PMMA 3D printouts by optimising printing process parameters: nozzle temperature, printing speed and infill.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Aston University
Authors: Zubel, M. G. (Ekstern), Fasano, A. (Intern), Woyessa, G. (Intern), Sugden, K. (Ekstern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
Pages: 6
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Publisher: University of Aston in Birmingham
ISBN (Electronic): 9781854494085
Main Research Area: Technical/natural sciences
Electronic versions:
PP32.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Accuracy assessment of an industrial actuator
A commercial linear actuator equipped with a 0.1 μm resolution encoder was used as a contact displacement sensor with adjustable force. The accuracy of the position reading of the actuator was evaluated from experimental data taking into account the uncertainty contributions. The tests consisted of length measurements of grade 0 steel gauge blocks. Measurements with different values of contact force were performed to assess its influence. A statistical analysis of the experimental data was performed to support the accuracy assessment. Systematic effects were identified and corrected. An expanded uncertainty (k=2) lower than 1 μm was estimated.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Torino
Authors: Dalla Costa, G. (Intern), Genta, G. (Ekstern), Barbato, G. (Ekstern), De Chiffre, L. (Intern), Hansen, H. N. (Intern)
Number of pages: 6
Pages: 417-422
Accuracy Enhancement of CT Measurements using Data Filtering

This paper describes the impact of data filtering on CT capability to inspect assemblies. The investigation was carried out using an industrial multi-material assembly provided by Novo Nordisk A/S. The assembly comprises two parts made of polyoxymethylene (POM) and of an alloy comprising polycarbonate (PC) and acrylonitrile butadiene styrene (ABS), respectively. 3D median filters with different window sizes were taken into account as influence factors, while a variety of dimensional and geometrical tolerances were used as evaluation parameters. All measurands were calibrated using a tactile CMM with uncertainty below 7 μm.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Novo Nordisk A/S
Authors: Stolfi, A. (Intern), Kallasse, M. (Ekstern), Carli, L. (Ekstern), De Chiffre, L. (Intern)
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Main Research Area: Technical/natural sciences
Conference: 6th Conference on Industrial Computed Tomography, Wels, Austria, 09/02/2016 - 09/02/2016
Computed tomography, Dimensional metrology, Multi-material measurements, INTERAQCT Marie Curie, Data filtering, Polymers
Electronic versions:
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Links:
http://www.ndt.net/search/docs.php3?showForm=off&id=18750
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Accuracy of an efficient framework for structural analysis of wind turbine blades

This paper presents a novel framework for the structural design and analysis of wind turbine blades and establishes its accuracy. The framework is based on a beam model composed of two parts—a 2D finite element-based cross-section analysis tool and a 3D beam finite element model. The cross-section analysis tool is able to capture the effects stemming from material anisotropy and inhomogeneity for sections of arbitrary geometry. The proposed framework is very efficient and therefore ideally suited for integration within wind turbine aeroelastic design and analysis tools. A number of benchmark examples are presented comparing the results from the proposed beam model to 3D shell and solid finite element models. The examples considered include a square prismatic beam, an entire wind turbine rotor blade and a detailed wind turbine blade cross section. Phenomena at both the blade length scale—deformation and eigenfrequencies—and cross section scale—3D material strain and stress fields—are analyzed. Furthermore, the effect of
the different assumptions regarding the boundary conditions is discussed in detail. The benchmark examples show excellent agreement suggesting that the proposed framework is a highly efficient alternative to 3D finite element models for structural analysis of wind turbine blades. Copyright © 2015 John Wiley & Sons, Ltd.
Accurate calibration of RL shunts for piezoelectric vibration damping of flexible structures

Piezoelectric RL (resistive-inductive) shunts are passive resonant devices used for damping of dominant vibration modes of a flexible structure and their efficiency relies on precise calibration of the shunt components. In the present paper, improved calibration accuracy is attained by an extension of the local piezoelectric transducer displacement by two additional terms, representing the flexibility and inertia contributions from the residual vibration modes, not explicitly targeted by the shunt damping. This results in an augmented dynamic model for the targeted resonant vibration mode, in which the residual contributions, represented by two correction factors, modify both the apparent transducer capacitance and the shunt impedance. Explicit expressions for the correction of the shunt circuit inductance and resistance are presented in a form that is generally applicable to calibration formulae derived on the basis of an assumed single-mode structure, in which the modal interaction has been deliberately neglected. A design procedure is devised and subsequently verified by numerical examples, demonstrating that effective mitigation can be obtained for an arbitrary vibration mode when the residual mode correction is included in the calibration of the RL shunt.

A computational model for heterogeneous heating during pulsed laser irradiation of polymers doped with light-absorbing microparticles

Doping of polymers with light-absorbing microparticles to increase their optical properties is a commonly used pretreatment technique in laser processing of polymers. The presence of these particles plays an important role during laser heating of the polymer that influences its surface characteristics. This work presents a study based on a computational model of laser heating of polymer doped with light-absorbing microparticles accounting for the heterogeneous nature of heating. The work aims at gaining a fundamental insight into the nature of the heating process and to understand the role of microparticles. The results suggest that apart from the laser intensity and pulse duration, the properties of the microparticles including their size and distribution also play an important role during the laser heating of polymers.
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.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Oticon Danmark AS
Authors: Doagou Rad, S. (Intern), Islam, A. (Intern), Fuglsang-Philip, M. (Ekstern)
Pages: 4
Publication date: 2016

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Title of host publication: Proceedings of the 11th International Conference on Multi-Material Micro Manufacture (4M2016) : co-organised with 10th International Workshop on Microfactories (IWMF2016)
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Main Research Area: Technical/natural sciences

A constitutive analysis of the extensional flows of nearly monodisperse polyisoprene melts

the shear flow of all NMMD polyisoprenes. Potential non-isothermal effects were addressed computationally using the pseudo time principle, assuming the most critical case of adiabatic heating.
A contribution to the understanding of the combined effect of nitrogen and boron in grey cast iron

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Energy Conversion and Storage, Mixed Conductors, Dansk Udviklings Formidling ApS
Authors: Strande, K. (Ekstern), Tiedje, N. S. (Intern), Chen, M. (Intern)
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Conference: 72nd World Foundry Congress (WFC 2016), Nagoya, Japan, 21/05/2016 - 21/05/2016
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A Coupled VOF-Eulerian Multiphase CFD Model to Simulate Breaking Wave Impacts on Offshore Structures

Breaking wave-induced loads on offshore structures can be extremely severe. The air entrainment mechanism during the breaking process plays a not well-known role in the exerted forces. This paper presents a CFD solver, developed in the Open-FOAM environment, capable of simulating the wave breaking-induced air entrainment. Firstly, the model was validated against a bubble column flow. Then it was employed to compute the in-line force exerted by a spilling breaking wave on a vertical cylinder in a 3D domain at a laboratory scale. Results showed that the entrained bubbles affected the magnitude of the force partially. Further analyses on the interaction of the bubble plume with the flow around the cylinder are needed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Tomaselli, P. (Intern), Christensen, E. D. (Intern)
Number of pages: 10
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Publisher: American Society of Mechanical Engineers
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BFI conference series: International Conference on Ocean, Offshore and Arctic Engineering (5010067)
Main Research Area: Technical/natural sciences
Conference: ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2016), Busan, Korea, Republic of, 19/06/2016 - 19/06/2016
Acoustic emission-based in-process monitoring of surface generation in robot-assisted polishing

The applicability of acoustic emission (AE) measurements for in-process monitoring of surface generation in the robot-assisted polishing (RAP) was investigated. Surface roughness measurements require interruption of the process, proper surface cleaning and measurements that sometimes necessitate removal of the part from the machine tool. In this study, stabilization of surface roughness during polishing rotational symmetric surfaces by the RAP process was monitored by AE measurements. An AE sensor was placed on a polishing arm in direct contact with a bonded abrasive polishing tool, and a cylindrical workpiece in Vanadis 4E steel was polished in 40 polishing passes from an initial turned surface roughness $Ra = 3.1 \mu m$ down to $Ra = 0.07 \mu m$. The polishing task was performed in five intervals and after 4, 8, 20, 30 and 40 passes, the resulting surface roughness was measured. The results show a decreasing trend in measured AE signal power and RMS, which is well qualitatively correlated with the development of surface roughness during polishing. The trend allows the identification of an asymptote representing the process completion (stabilization of surface roughness), reliable for correct in-process determination of the process endpoint. This makes it possible to reliably determine the right time for changing the polishing media to finer abrasive when applying a given set of parameters is no longer effective to create a smoother surface, thus improving the efficiency of the process. The findings enabling automatic detection of optimal process endpoint allow intelligent process control, creating fundamental elements in development of robust fully automated RAP process for its widespread industrial application.

General information

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Strecon A/S
Authors: Pilny, L. (Intern), Bissacco, G. (Intern), De Chiffre, L. (Intern), Ramsing, J. (Ekstern)
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.825 SNIP 1.277 CiteScore 1.78
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.827 SNIP 1.405 CiteScore 1.52
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.784 SNIP 1.238 CiteScore 1.47
ISI indexed (2012): ISI indexed yes
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Scopus rating (2011): SJR 0.627 SNIP 0.979 CiteScore 1.41
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.486 SNIP 0.979
BFI (2009): BFI-level 1
Active lubrication applied to radial gas journal bearings. Part 2: Modelling improvement and experimental validation

Actively-controlled lubrication techniques are applied to radial gas bearings aiming at enhancing one of their most critical drawbacks, their lack of damping. A model-based control design approach is presented using simple feedback control laws, i.e. proportional controllers. The design approach combines three main domains: tribology, dynamics and control. The Reynolds equation with radial injection, including piezoelectrically controlled jet, describes the non-linear interaction between bearing surface and rotating shaft. Dynamics of the flexible shaft and rotating parts are modelled aid by finite element method and the global model is used as control design tool. Active lubrication allows for significant increase in damping factor of the rotor-bearing system. Very good agreement between theory and experiment is obtained, supporting the multi-physic design tool developed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pierart, F. G. (Intern), Santos, I. F. (Intern)
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Publication date: 2016
Main Research Area: Technical/natural sciences

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Scopus rating (2016): CiteScore 3.16 SJR 1.382 SNIP 2.094
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BFI (2015): BFI-level 1
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Scopus rating (2013): SJR 1.473 SNIP 2.793 CiteScore 2.51
ISI indexed (2013): ISI indexed yes
Activity-based Sustainability Assessment of Highly Automated Manufacturing

Sustainability of technology is a multifaceted endeavor and a main requirement from industry is to make it a profitable business case with clearly defined targets. To achieve that, a new assessment framework and applicable method [1] is presented which has been developed closely with industry. It uses a top-down decision-making process known from financial target setting for each cost center and the well-known life-cycle perspective according to ISO 14040 [2] in Sustainability Assessment. Thereby it is possible to allocate absolute environmental thresholds of functionalities (e.g. “transportation”) down to smallest production units by using activity-based target setting in a consistent way to lowers risks in the planning phase of products and production.

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Mechanical Engineering, Manufacturing Engineering
Authors: Rödger, J. (Intern), Bey, N. (Intern), Alting, L. (Intern)
Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
Abstract_JANUW.pdf
Adaptive Layer Height During DLP Materials Processing
This research aims to show how manufacturing speeds during vat polymerisation can be vastly increased through an adaptive layer height strategy that takes the geometry into account through analysis of the relationship between layer height, cross-section variability and surface structure. This allows for considerable process speedup during the Additive Manufacture of components that contain areas of low cross-section variability, at no loss of surface quality. The adaptive slicing strategy was tested with a purpose-built vat polymerisation system and numerical engine designed and constructed to serve as a Next-Gen technology platform. By means of assessing hemispherical manufactured test specimens and through 3D surface mapping with variable-focus microscopy and confocal microscopy, a balance between minimal loss of surface quality with a maximal increase of manufacturing rate has been identified as a simple angle-dependent rule. The achievable increase in manufacturing rate was above 38% compared to conventional part slicing.

Adaptive Neuro-Fuzzy Inference System Models for Force Prediction of a Mechatronic Flexible Structure
This paper presents the results obtained from a research work investigating the performance of different Adaptive Neuro-Fuzzy Inference System (ANFIS) models developed to predict excitation forces on a dynamically loaded flexible structure. For this purpose, a flexible structure is equipped with acceleration transducers at each degree of freedom and a force transducer for validation and training. Two types of models were developed; the first type uses current accelerations only while the second type considers both the current accelerations and the historical values. The models are trained using data obtained from applying a random excitation force on the flexible structure. The performance of the developed models is evaluated by analyzing the prediction capabilities based on a normalized prediction error. The frequency domain is considered to analyze the similarity of the frequencies in the predicted and the original force signal. For a selection of the best models, a more advanced performance analysis is carried out. This includes application of the trained models to deterministic and non-deterministic excitation forces with different excitation frequencies and amplitudes. Additionally, the influence of the sampling frequency and sensor location on the model performance is investigated. The results obtained in this paper show that ANFIS models can be used to set up reliable force predictors for dynamical loaded flexible structures, when a certain degree of inaccuracy is accepted. Furthermore, the comparison study points out that the transducer location is crucial for the model performance. However, there exists no general solution for the final selection of models. The findings showed that the model type employing historical values gives better predictions when operating in their trained regions while the models using only current values have generally higher prediction errors in trained regions but are less sensitive to changes of the system dynamics history.
A design approach for integrating thermoelectric devices using topology optimization

Efficient operation of thermoelectric devices strongly relies on the thermal integration into the energy conversion system in which they operate. Effective thermal integration reduces the temperature differences between the thermoelectric module and its thermal reservoirs, allowing the system to operate more efficiently. This work proposes and experimentally demonstrates a topology optimization approach as a design tool for efficient integration of thermoelectric modules into systems with specific design constraints. The approach allows thermal layout optimization of thermoelectric systems for different operating conditions and objective functions, such as temperature span, efficiency, and power recovery rate. As a specific application, the integration of a thermoelectric cooler into the electronics section of a downhole oil well intervention tool is investigated, with the objective of minimizing the temperature of the cooled electronics. Several challenges are addressed: ensuring effective heat transfer from the load, minimizing the thermal resistances within the integrated system, maximizing the thermal protection of the cooled zone, and enhancing the conduction of the rejected heat to the oil well. The design method incorporates temperature dependent properties of the thermoelectric device and other materials. The 3D topology optimization model developed in this work was used to design a thermoelectric system, complete with insulation and heat sink, that was produced and tested. Good agreement between experimental results and model forecasts was obtained and the system was able to maintain the load at more than 33 K below the oil well temperature. Results of this study support topology optimization as a powerful design tool for thermal design of thermoelectric systems.

General information
State: Published
Organisations: Department of Energy Conversion and Storage, Electrofunctional materials, Department of Mechanical Engineering, Solid Mechanics
Adjustable hybrid gas bearing – Influence of piezoelectrically adjusted injection on damping factors and natural frequencies of a flexible rotor operating under critical speeds

Damping factors and natural frequencies of a flexible rotor supported by a gas bearing with piezoelectrically adjusted flow, are theoretically determined using a rotor finite element model coupled with the modified Reynolds equation. An extra term is added to the standard formulation of Reynolds equation aiming at incorporating the effect of the adjustable external pressurized inlet flow. Two different configurations are theoretically as well as experimentally studied:(a) the air is injected from a single orifice positioned at the bottom of the bearing and (b) the air is injected through four radial injectors equally pressurized. For the two configurations, the theoretical results are experimentally validated as a function of the piezoactuators input voltage and the journal angular velocity. Results show a good agreement for natural frequencies and damping factors. Theoretical and experimental results show qualitatively as well as quantitatively that the injectors position and the injection flow (dependent on the piezoactuator input voltage) have an important influence on the dynamic characteristics of the rotor-bearing system. By using one single injector positioned at the bearing bottom, the damping factor associated with the first mode shape can be increased by 10 times when compared to four injectors equally pressurized.
Advanced exergy analysis of a R744 booster refrigeration system with parallel compression

In this paper, the advanced exergy analysis was applied to a R744 booster refrigeration system with parallel compression taking into account the design external temperatures of 25 degrees C and 35 degrees C, as well as the operating conditions of a conventional European supermarket. The global efficiencies of all the chosen compressors were extrapolated from some manufactures' data and appropriated optimization procedures of the performance of the investigated solution were implemented. According to the results associated with the conventional exergy evaluation, the gas cooler/condenser, the HS (high stage) compressor and the MT (medium temperature) display cabinet exhibited the highest enhancement potential. The further splitting of their corresponding exergy destruction rates into their different parts and the following assessment of the interactions among the components allowed figuring out the real achievable improvements. The avoidable irreversibilities of the HS compressor and that of the MT evaporator were mainly and completely endogenous, respectively. On the other hand, the gas cooler/condenser could be predominantly improved by decreasing the inefficiencies of the MT evaporator. As regards the auxiliary compressor, large enhancements were attainable through the drop in the irreversibilities occurring in the remaining components. (C) 2016 Elsevier Ltd. All rights reserved.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, University of Udine
Authors: Gullo, P. (Ekstern), Elmegaard, B. (Intern), Cortella, G. (Ekstern)
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Main Research Area: Technical/natural sciences

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Advanced microstructural analysis of cyclically deforming metallic materials towards lifetime improvement

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Physics, Neutrons and X-rays for Materials Physics, Deutsches Elektronen-Synchrotron
Authors: Diederichs, A. M. (Intern), Lienert, U. (Ekstern), Poulsen, H. F. (Intern), Pantleon, W. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
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Aerodynamically shaped vortex generators
An aerodynamically shaped vortex generator has been proposed, manufactured and tested in a wind tunnel. The effect on the overall performance when applied on a thick airfoil is an increased lift to drag ratio compared with standard vortex generators. Copyright © 2015 John Wiley & Sons, Ltd.

General information
State: Published
Organisations: Department of Wind Energy, Fluid Mechanics, Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Aeroelastic Design, LM Wind Power, Norwegian University of Science and Technology
Authors: Hansen, M. O. L. (Intern), Velte, C. M. (Intern), Øye, S. (Intern), Hansen, R. (Ekstern), Sørensen, N. N. (Intern), Madsen, J. (Ekstern), Mikkelsen, R. (Ekstern)
Number of pages: 5
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Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 2
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.37 SJR 1.104 SNIP 2.306
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.196 SNIP 2.086 CiteScore 3.06
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.272 SNIP 3.75 CiteScore 3.42
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.275 SNIP 2.464 CiteScore 2.75
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.126 SNIP 2.39 CiteScore 2.36
A finite element framework for distortion gradient plasticity with applications to bending of thin foils

A novel general purpose Finite Element framework is presented to study small-scale metal plasticity. A distinct feature of the adopted distortion gradient plasticity formulation, with respect to strain gradient plasticity theories, is the constitutive inclusion of the plastic spin, as proposed by Gurtin (2004) through the prescription of a free energy dependent on Nye's dislocation density tensor. The proposed numerical scheme is developed by following and extending the mathematical principles established by Fleck and Willis (2009). The modeling of thin metallic foils under bending reveals a significant influence of the plastic shear strain and spin due to a mechanism associated with the higher-order boundary conditions allowing dislocations to exit the body. This mechanism leads to an unexpected mechanical response in terms of bending moment versus curvature, dependent on the foil length, if either viscoplasticity or isotropic hardening are included in the model. In order to study the effect of dissipative higher-order stresses, the mechanical response under non-proportional loading is also investigated.
Manufacturing companies are changing. More and more companies are taking greater responsibility for their products, expanding their customer relationships and providing new sets of service offerings. Increasing amounts of manufacturing companies are even switching from offering products (e.g. trucks) to offering performance (e.g. transport solutions). This transition is challenging, as it puts great demands on the company’s capabilities, both within the company and externally, in the company’s inter-organisational relationships. Taking greater responsibility of the product performance includes greater risk for the manufacturer, for which reason network capabilities become vital. Relationships to suppliers – and to suppliers’ suppliers – become essential factors in securing high-quality products, availability assurance, and suitable cost. Likewise, the customer relationship changes from a transactional to a relational interaction, in order to proactively meet the customer’s changing needs and establish to a continuous information flow, allowing preventive maintenance. Dissolving the sequential value chain into a collaborative ecosystem of stakeholders is a necessity, when offering Product/Service-System (PSS) solutions. Altered relationships and roles embracing the success of all involved stakeholders is one way (arguably, the only way) to a successful PSS. Danish maritime suppliers are involuntarily facing this challenge; a lifetime of large order books from the Danish OSS shipyard at Lindø, near Odense, was cut with its closure in the early part of the second decade of the 2000’s. This forced suppliers to switch their focus from the shipyard to the shipowner. Thus, in one year the business changed from a product focus to an after-sales focus. This research project, which has been part of the Danish Innovation Consortium PROTEUS (PRoduct-service/system-Tools to Ensure User centred Services), was carried out at the Technical University of Denmark at the Section of Engineering Design and Product Development. The project’s aim was to investigate how to support the Danish maritime industry in this upheaval and change towards a new mode of business- and product development. The research presented in this thesis is based on action-research, involving all ten companies participating in the PROTEUS consortium, plus a comparative case study of MAN PrimeServ Frederikshavn and Alfa Laval Aalborg. The main contributions of the thesis are the following:

- A comprehensive longitudinal empirical study across a whole industry sector, which was in transition from product- to product/service-system oriented business.
- A theoretical foundation for PSS development, with a particular focus on network collaboration. In addition, a contribution to the theoretical knowledge about how the network paradigm “network oriented product development” and PSS theory can be assessed and developed.
- An objectively derived normative framework of combined network-oriented PSS development, based on theoretical and empirical findings and verified in case companies. Three new PSS tools to support PSS conceptualisation.
- Contributions to the PROTEUS Workbook series – communicating the results of the PROTEUS research consortium to both academics and industry practitioners.
A fully-coupled approach combining plastic deformation and liquid lubrication
This paper presents a new approach based on a fully coupled procedure in which the lubricant flow and the plastic deformation of the metallic material are solved simultaneously. The approach is applied to strip reduction of a sheet with surface pockets in order to investigate the escape of the lubricant from the pocket by means of MicroPlasto HydroDynamic Lubrication (MPHDL) and Micro Plasto HydroStatic Lubrication (MPHSL) mechanisms.

A Fully-Coupled Approach for Modelling Plastic Deformation and Liquid Lubrication in Metal Forming
This paper presents a new approach for combined modelling of plastic deformation and liquid lubrication in the contact interfaces between material and tooling in metal forming including situations where the lubricant is functioning as a pressure carrier. The approach is an alternative to conventional modelling techniques based on the utilization of friction shear stresses built upon existing friction laws as e.g. the Coulomb law and the law of constant friction stress. As such it represents a shift from phenomenological modelling adopting an artificial friction layer technique consisting of interface elements with fictitious small stiffness to physical modelling based on a fully coupled procedure in which the lubricant flow and the plastic deformation of the metallic material are solved simultaneously. The approach takes advantage of the intrinsic velocity-pressure characteristics of the finite element flow formulation which stands on the border line between fluid and solid mechanics and allows treating the lubricants as viscous incompressible (or nearly incompressible) fluid and the metallic materials as non-Newtonian, high viscous, incompressible fluids. The presentation is focused on the theoretical and numerical fundamentals of the proposed approach and includes selected examples in order to illustrate its advantages and limitations.

A high order regularisation method for solving the Poisson equation and selected applications using vortex methods
A regularisation method for solving the Poisson equation using Green’s functions is presented. The method is shown to obtain a convergence rate which corresponds to the design of the regularised Green’s function and a spectral-like convergence rate is obtained using a spectrally ideal regularisation. It is shown that the regularised Poisson solver can be extended to handle mixed periodic and free-space boundary conditions. This is done by solving the equation spectrally in the periodic directions which yields a modified Helmholtz equation for the free-space directions which in turn is solved by deriving the appropriate regularised Green’s functions. Using an analogy to the particle-particle particle-mesh method, a framework for calculating multi-resolution solutions using local refinement patches is presented. The regularised Poisson solver is shown to maintain a high order converging solution for different configurations of the refinement patches. The regularised Poisson solver has been implemented in a high order particle-mesh based vortex method for simulating incompressible fluid flow. A re-meshing of the vortex particles is used to ensure the convergence of the method and a re-projection of the vorticity field is included to explicitly fulfill the kinematic constraints of the flow-field. The high order unbounded particle-mesh based vortex method is used to simulate the instability, transition to turbulence and eventual
destruction of a single vortex ring. From the simulation data, a novel analysis on the vortex ring dynamics is presented based on the alignment of the vorticity vector with the principal axis of the strain rate tensor. A novel iterative implementation of the Brinkman penalisation method is introduced for the enforcement of a fluid-solid interface in re-meshed vortex methods. The iterative scheme is shown to improve the enforcement of the interface and also allow the simulation to perform significantly larger time steps, than what is customary for the method. The improved accuracy of the iterative implementation is demonstrated by considering challenging benchmark problems such as the impulsively started flow past a cylinder and a flat plate normal or inclined to the flow. The iterative implementation is shown to enhance the quality of the solution by Brinkman penalisation significantly for simulations of highly unsteady flows past complex geometries. A stochastic method of generating a synthetic turbulent flow field is combined with a 2D mesh-free vortex method to simulate the effect of an oncoming turbulent flow on a bridge deck cross-section within the atmospheric boundary layer. The mesh-free vortex method is found to be capable of preserving the a priori specified statistics as well as anisotropic characteristics of the synthesised turbulent flow field. From the simulation, the aerodynamic admittance of four aerodynamically different bridge sections are compared to available wind tunnel data, showing good agreement between the two. A vorticity formulated stochastic turbulence generator is presented which improves the kinetic properties of the generated turbulent field compared to present methods. Additional measures, such as explicit high order smoothing of the flow field, is introduced to insure that the generated field can be introduced into numerical simulations without an excessive loss of energy due to numerical dissipation.

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Airfoil selection methodology for Small Wind Turbines
On wind turbine technology, the aerodynamic performance is fundamental to increase efficiency. Nowadays there are several databases with airfoils designed and simulated for different applications; that is why it is necessary to select those suitable for a specific application. This work presents a new methodology for airfoil selection used in feasibility and optimization of small wind turbines with low cut-in speed. On the first stage, airfoils data is tested on XFOIL software to check its compatibility with the simulator; then, arithmetic mean criteria is recursively used to discard underperformed airfoils; the best airfoil data was exported to Matlab for a deeper analysis. In the second part, data points were interpolated using "splines" to calculate glide ratio and stability across multiple angles of attack, those who present a bigger steadiness were conserved. As a result, 3 airfoils, from an initial group of 189, were selected due to its performance above the average as exemplification of the methodology.

General information
State: Published
Organisations: Department of Mechanical Engineering, Universidad Internacional del Ecuador
Authors: Salgado Fuentes, V. (Intern), Troya, C. (Ekstern), Moreno, G. (Ekstern), Molina, J. (Ekstern)
Pages: 1410-1415
Publication date: 2016
Almost like being there; the Power of Personas when designing for foreign Cultures

Much research on personas focuses on how to develop and use personas, less on the validation and concrete value of them in the development of products for cultures far away from the actual design site. This article illustrates how such a validation was accomplished through producing a film and it provides an in-depth case description of how personas were developed and used. When designing a waste management system for soft plastic for a small village in India, personas were developed and applied by the designer to maintain a user-oriented focus throughout the participatory design process. During a three-month stay in the village, personas based on real people and the villagers’ everyday life and practices were developed by getting to know people and their ways of life through the use of ethnographic methods (observations, interviews, workshops and a film). The personas created a substantial understanding of the users’ individual needs, interests, values and emotions and helped to overcome the physical and cultural distance, enabling a strongly contextualised design.
A method for aggregating external operating conditions in multi-generation system optimization models

This paper presents a novel, simple method for reducing external operating condition datasets to be used in multi-generation system optimization models. The method, called the Characteristic Operating Pattern (CHOP) method, is a visually-based aggregation method that clusters reference data based on parameter values rather than time of occurrence, thereby preserving important information on short-term relations between the relevant operating parameters. This is opposed to commonly used methods where data are averaged over chronological periods (months or years), and extreme conditions are hidden in the averaged values. The CHOP method is tested in a case study where the operation of a fictive Danish combined heat and power plant is optimized over a historical 5-year period. The optimization model is solved using the full external operating condition dataset, a reduced dataset obtained using the CHOP method, a monthly-averaged dataset, and a seasonal peak/off-peak averaged dataset. The economic result obtained using the CHOP-reduced dataset is significantly more accurate than that obtained using any of the other reduced datasets, while the calculation time is similar to those obtained using the monthly averaged and seasonal peak/off-peak averaged datasets. The outcomes of the study suggest that the CHOP method is advantageous compared to chronology-averaging methods in reducing external operating condition datasets to be used in the design optimization models of flexible multi-generation systems.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Management Engineering, Ecole Polytechnique Federale de Lausanne (EPFL)
Authors: Lythcke-Jørgensen, C. E. (Intern), Münster, M. (Intern), Ensinas, A. V. (Ekstern), Haglind, F. (Intern)
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Personas, Foreign culture, Participatory design, Qualitative methods, Waste management system, Development country
DOIs:
10.1080/15710882.2015.1127385
A Method for Ship Collision Damage and Energy Absorption Analysis and its Validation

For design evaluation there is a need for a method which is fast, practical and yet accurate enough to determine the absorbed energy and collision damage extent in ship collision analysis. The most well-known simplified empirical approach to collision analysis was made probably by Minorsky and its limitation is also well recognized. The authors have previously developed simple expressions for the relation between the absorbed energy and the damaged material volume which take into account the structural arrangements, the material properties and the damage modes. The purpose of the present paper is to re-examine this method's validity and accuracy for ship collision damage analysis in ship design.
assessments by comprehensive validations with the experimental results from the public domain. Twenty experimental tests have been selected, analysed and compared with the results calculated using the proposed method. It can be concluded that the proposed method has a good accuracy with the mean value of 0.988 and standard deviation of 0.042.

A methodology for designing flexible multi-generation systems
An FMG (flexible multi-generation system) consists of integrated and flexibly operated facilities that provide multiple links between the various layers of the energy system. FMGs may facilitate integration and balancing of fluctuating renewable energy sources in the energy system in a cost- and energy-efficient way, thereby playing an important part in smart energy systems.

The development of efficient FMGs requires systematic optimization approaches. This study presents a novel, generic methodology for designing FMGs that facilitates quick and reliable pre-feasibility analyses. The methodology is based on consideration of the following points: Selection, location and dimensioning of processes; systematic heat and mass integration; flexible operation optimization with respect to both short-term market fluctuations and long-term energy system development; global sensitivity and uncertainty analysis; biomass supply chains; variable part-load performance; and multi-objective optimization considering economic and environmental performance.

Tested in a case study, the methodology is proved effective in screening the solution space for efficient FMG designs, in assessing the importance of parameter uncertainties and in estimating the likely performance variability for promising designs. The results of the case study emphasize the importance of considering systematic process integration when developing smart energy systems.
A micro-mechanical analysis of thermo-elastic properties and local residual stresses in ductile iron based on a new anisotropic model for the graphite nodules: Paper

In this paper, the thermo-elastic behavior of the graphite nodules contained in ductile iron is derived on the basis of recent transmission electron microscopy investigations of their real internal structure. The proposed model is initially validated by performing a finite element homogenization analysis to verify its consistency with the room-temperature elastic properties of ductile iron measured at the macro scale. Subsequently, it is used to investigate the formation of local residual stresses around the graphite particles by simulating the manufacturing process of a typical ferritic ductile iron grade, and the results are compared with preliminary measurements using synchrotron x-rays. Finally, the obtained accurate description of the stress & strain field at the micro scale is used to shed light on common failure modes reported for the nodules and on some peculiar properties observed in ductile iron at both micro and macro scale.
A Model of Parallel Kinematics for Machine Calibration

Parallel kinematics have been adopted by more than 25 manufacturers of high-end desktop 3D printers [Wohlers Report (2015), p.118] as well as by research projects such as the WASP project [WASP (2015)], a 12 meter tall linear delta robot for Additive Manufacture of large-scale components for construction engineering applications. The parallel kinematics of a linear delta robot has the potential to out-complete Cartesian point-based deposition systems with respect of acceleration-and thus repositioning speeds since the primary movable mass in these types of systems can be kept to a minimum. This research identifies that the rapid lift and repositioning capabilities of delta robots can reduce defects on extruded 3D printed parts when compared to traditional Cartesian motion systems. This is largely due to the fact that repositioning is so rapid that the extruded strand is instantly broken, and that repositioning can be completed before material oozing from the extruder can occur. The aim will be to address one of the primary disadvantages to parallel kinematics systems.

Calibration and geometrical validation. Calibration of a delta robot can be a source of frustration. This research aim to provide the operator with a strong tool for easing this task. The kinematics and calibration of delta robots, in particular, are less researched than that of traditional Cartesian robots, for which tried-and-true methods for calibrating are well known. A forwards and reverse virtual model of a delta robot has been developed in order to decompose the different types of geometrical errors into 6 elementary cases. Deliberate introduction of errors to the virtual machine has subsequently allowed for the generation of deviation plots that can be used as a strong tool for the identification and correction of geometrical errors on a physical machine tool.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Pedersen, D. B. (Intern), Bæk Nielsen, M. (Ekstern), Kløve Christensen, S. (Ekstern), Nielsen, J. S. (Intern), Hansen, H. N. (Intern)
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Source-ID: 123901871
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

A multi-layered approach to product architecture modeling: Applied to technology prototypes

Companies that wish to include novel technology in the product portfolio may need to test and evaluate the technology with the use of prototypes to learn its benefits. Without clear knowledge of the benefits of the technology to the products in the portfolio, in the form of increased performance, added functions, or material savings, the prototype development can be hard to manage. In this article, two contributions are made. The first adds to the vocabulary of prototyping, defining technology prototype, a prototype used for testing a novel technology in the context of an existing product. The second is a tool to model and manage technology prototypes: the Technology Prototype Product Architecture Tool (TePPAT). The TePPAT is a product architecture tool with three main sections: Purpose, Concept, and Architecture. The TePPAT was tested in four industry cases, all part of a public–private partnership project to support the development of technology prototypes using electro-active polymer transducer technology. The findings showed that the TePPAT supported the development teams in the four cases. It is concluded that the TePPAT can support multidisciplinary development teams in modeling and managing technology prototypes and can be correlated with improvements in the team collaboration, communication, and development performance.
A multiresolution method for solving the Poisson equation using high order regularization

We present a novel high order multiresolution Poisson solver based on regularized Green's function solutions to obtain exact free-space boundary conditions while using fast Fourier transforms for computational efficiency. Multiresolution is achieved through local refinement patches and regularized Green's functions corresponding to the difference in the spatial resolution between the patches. The full solution is obtained utilizing the linearity of the Poisson equation enabling superposition of solutions. We show that the multiresolution Poisson solver produces convergence rates that correspond to the regularization order of the derived Green's functions.

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Web of Science (2016): Indexed yes
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Scopus rating (2014): SJR 2.166 SNIP 2.193 CiteScore 3.12
Web of Science (2014): Indexed yes
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ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 2.185 SNIP 2.096
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 2.439 SNIP 2.219
Web of Science (2009): Indexed yes
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Scopus rating (2008): SJR 2.247 SNIP 2.03
Additive manufacturing has been identified as a technology that could revolutionize the production processes and change currently employed production strategies. However, additive manufacturing is still mainly used in the production of prototypes, in which high flexibility and low costs for specific tooling are required. The trend is that the additive manufacturing gradually becomes part of the production processes for final products as it reaches higher levels of quality, such as dimensional accuracy, finishing and tolerances, besides lower production costs, moving closer to those existing in the large-scale production. In this scenario, this paper aims to analyze and compare costs for a standard piece produced by additive manufacturing and conventional production methods, analyzing the feasibility of implementing the technology as an essential part of production processes. This research also provides the establishment of a standard piece, its design features and typical production volumes - from which periodic analysis should be conducted to evaluate costs, given the increasing scale and the learning curve consolidation in the production of additive manufacturing equipment.

### General information

- **State**: Published
- **Organisations**: Department of Mechanical Engineering, Engineering Design and Product Development, Universidade de Sao Paulo
- **Authors**: Mezzeti Giordano, C. (Ekstern), de Senzi Zancul, E. (Ekstern), Rodrigues, V. P. (Intern)
- **Pages**: 499-523
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- **Source**: PublicationPreSubmission
Analysis of experimental grain scale data in a crystal plasticity framework

Three-dimensional X-ray diffraction microscopy (3DXRD) has been employed to investigate the behaviour of individual grains deeply embedded in the bulk of interstitial-free (bcc) and austenitic stainless (fcc) steels during tensile deformation. Three-dimensional grain maps have been constructed, meaning that each individual grain is characterised with respect to crystallographic orientation, size and shape. The behaviour of selected individual grains is characterised and their lattice rotations and developing orientation spread are analysed in terms of slip systems by means of crystal plasticity. The differences between individual grains of initially similar orientation will be analysed in relation to their environment of neighbouring grains. The goal is to identify the interaction mechanisms and employ these in prediction of the behaviour of individual grains.

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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
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Analysis of grain-scale experimental data in a crystal plasticity framework
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2017

Analysis of hybrid viscous damper by real time hybrid simulations

Results from real time hybrid simulations are compared to full numerical simulations for a hybrid viscous damper, composed of a viscous dashpot in series with an active actuator and a load cell. By controlling the actuator displacement via filtered integral force feedback the damping performance of the hybrid viscous damper is improved, while for pure integral force feedback the damper stroke is instead increased. In the real time hybrid simulations viscous damping is emulated by a bang-bang controlled Magneto-Rheological (MR) damper. The controller activates high-frequency modes and generates drift in the actuator displacement, and only a fraction of the measured damper force can therefore be used as input to the investigated integral force feedback in the real time hybrid simulations.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Purdue University
Authors: Brodersen, M. L. (Intern), Ou, G. (Ekstern), Høgsberg, J. B. (Intern), Dyke, S. (Ekstern)
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.93 SJR 1.578 SNIP 2.048
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Scopus rating (2015): SJR 1.696 SNIP 2.195 CiteScore 2.59
Web of Science (2015): Indexed yes
Analysis of moisture transport between connected enclosures under a forced thermal gradient

Nowadays, many electronic products are exposed to harsh climatic conditions, and hence the protection of these devices is a crucial factor in design of systems. Therefore, the modelling tools have become very useful in the electronics design which supports the search of optimal electronics design and humidity control solutions. While high fidelity CFD codes are too time consuming due to computational effort/time, the well-known Resistor-Capacitor (RC) approach has much lower calculation time and is more efficient to use in enclosures without too complex geometry in their interior. Thus, the objective of this paper is to build an in-house code based on the RC approach for simulating coupled heat and mass transport. The developed code is used for simulating moisture transport between two boxes/enclosures having different temperatures, connected with a tube of known geometry. It has also the capability of combining a 1D description and lumped components. Here, a FVM discretization of the heat conduction equation and Fick's second law for 1D description is applied to model heat and mass transport. The intention is to predict the amount of moisture transported only via diffusion (convection is neglected in this study) through the tube from the warm to the cold region.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials and Surface Engineering
Analysis of the effect of ultrasonic vibrations on the performance of micro-electrical discharge machining of A2 tool steel

The application of ultrasonic vibrations to a workpiece or tool is a novel hybrid approach in micro-electrical discharge machining. The advantages of this method include effective flushing out of debris, higher machining efficiency and lesser short-circuits during machining. This paper presents a systematic analysis of the influence of kinetic effects of the ultrasonic vibrations on the material removal rate (MRR) and tool electrode wear rate (TWR). The tool wear ratio was estimated for the process at all processing conditions. The maximum variation in tool wear ratio is observed to be 82%. Therefore, MRR and TWR were independently analyzed by using three scientific tools: i) AOM plots, ii) interaction plots and iii) three-dimensional scatter plots. The increase in MRR is 47% corresponding to an increase in the maximum power of vibrations by 30%. The ultrasonic vibrations are found to be very effective at higher machining depths for achieving stable machining conditions. Regression equations were developed for MRR and TWR with capacitance, ultrasonic vibration factor, feed rate and machining time.
An analytical solution describing the shape of a yield stress material subjected to an overpressure

Many fluids and granular materials are able to withstand a limited shear stress without flowing. These materials are known as yield stress materials. Previously, an analytical solution was presented to quantify the yield stress for such materials. The yield stress is obtained based on the density as well as the spread length and height of the material when deformed in a box due to gravity. In the present work, the analytical solution is extended with the addition of an overpressure that acts over the entire body of the material. This extension enables finding the shape of a yield stress material with known density and yield stress when for instance deformed under water or subjected to a forced air pressure.
An assessment of in-tube flow boiling correlations for ammonia-water mixtures and their influence on heat exchanger size

Heat transfer correlations for pool and flow boiling are indispensable for boiler design. The correlations for predicting in-tube flow boiling heat transfer of ammonia-water mixtures are not well established in the open literature and there is a lack of experimental measurements for the full range of composition, vapor qualities, fluid conditions, etc. This paper presents a comparison of several flow boiling heat transfer prediction methods (correlations) for ammonia-water mixtures. Firstly, these methods are reviewed and compared at various fluid conditions. The methods include: (1) the ammonia-water specific flow boiling correlations from the open literature, (2) the ammonia-water specific pool boiling correlations from the open literature extended to flow boiling by using the pure fluid correlation by Gungor and Winterton, and (3) the classical wide-boiling correlations. Secondly, their influence on the required heat exchanger size (surface area) is investigated during numerical design. For this purpose, two case studies related to the use of the Kalina cycle are considered: a flue gas based heat recovery boiler for a combined cycle power plant and a hot oil based boiler for a solar thermal power plant. The results indicate that the nucleate boiling contribution to flow boiling is small compared to the flow boiling contribution for the investigated conditions. Furthermore, the use of the different flow boiling correlation methods resulted in evaporator size differences within 6% for the heat recovery boiler and 28% for the oil based boiler.

General information
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Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Kærn, M. R. (Intern), Modi, A. (Intern), Jensen, J. K. (Intern), Andreasen, J. G. (Intern), Haglind, F. (Intern)
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Scopus rating (2015): SJR 1.734 SNIP 1.898 CiteScore 3.32
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.576 SNIP 2.206 CiteScore 3.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.516 SNIP 2.5 CiteScore 3.31
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.54 SNIP 2.432 CiteScore 2.7
An attempt to define critical wave and wind scenarios leading to capsize in beam sea

The IMO Weather Criterion has proven to be the governing stability criteria regarding minimum GM for e.g. small ferries and large passenger ships. The formulation of the Weather Criterion is based on some empirical relations derived many years ago for vessels not necessary representative for current new buildings with large superstructures. Thus it seems reasonable to investigate the possibility of capsizing in beam sea under the joint action of waves and wind using direct time domain simulations. This has already been done in several studies. Here it is combined with the First Order Reliability Method to define possible combined critical wave and wind scenarios leading to capsize and corresponding probability of capsize. The results for a fictitious vessel are compared with Monte Carlo simulation and good agreement is found at a much lesser computational effort. Finally, the results for a large container vessel and a small ferry will be discussed in the light of the current weather criterion.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Lloyd's Register EMEA, Søfartsstyrelsen
Authors: Jensen, J. J. (Intern), Choi, J. (Intern), Kristensen, H. O. H. (Intern), Nielsen, U. D. (Intern), Erichsen, H. (Ekstern), Tvedt, E. I. (Ekstern)
Number of pages: 7
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Title of host publication: Proceedings of the 13th International Symposium on Practical Design of Ships and Other Floating Structures (PRADS'2016)
Publisher: Technical University of Denmark (DTU)
Editors: Dam Nielsen, U., Juncher Jensen, J.
An axisymmetrical non-linear finite element model for induction heating in injection molding tools

To analyze the heating and cooling phase of an induction heated injection molding tool accurately, the temperature dependent magnetic properties, namely the non-linear B-H curves, need to be accounted for in an induction heating simulation. Hence, a finite element model has been developed, including the non-linear temperature dependent magnetic data described by a three-parameter modified Frohlich equation fitted to the magnetic saturation curve, and solved with an iterative procedure. The numerical calculations are compared with experiments conducted with two types of induction coils, built in to the injection molding tool. The model shows very good agreement with the experimental temperature measurements. It is also shown that the non-linearity can be used without the temperature dependency in some cases, and a proposed method is presented of how to estimate an effective linear permeability to use with simulation codes not able to utilize a non-linear solver. (C) 2015 Elsevier B.V. All rights reserved.
A new 12% chromium steel strengthened by Z-phase precipitates

In order to increase the corrosion resistance and simultaneously maintain the creep resistance of 9-12% Cr steels at 650 degrees C, a new alloy design concept was proposed, using thermodynamically stable Z-phase (CrTaN) precipitates to strengthen the steel. A new trial Z-phase strengthened 12% Cr steel was produced and creep tested. The steel exhibited good long-term creep resistance. Dense nano-sized Z-phase precipitates were formed at an early stage, and coarsened slowly. They remained small after more than 10,000 h. (C) 2015 Elsevier Ltd. All rights reserved.
An experimental investigation of the performance of metallic and sandwich ship bulkheads under combined thermo-mechanical loading

Despite the well know advantages of composite materials that have consolidated their implementation in a variety of industrial applications, very few non-military applications exist in the marine industry. In fact, the majority of marine structures is almost exclusively designed and manufactured using metallic materials despite the fact that these lead to heavy designs, and they are susceptible to corrosion and fatigue. The reason why composites have not been implemented in commercial shipping is because until 2002, when the so-called regulation 17 was introduced, SOLAS regulations did not allow the use of combustible materials onboard ships [1]. Nevertheless this rule has proven hard to implement as the evaluation and acceptance of designs encompassing composite materials has proven cumbersome. Moreover, the existing set of regulations were introduced at a time when metallic materials were the sole option and as such they do not explicitly address issues related to the performance of composite materials but rather try to enforce the same operational criteria that exist for metallic structures to their composite counterparts. The scope of this work is to compare the performance of three different structural bulkhead designs, located at the superstructure of a passenger ship, under combined thermal and mechanical loading following the prescribed FTP code standards [2]
An international comparison of surface texture parameters quantification on polymer artefacts using optical instruments

An international comparison of optical instruments measuring polymer surfaces with arithmetic mean height values in the sub-micrometre range has been carried out. The comparison involved sixteen optical surface texture instruments (focus variation instruments, confocal microscopes and coherent scanning interferometers) from thirteen research laboratories worldwide. Results demonstrated that: (i) agreement among different instruments could be achieved to a limited extent; (ii) standardised guidelines for uncertainty evaluation of areal surface parameters are needed for users; (iii) it is essential that the performance characteristics (and especially the spatial frequency response) of an instrument is understood prior to a measurement.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Mitutoyo Research Center Europe, University of Nottingham, Lego Systems A/S
Authors: Tosello, G. (Intern), Haitjema, H. (Ekstern), Leach, R. (Ekstern), Quagliotti, D. (Intern), Gasparin, S. (Ekstern), Hansen, H. N. (Intern)
Pages: 529-532
Publication date: 2016
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  Web of Science (2018): Indexed yes
  BFI (2017): BFI-level 2
  Web of Science (2017): Indexed Yes
  BFI (2016): BFI-level 2
  Scopus rating (2016): CiteScore 3.93 SJR 1.672 SNIP 3.072
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 2
  Scopus rating (2015): SJR 1.839 SNIP 3.185 CiteScore 3.83
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): SJR 2.73 SNIP 3.99 CiteScore 4.39
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): SJR 2.455 SNIP 3.875 CiteScore 3.87
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  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 2
  Scopus rating (2012): SJR 2.175 SNIP 4.2 CiteScore 3.04
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
An optimized outlier detection algorithm for jury-based grading of engineering design projects

This work characterizes and optimizes an outlier detection algorithm to identify potentially invalid scores produced by jury members while grading engineering design projects. The paper describes the original algorithm and the associated adjudication process in detail. The impact of the various conditions in the algorithm on the false positive and false negative rates is explored. A response surface design is performed to optimize the algorithm using a data set from Fall 2010. Finally, the results are tested against a data set from Fall 2011. It is shown that all elements of the original algorithm (the base rule and the three additional conditions) play a role in the algorithm's performance and should be included in the algorithm. Because there is significant interaction between the base rule and the additional conditions, many acceptable combinations that balance the FPR and FNR can be found, but no true optimum seems to exist. The performance of the best optimizations and the original algorithm are similar. Therefore, it should be possible to choose new coefficient values for jury populations in other cultures and contexts logically and empirically without a full optimization as long as the algorithm assumptions are valid and the limitations for its use are well understood.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, Technical University of Denmark
Authors: Thompson, M. K. (Intern), Espensen, C. (Ekstern), Clemmensen, L. K. H. (Intern)
A note on the relative efficiency of methods for computing the transient free-surface Green function

A number of papers have appeared recently on computing the time-domain, free-surface Green function. Two papers in particular, Chuang et al. (2007) and Li et al. (2015) considered the method developed by Clement (1998) who showed that this Green function is the solution to a fourth-order Ordinary Differential Equation (ODE). This ODE has been suggested as a means for speeding up the calculation of the Green function coefficients compared to the standard algorithms developed for example by Newman (1992). Clement solved the ODE using the classical fourth-order, four-step Runge–Kutta scheme (RK44) with a fixed time step size. The two papers mentioned above proposed alternative numerical methods which are claimed to be more efficient. In this note we consider the relative efficiency of these four methods on a representative test case, and conclude that the standard method is the most efficient. Of the ODE-based methods, the method of Chuang et al. (2007) is found to be slightly more efficient than the RK44 method, while the method of Li et al. (2015) is at least an order of magnitude less efficient. It is also pointed out that ODE methods have yet to be extended to include finite water depth.

General information
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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Bingham, H. B. (Intern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.46 SJR 1.315 SNIP 2.014
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.172 SNIP 1.989 CiteScore 2.19
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.252 SNIP 2.323 CiteScore 2.11
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.178 SNIP 2.773 CiteScore 2.2
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.206 SNIP 2.445 CiteScore 1.71
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.055 SNIP 2.528 CiteScore 1.85
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.153 SNIP 2.207
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.063 SNIP 1.975
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.935 SNIP 1.673
Scopus rating (2007): SJR 0.941 SNIP 1.912
A novel model for interpreting experimental results from sandwich composites exposed to fire conditions

Composite materials offer a large range of advantages for the marine industry such as light weight, reduction of the maintenance costs and the possibility to create complex shapes. However, in order to have the approval of the authorities for building a SOLAS vessel with composite materials, this alternative design has to show an equivalent level of safety as the prescriptive requirement which is based on the use of metals [1]. Several solutions have been proposed to define new methodologies that demonstrate the required fire safety, these can be distinguished into two main ideologies; A) The tradeoff approach, i.e. staying as close as possible to the prescriptive regulations by making conservative equivalences, often in terms of passive protection, compared to an equivalent prescriptive design [2], and B) The performance based approach that looks into the overall performance in a fire situation. [3].

General information

State: Published
Organisations: Department of Civil Engineering, Section for Building Design, Department of Mechanical Engineering, Solid Mechanics
Authors: Mindykowski, P. A. (Intern), Karatzas, V. (Intern), Jomaas, G. (Intern)
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A perfectly matched layer for fluid-solid problems: Application to ocean-acoustics simulations with solid ocean bottoms

A time-domain Legendre spectral-element method is described for full-wave simulation of ocean acoustics models, i.e., coupled fluid-solid problems in unbounded or semi-infinite domains, taking into account shear wave propagation in the ocean bottom. The technique can accommodate range-dependent and depth-dependent wave speed and density, as well as steep ocean floor topography. For truncation of the infinite domain, to efficiently absorb outgoing waves, a fluid-solid complex-frequency-shifted unsplit perfectly matched layer is introduced based on the complex coordinate stretching technique. The complex stretching is rigorously taken into account in the derivation of the fluid-solid matching condition inside the absorbing layer, which has never been done before in the time domain. Two implementations are designed: a convolutional formulation and an auxiliary differential equation formulation because the latter allows for implementation of high-order time schemes, leading to reduced numerical dispersion and dissipation, a topic of importance, in particular, in long-range ocean acoustics simulations. The method is validated for a two dimensional fluid-solid Pekeris waveguide and for a three dimensional seamount model, which shows that the technique is accurate and numerically long-time stable. Compared with widely used paraxial absorbing boundary conditions, the perfectly matched layer is significantly more efficient at absorbing both body waves and interface waves.
Application of a model of plastic porous materials including void shape effects to the prediction of ductile failure under shear-dominated loadings

An extension of Gurson's famous model (Gurson, 1977) of porous plastic solids, incorporating void shape effects, has recently been proposed by Madou and Leblond (Madou and Leblond, 2012a, 2012b, 2013; Madou et al., 2013). In this extension the voids are no longer modelled as spherical but ellipsoidal with three different axes, and changes of the magnitude and orientation of these axes are accounted for. The aim of this paper is to show that the new model is able to predict softening due essentially to such changes, in the absence of significant void growth. This is done in two steps. First, a numerical implementation of the model is proposed and incorporated into the SYSTUS® and ABAQUS® finite element programmes (through some freely available UMAT (Leblond, 2015) in the second case). Second, the implementation in SYSTUS® is used to simulate previous "numerical experiments" of Tvergaard and coworkers (Tvergaard, 2008, 2009, 2012, 2015a; Dahl et al., 2012; Nielsen et al., 2012) involving the shear loading of elementary porous cells, where softening due to changes of the void shape and orientation was very apparent. It is found that with a simple, heuristic modelling of the phenomenon of mesoscopic strain localization, the model is indeed able to reproduce the results of these numerical experiments, in contrast to Gurson's model disregarding void shape effects.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Sorbonne Universités
Authors: Morin, L. (Ekstern), Leblond, J. B. (Ekstern), Tvergaard, V. (Intern)
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Scopus rating (2016): CiteScore 4.33 SJR 2.155 SNIP 2.048
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.439 SNIP 2.157 CiteScore 4.29
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.677 SNIP 2.304 CiteScore 4.7
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Applying Robust Design in an Industrial Context

The ability to develop and manufacture products of high quality is a decisive competitive parameter for any production company. The costs of non-quality, i.e. not fulfilling the functional requirements for a given product, are considerable, often manifesting as scrapped products, product recalls, lost sales, customer complaints and delayed product launches. Over time, the responsibility for obtaining consistent product performance has moved upstream in the development process, motivated by the saved costs of discovering and removing design errors prior to large investments in manufacturing tools and production facilities. An extensive set of frameworks, tools and methods are available for ensuring and improving product quality. The research presented in this thesis focuses on the Robust Design Methodology – which is a collection of methods and tools intended to support the design engineer in creating products with consistent performance, despite influences from manufacturing variability and use conditions. Although Robust Design is claimed to be applicable during the early phases of product development, surveys have shown (Thornton et al 2000; Gremyr et al 2003; Araujo et al 1996) that it is only used by a small minority of production companies and it has been criticised for being too complex to use and only being applicable during late-stage design optimisations. This project addresses these issues and contributes to the industrial understanding and application of Robust Design methods and principles, by attempting to remove the existing barriers for widespread industrial use of the Robust Design Methodology. The research finds, through the definition of an
impact model linking non-robustness to profit loss in an organisation. The link is made through a series of causal factors such as overly tight tolerances, high scrap rates, missed launch dates, and product recalls. All of these causal factors are considered as symptoms of non-robustness and are used in an applicability assessment to gauge the potential benefit of implementing Robust Design in an organisation. One particular symptom has been investigated in greater detail to partially verify the impact model, namely the ‘Misapplication of R&D resources’. In one case-company it is shown that R&D resources used to make late design changes after 'Design Verification', where the design is ideally frozen and prepared for production, was up to 400% more than used during the design and development phase! On deeper investigation of the change notes, it is shown that over 60% of these are related to kinematic and mechanical interface issues. With such apparent robustness issues embedded into the geometry of designs seen throughout industry, Robust Optimisation, which is the main focus in academia, is quite futile. There is a need to lay out the foundation for the Robust Design Methodology (RDM) using the approaches of kinematic design and design clarity, two fundamental methods to be added to RDM providing the guidance for designing robust mechanical architectures. Furthermore a set of 15 robust design principles for reducing the variation in functional performance is compiled in a format directly supporting the work of the design engineer. With these foundational methods in place, the existing tools, methods and KPIs of Robust Design are reviewed and positioned within a framework, which also identifies the need for quantitative, leading indicators of robustness, which are now further developed in the so-called Six Theta® framework. However, the lack of adoption of robust design is not simply due to the lack of simplicity, education and coherence around the available tools and methods, but also the organizational change management that is key to any successful implementation. After identifying four companies seen as front runners in terms of robust design implementation, all from different industries but based on mechanical design, a series of interviews were conducted to identify best practice procedures. The analysis and results showed that there is no single solution and each company had a different approach, which worked for their company culture and the nature of the products they were developing. As a result different implementation archetypes are created so that R&D managers are able to choose and take inspiration for the archetype that they think best fits their company. The methods Kinematic Design and Design Clarity are applied in a case project in a consumer electronics company to give an indication of the effects. The data suggests that there is a potential for a substantial reduction of late-stage design changes in comparison to the original benchmark studies prior to the methods being implemented.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Christensen, M. E. (Intern), Howard, T. J. (Intern), McAloone, T. C. (Intern), Mortensen, N. H. (Intern)
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Relations
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Applying Robust Design in an Industrial Context
Publication: Research › Ph.D. thesis – Annual report year: 2017

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.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Acoustic Technology
A preliminary analysis of floating production storage and offloading facilities with gas liquefaction processes

Floating, production, storage and offloading (FPSO) plants are facilities used in upstream petroleum processing. They have gained interest because they are more flexible than conventional plants and can be used for producing oil and gas in deep-water fields. In general, gas export is challenging because of the lack of infrastructure in remote locations. The present work investigates the possibility of integrating liquefaction processes on such facilities, considering two mixed-refrigerant and two expansion-based processes suitable for offshore applications. Two FPSO configurations are considered in this work, and they were suggested by Brazilian operators for fields processing natural gas with moderate to high content of carbon dioxide. The performance of the combined systems is analysed by conducting energy and exergy analyses. The integration of gas liquefaction results in greater power consumption and exergy destruction than in the baseline cases with compression and injection. Gas liquefaction systems with expansion-based processes are the least performant: the exergy destruction reaches up to 50 MW, and may represent up to 120% of the exergy destruction in the processing plant.

A Review of Literature on analysis of JIG Grinding Process

Jig grinding is a process practically used by tool and die makers in the creation of jigs or mating holes and pegs on dies. The abrasives normally used in jig grinding are divided into Natural Abrasives and Artificial Abrasives. Artificial Abrasives are preferred in manufacturing of grinding wheels in jig grinding, because of their uniformity and purity. In this paper, an abrief review of the analysis of jig grinding process considering various research trends is presented. The areas highlighted are: optimization, selection of abrasives, selection of processing conditions and practical considerations. The optimization of parameters in jig grinding process is important to maximize productivity and to improve quality. The abrasives of hard jig grinding wheels get blunt quickly so these are recommended to grind workpiece of low hardness and soft grinding wheels are recommended for hard material workpieces. The jig grinding is also classified into rough grinding and precision grinding, based on the processing conditions. The jig grinding process is also adapted for a variety of practical applications and for different materials.
A Review of Sea State Estimation Procedures Based on Measured Vessel Responses

The operation of ships requires careful monitoring of the related costs while, at the same time, ensuring a high level of safety. A ship’s performance with respect to safety and fuel efficiency may be compromised by the encountered waves. Consequently, it is important to estimate the surrounding seastate, and any shipboard decision support system (DSS) needs to have as input information about the encountered waves for the DSS to be the most accurate and reliable. Trustful means for sea state estimation (SSE) include floating wave rider buoys. However, for ships navigating the oceans, wave rider buoys are not practical, as sea state information in real-time and at the actual geographical position of the ship is needed. On the other hand, the analogy between a ship and a floating buoy naturally suggests to using the ship itself as a wave buoy. This paper presents a status on techniques for shipboard SSE using measured vessel responses, resembling the concept of traditional wave rider buoys. Moreover, newly developed ideas for shipboard sea state estimation are introduced. The presented material is all based on the author’s personal experience, developed within extensive work on the subject in the last fifteen years; work conducted alone and together with national as well as international colleagues.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Nielsen, U. D. (Intern)
Number of pages: 6
Publication date: 2016
Main Research Area: Technical/natural sciences

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Shipboard Sea State Estimation, Measured Vessel Responses, Decision Support Systems
Source: PublicationPreSubmission
Source-ID: 127367374
Publication: Research - peer-review › Journal article – Annual report year: 2016

A Review on the Mechanical Modeling of Composite Manufacturing Processes

The increased usage of fiber reinforced polymer composites in load bearing applications requires a detailed understanding of the process induced residual stresses and their effect on the shape distortions. This is utmost necessary in order to have more reliable composite manufacturing since the residual stresses alter the internal stress level of the composite part during the service life and the residual shape distortions may lead to not meeting the desired geometrical tolerances. The occurrence of residual stresses during the manufacturing process inherently contains diverse interactions between the involved physical phenomena mainly related to material flow, heat transfer and polymerization or crystallization. Development of numerical process models is required for virtual design and optimization of the composite manufacturing process which avoids the expensive trial-and-error based approaches. The process models as well as applications focusing on the prediction of residual stresses and shape distortions taking place in composite manufacturing are discussed in this study. The applications on both thermoset and thermoplastic based composites are reviewed in detail.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Twente, Namik Kemal University, Bogazici University
Authors: Baran, I. (Ekstern), Cinar, K. (Ekstern), Ersoy, N. (Ekstern), Akkerman, R. (Ekstern), Hattel, J. H. (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
Web of Science (2017): Indexed Yes
For robust nonlinear wave simulation in a moving reference frame, we recast the free surface problem in Hamilton-Jacobi form and propose a Weighted Essentially Non-Oscillatory (WENO) scheme to automatically handle the upwinding of the convective term. A new automatic procedure for deriving the linear WENO weights based on a Taylor series expansion is introduced. A simplified smoothness indicator is proposed and is shown to perform well. The scheme is combined with high-order explicit Runge-Kutta time integration and a dissipative Lax-Friedrichs-type flux to solve for nonlinear wave propagation in a moving frame of reference. The WENO scheme is robust and less dissipative than the equivalent order upwind-biased finite difference scheme for all ratios of frame of reference to wave propagation speed tested. This provides the basis for solving general nonlinear wave-structure interaction problems at forward speed.
A self-calibrating robot based upon a virtual machine model of parallel kinematics

A delta-type parallel kinematics system for Additive Manufacturing has been created, which through a probing system can recognise its geometrical deviations from nominal and compensate for these in the driving inverse kinematic model of the machine. Novelty is that this model is derived from a virtual machine of the kinematics system, built on principles from geometrical metrology. Relevant mathematically non-trivial deviations to the ideal machine are identified and decomposed into elemental deviations. From these deviations, a routine is added to a physical machine tool, which allows it to recognise its own geometry by probing the vertical offset from tool point to the machine table, at positions in the horizontal plane. After automatic calibration the positioning error of the machine tool was reduced from an initial error after its assembly of ±170 µm to a calibrated error of ±3 µm. Excelling by speed, the calibration was executed in less than 3 min.
A Self-Peeling Vat for Improved Release Capabilities During DLP Materials Processing

This paper describes research to increase the competitiveness of vat polymerisation by increasing the manufacturing rate while lowering the normal forces that induce part stress during the lift procedure of vat based systems. This is achieved through introducing a polymerisation vat that allows for an eased release of the manufactured part from the vat by means of a flexible membrane system. A membrane of fluorinated ethylene polymer will through elastic deformation automatically peel off the part as the part is lifted during layer changes. Peeling has been qualified by means of a truncated inverted cone as test geometry. As the cross-sectional diameter of the cone increases throughout the build-job, the geometry will release from the glass based build platform at the point where the peeling force exceed the adhesion force between platform and part. At failure point the lateral surface area of the top and bottom of the truncated cone is used as a measure of the performance of the vat with respect to release-capability. This has been tested at increasing manufacturing rates. The new self-peeling vat outperformed industrial state-of-the-art vats by 814% percent.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Pedersen, D. B. (Intern), Zhang, Y. (Intern), Nielsen, J. S. (Intern), Hansen, H. N. (Intern)
Pages: 241-245
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Publisher: Research Publishing Services
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Main Research Area: Technical/natural sciences
Conference: 2nd International Conference on Progress in Additive Manufacturing, Singapore, Singapore, 16/05/2016 - 16/05/2016
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A simulation of the effect of TWD (tool wear per discharge) estimation error on the depth of machined surfaces in micro-EDM milling

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern), Bissacco, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 1
Assessing the cost saving potential of shared product architectures

This article presents a method for calculating cost savings of shared architectures in industrial companies called Architecture Mapping and Evaluation. The main contribution is an operational method to evaluate the cost potential and evaluate the number of product architectures in an industrial company. Experiences from the case study show it is possible to reduce the number of architectures with 60% which leads to significant reduction in direct material and labor costs. This can be achieved without compromising the market offerings of products. Experiences from the case study indicate cost reductions between 0.5% and 2% of turnover. The main implication is that the method provides a quantitative basis for the discussion on whether or not to implement shared product architectures. This means a more fact-based approach is introduced.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Department of Management Engineering, Management Science
Authors: Mortensen, N. H. (Intern), Hansen, C. L. (Intern), Løkkegaard, M. (Intern), Hvam, L. (Intern)
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.45 SJR 0.5 SNIP 1.121
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.594 SNIP 1.053 CiteScore 1.14
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.398 SNIP 0.876 CiteScore 1.08
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.495 SNIP 1.035 CiteScore 0.9
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.453 SNIP 0.639 CiteScore 0.65
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.377 SNIP 0.911 CiteScore 0.89
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Assessment of chromium(VI) release from 848 jewellery items by use of a diphenylcarbazide spot test

We recently evaluated and validated a diphenylcarbazide (DPC)-based screening spot test that can detect the release of chromium(VI) ions (≥0.5 ppm) from various metallic items and leather goods (1). We then screened a selection of metal screws, leather shoes, and gloves, as well as 50 earrings, and identified chromium(VI) release from one earring. In the present study, we used the DPC spot test to assess chromium(VI) release in a much larger sample of jewellery items (n=848), 160 (19%) of which had previously been shown to contain chromium when analysed with X-ray fluorescence spectroscopy (2).

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Jagiellonian University Medical College, Copenhagen University Hospital, Ohio State University, Loma Linda University, Contact Dermatitis Institute
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Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.47 SJR 0.829 SNIP 1.59
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Assessment of Emerging Renewable Energy-based Cogeneration Systems for nZEB Residential Buildings

Net Zero Energy Buildings (nZEB) imply reduced consumption by means of good insulation, passive strategies and highly efficient energy supply systems. Among others, micro cogeneration systems are considered as one of the system solutions with the highest potential to enable nZEB. These systems entail production of electricity and usable thermal energy (heat and/or cooling) to cover the energy demands of residential buildings, high energy efficiency levels and proximity of the energy source to the building. The concept of cogeneration is not new but the interest in smallscale cogeneration technologies based on renewable energy sources has increased tremendously in the last decade. A significant amount of experimental and modelling research has recently been presented on emerging technologies. In this paper, four main technologies are assessed: Fuel Cells (FC), Photovoltaic thermal (PV/T), solar thermal reversible heat pump /organic Rankine cycle (HP/ORC) and cogeneration solar Thermoelectric generators (TEG). This paper aims to give an overview of the state-of-the-art developments, discuss the fundamental and technical challenges facing commercial adoption and prospects of these technologies for use in single-family houses. A schematic of each technology, a graph comparing the technical characteristics and a radar chart contrasting the strengths and weaknesses of each technology in market diffusion are provided.
Assessment of thermodynamic models for the design, analysis and optimisation of gas liquefaction systems

Natural gas liquefaction systems are based on refrigeration cycles – they consist of the same operations such as heat exchange, compression and expansion, but they have different layouts, components and working fluids. The design of these systems requires a preliminary simulation and evaluation of their performance. However, the thermodynamic models used for this purpose are characterised by different mathematical formulations, ranges of application and levels of accuracy. This may lead to inconsistent results when estimating hydrocarbon properties and assessing the efficiency of a given process. This paper presents a thorough comparison of six equations of state widely used in the academia and industry, including the GERG-2008 model, which has recently been adopted as an ISO standard for natural gases. These models are used to (i) estimate the thermophysical properties of a Danish natural gas, (ii) simulate, and (iii) optimise liquefaction systems. Three case studies are considered: a cascade layout with three pure refrigerants, a single mixed-refrigerant unit, and an expander-based configuration. Significant deviations are found between all property models, and in all case studies. The main discrepancies are related to the prediction of the energy flows (up to 7%) and to the heat exchanger conductances (up to 11%), and they are not systematic errors. The results illustrate the superiority of using the GERG-2008 model for designing gas processes in real applications, with the aim of reducing their energy use. They demonstrate as well that particular caution should be exercised when extrapolating the results of the conventional thermodynamic models to the actual conception of the gas liquefaction chain.
A Study on the uncertainty and sensitivity in numerical simulation of parametric roll

Uncertainties related to numerical modelling of parametric roll have been investigated by using a 6-DOFs model with nonlinear damping and roll restoring forces. At first, uncertainty on damping coefficients and its effect on the roll response is evaluated. Secondly, uncertainty due to the “effective (equivalent) wave” concept in calculation of restoring moment is studied. Finally, uncertainty to roll response from different methods of GZ calculation has been checked. It is found that the equivalent wave concept is sufficiently accurate for the purpose of GZ calculation. Two different GZ approximations give a good agreement with direct calculation method if relevant coefficients have been properly found in the fitting.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Choi, J. (Intern), Nielsen, U. D. (Intern), Jensen, J. J. (Intern)
A systematic approach applied in design of a micro heat exchanger

The number of products benefiting from micro components in the market is increasing, and consequently, the demand for well-matched tools, equipment and systems with micro features is eventually increasing as well. During the design process of micro products, a number of issues appear which are inherent due to the down scaling or physical phenomena dominating in the micro range but negligible in the macro scale. In fact, some aspects in design for micro manufacturing are considerably different compared to the de- sign procedure taken at the macro level. Identifying the differences between design considerations at micro compared to macro scale, and defining potential guidelines based on them, provides an opportunity to modify the conventional design methodologies towards becoming micro specific. In this paper, the need for a micro-oriented approach for designing micro products which has not been investigated hitherto studied. For this purpose, an additional step named “Rules To Consider” (RTC) is added to the conventional design methodologies. This step is constituted based on the feedbacks gained during analyzing the different iterations of the design. The knowledge obtained during the design process of a micro product can be added to the RTC unit, and this unit becomes enriched progressively in design process of similar micro products and supplemented to the conventional design methodologies to be served as a micro-oriented design methodology. In order to present the application of RTC unit, the design process of a micro heat exchanger is investigated. Manufacturability and functional performance are considered as evaluation criteria, and the lessons learned from each design iteration and evaluation are employed in the subsequent design proposals until an acceptable design is achieved. Thermal performance of the heat exchangers is evaluated using finite element (FE) simulation of the conjugate heat transfer. The design proposals are optimized in terms of geometrical dimensions, and a sensitivity analysis is conducted on the mass flow rate and heat generation power in the heat source. Finally, the designs with higher thermal performance and manufacturability are introduced. The result of the thermal analysis reveals the fact that the presence of the fins and modification of their dimensions as well as the constituent material for fabricating the micro heat exchanger do not significantly improve the thermal performance of the micro heat exchangers. This is an interesting outcome which can result in considerable reduction of the manufacturing costs by simplifying the geometrical design of the heat exchanger. The micro-specific design considerations which are extracted from the design process of the micro heat exchanger are added to the RTC unit and can be applied as guidelines in design process of any other micro heat exchanger. In other words, the current study can provide a useful guideline in design for manufacturing of micro products.
A thermo-electro-mechanical simulation model for hot wire cutting of EPS foam

A one-dimensional thermo-electro-mechanical mathematical model describing the effects taking place within a Ni-Cr20% wire used in a hot-wire cutting process for free forming and rapid prototyping of expanded polystyrene (EPS) is investigated and simulated. The model implements and solves three semi coupled non-linear differential equations (the heat diffusion equation, the electrical diffusion equation and the static equilibrium equation) with temperature dependent parameters in order to predict the temperature, kerfwidth, longitudinal stress and displacement, and other process variables.
parameters during cutting of EPS in contact with a cutting tool made of an electrically heated metal wire attached to a robot device. The finite difference method is used to solve the coupled equations in the two environments (domains) in which the hot-wire operates, namely air and EPS. The model is calibrated against experimentally obtained data. Novel findings are a transient temperature-dependent kerfwidth prediction and a relation between kerfwidth and the cutting angle as measured from the horizontal direction. These are important relations in the aim for higher geometrical accuracy of the hot-wire cutting process. (C) 2016 Elsevier Ltd. All rights reserved.
Attaining the rate-independent limit of a rate-dependent strain gradient plasticity theory

The existence of characteristic strain rates in rate-dependent material models, corresponding to rate-independent model behavior, is studied within a back stress based rate-dependent higher order strain gradient crystal plasticity model. Such characteristic rates have recently been observed for steady-state processes, and the present study aims to demonstrate that the observations in fact unearth a more widespread phenomenon. In this work, two newly proposed back stress formulations are adopted to account for the strain gradient effects in the single slip simple shear case, and characteristic rates for a selected quantity are identified through numerical analysis. Evidently, the concept of a characteristic rate, within the rate-dependent material models, may help unlock an otherwise inaccessible parameter space.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: El-Naaman, S. A. (Intern), Nielsen, K. L. (Intern), Niordson, C. F. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.701 SNIP 0.517 CiteScore 1.3
Original language: English
Back stress formulation, Crystal plasticity, Rate-dependent theory, Size-effects, Strain gradient plasticity
Electronic versions:
DOIs:
10.1016/j.eml.2016.04.012
Source: FindIt
Source-ID: 2304289940
Publication: Research - peer-review › Journal article – Annual report year: 2016

Automatic generation of design structure matrices through the evolution of product models

Dealing with component interactions and dependencies remains a core and fundamental aspect of engineering, where conflicts and constraints are solved on an almost daily basis. Failure to consider these interactions and dependencies can lead to costly overruns, failure to meet requirements, and lengthy redesigns. Thus, the management and monitoring of these dependencies remains a crucial activity in engineering projects and is becoming ever more challenging with the increase in the number of components, component interactions, and component dependencies, in both a structural and a functional sense. For these reasons, tools and methods to support the identification and monitoring of component interactions and dependencies continues to be an active area of research. In particular, design structure matrices (DSMs) have been extensively applied to identify and visualize product and organizational architectures across a number of engineering disciplines. However, the process of generating these DSMs has primarily used surveys, structured interviews, and/or meetings with engineers. As a consequence, there is a high cost associated with engineers' time alongside the requirement to continually update the DSM structure as a product develops. It follows that the proposition of this paper is to investigate whether an automated and continuously evolving DSM can be generated by monitoring the changes in the digital models that represent the product. This includes models that are generated from computer-aided design, finite element analysis, and computational fluid dynamics systems. The paper shows that a DSM generated from
the changes in the product models corroborates with the product architecture as defined by the engineers and results from previous DSM studies. In addition, further levels of product architecture dependency were also identified. A particular affordance of automatically generating DSMs is the ability to continually generate DSMs throughout the project. This paper demonstrates the opportunity for project managers to monitor emerging product dependencies alongside changes in modes of working between the engineers. The application of this technique could be used to support existing product life cycle change management solutions, cross-company product development, and small to medium enterprises who do not have a product life cycle management solution.

General information
State: Published
Organisations: Department of Mechanical Engineering, University of Bristol
Authors: Gopsill, J. A. (Ekstern), Snider, C. (Ekstern), McMahon, C. (Intern), Hicks, B. (Ekstern)
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BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.09 SJR 0.414 SNIP 0.768
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.501 SNIP 1.244 CiteScore 0.81
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.578 SNIP 1.149 CiteScore 1.27
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.759 SNIP 1.262 CiteScore 1.19
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.45 SNIP 1.493 CiteScore 1.05
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.622 SNIP 1.873 CiteScore 1.6
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.631 SNIP 1.148
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.393 SNIP 0.713
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.391 SNIP 0.57
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.63 SNIP 1.044
Scopus rating (2006): SJR 0.346 SNIP 0.636
Scopus rating (2005): SJR 0.245 SNIP 0.463
Scopus rating (2004): SJR 0.489 SNIP 0.748
Scopus rating (2003): SJR 0.364 SNIP 0.9
Scopus rating (2002): SJR 0.509 SNIP 0.628
Band gap tuning of amorphous Al oxides by Zr alloying

The optical band gap and electronic structure of amorphous Al-Zr mixed oxides, with Zr content ranging from 4.8 to 21.9%, were determined using vacuum ultraviolet (VUV) and X-ray absorption spectroscopy (XAS). The light scattering by the nano-porous structure of alumina at low wavelengths was estimated based on the Mie scattering theory. The dependence of the optical band gap of the Al-Zr mixed oxides on Zr content deviates from linearity and decreases from 7.3 eV for pure anodized Al2O3 to 6.45 eV for Al-Zr mixed oxide with Zr content of 21.9%. With increasing Zr content, the conduction band minimum changes non-linearly as well. Fitting of the energy band gap values resulted in a bowing parameter of 2 eV. The band gap bowing of the mixed oxides is assigned to the presence of the Zr d-electron states localized below the conduction band minimum of anodized Al2O3.

General information

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Organisations: Department of Photonics Engineering, Optical Microsensors and Micromaterials, Department of Mechanical Engineering, Materials and Surface Engineering, Department of Management Engineering, Risø National Laboratory for Sustainable Energy, Paul Scherrer Institut, Danish Technological Institute, Aarhus University
Authors: Canulescu, S. (Intern), Jones, N. C. (Ekstern), Borca, C. N. (Ekstern), Piamonteze, C. (Ekstern), Rechendorff, K. (Ekstern), Gudla, V. C. (Intern), Bordo, K. (Intern), Nielsen, L. P. (Ekstern), Hoffmann, S. V. (Ekstern), Almtoft, K. P. (Ekstern), Ambat, R. (Intern), Schou, J. (Intern)
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.67 SJR 1.132 SNIP 0.996
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.085 SNIP 0.983 CiteScore 2.47
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.799 SNIP 1.462 CiteScore 3.25
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.149 SNIP 1.652 CiteScore 3.77
Bayesian inference model for fatigue life of laminated composites

A probabilistic model for estimating the fatigue life of laminated composite plates is developed. The model is based on lamina-level input data, making it possible to predict fatigue properties for a wide range of laminate configurations. Model parameters are estimated by Bayesian inference. The reference data used consists of constant-amplitude cycle test results for four laminates with different layup configurations. The paper describes the modeling techniques and the parameter estimation procedure, supported by an illustrative application.

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Organisations: Department of Wind Energy, Wind Turbines, Department of Mechanical Engineering, Solid Mechanics, University of California at Berkeley
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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.42 SJR 0.517 SNIP 0.781
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.586 SNIP 0.88 CiteScore 1.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.606 SNIP 1.183 CiteScore 1.44
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.624 SNIP 1.207 CiteScore 1.45
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.607 SNIP 1.26 CiteScore 1.21
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.656 SNIP 1.283 CiteScore 1.23
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.678 SNIP 1.135
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.73 SNIP 1.076
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.791 SNIP 1.124
Scopus rating (2007): SJR 0.689 SNIP 1.216
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.598 SNIP 1.321
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.753 SNIP 1.184
Scopus rating (2004): SJR 0.751 SNIP 1.138
Scopus rating (2003): SJR 0.657 SNIP 0.981
Scopus rating (2002): SJR 1.692 SNIP 1.362
Scopus rating (2001): SJR 1.285 SNIP 1.522
Scopus rating (2000): SJR 1.64 SNIP 1.575
Scopus rating (1999): SJR 1.186 SNIP 1.348
Original language: English
Probabilistic, Fatigue, Bayesian, Laminates, Composite
Biomixing in stagnant water above population of blue mussels (*Mytilus edulis*).
Dense beds of filter-feeding mussels can exert a considerable grazing impact on phytoplankton in many marine areas depending on downmixing promoted by current, wave- and wind action. But downmixing may also be promoted by biomixing caused by the action of the strong exhalent jets of water from the mussels. Here we study the strength of biomixing exerted by large actively filtering blue mussels *Mytilus edulis* in stagnant water. Vertical concentration profiles of added algal cells (*Rhodomonas salina*) were measured (as chl a) over a 70 cm high and stagnant water column in an aquarium above a population of 48 ind.m⁻² of mussels of shell length 69.5 ± 2.3 mm. Due to the intense agitation (biomixing) generated by exhalent jets of the actively feeding mussels the profiles remained nearly uniform over the full water column while decreasing exponentially with time, reaching a level of about 40% of the initial level after 120 min, which implied a population filtration rate of about 0.3 m³.h⁻¹.m⁻² in agreement with prior clearance measurements. Comparing to numerical solutions of a one-dimensional diffusion model, varying the eddy diffusivity, a value of $D = 550 \times 10^{-6}$ m².s⁻¹ was estimated. This high strength of biomixing far exceeds those of previous similar studies on the filter-feeding polychaete *Nereis diversicolor* ($0.3 \times 10^{-6}$ m².s⁻¹) and the ascidian *Ciona intestinalis* ($150 \times 10^{-6}$ m².s⁻¹) and suggests that biomixing in moderate benthic boundary layer flows past mussel beds may contribute to the downmixing of phytoplankton.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, University of Southern Denmark
Authors: Larsen, P. S. (Intern), Andrup, P. (Forskerdatabase), Tang, B. (Forskerdatabase), Riisgård, H. (Ekstern)
Number of pages: 4
Publication date: 2016
Main Research Area: Technical/natural sciences

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Electronic versions:
biomixing_in_stagnant_water_above_population_of_blue_mussels_mytilusedulis_.pdf

**Bibliographical note**
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Source: PublicationPreSubmission
Source-ID: 127442600
Publication: Research - peer-review › Journal article – Annual report year: 2016

**Bonding mechanisms in spot welded three layer combinations**
The strength of a spot weld generally stems from fusion bonding of the metal layers, but other solid state bonding mechanisms also contribute to the overall strength. Metallographic analyses are presented to identify the phases formed near and across the weld interfaces and to identify the occurring bonding mechanisms. When welding a combination of three galvanized steel layers where one outer layer is a thin low-carbon steel it is a common challenge to obtain nugget penetration into the thin low-carbon steel. It therefore happens in real production that no nugget is formed across this interface. It has been shown previously that such a joint can reach relatively high strength resulting in plug failure in tensile shear testing. Additional strength due to these bonding mechanisms is also obtained in common spot welds in the so-called corona band around the weld nugget.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Materials and Surface Engineering
Authors: Moghadam, M. (Intern), Tiedje, N. S. (Intern), Seyyedian Choobi, M. (Intern), Nielsen, C. V. (Intern), Pantleon, K. (Intern), Bay, N. O. (Intern)
Number of pages: 12
Calibration of a Numerical Model for Heat Transfer and Fluid Flow in an Extruder

This paper discusses experiments performed in order to validate simulations on a fused deposition modelling (FDM) extruder. The nozzle has been simulated in terms of heat transfer and fluid flow. In order to calibrate and validate these simulations, experiments were performed giving a significant look into the physical behaviour of the nozzle, heating and cooling systems. Experiments on the model were performed at different sub-mm diameters of the extruder. Physical parameters of the model – especially temperature dependent parameters – were set into analytical relationships in order to receive dynamical parameters. This research sets the foundation for further research within melted extrusion based additive manufacturing. The heating process of the extruder will be described and a note on the material feeding will be given.

Calibration of surface roughness standards

The key comparison EURAMET.L-K8.2013 on roughness was carried out in the framework of a EURAMET project starting in 2013 and ending in 2015. It involved the participation of 17 National Metrology Institutes from Europe, Asia, South America and Africa representing four regional metrology organisations. Five surface texture standards of different type were circulated and on each of the standards several roughness parameters according to the standard ISO 4287 had to be determined. 32 out of 395 individual results were not consistent with the reference value. After some corrective actions the number of inconsistent results could be reduced to 20, which correspond to about 5% of the total and can statistically be expected. In addition to the material standards, two softgauges were circulated, which allow to test the software of the instruments used in the comparison. The comparison results help to support the calibraton and measurement capabilities (CMCs) of the laboratories involved in the CIPM MRA. Main text To reach the main text of this paper, click on Final Report. Note that this text is that which appears in Appendix B of the BIPM key comparison database kcdb.bipm.org/. The final report has been peer-reviewed and approved for publication by the CCL, according to the provisions of the CIPM Mutual Recognition Arrangement (CIPM MRA).
Carbon nanotube-based coatings to induce flow enhancement in hydrophilic nanopores

With the emergence of the field of nanofluidics, the transport of water in hydrophilic nanopores has attracted intensive research due to its many promising applications. Experiments and simulations have found that flow resistance in hydrophilic nanochannels is much higher than those in macrochannels. Indeed, this might be attributed to significant fluid adsorption on the channel walls and to the effect of the increased surface to volume ratio inherent to the nanoconfinement. Therefore, it is desirable to explore strategies for drag reduction in nanopores. Recently, studies have found that carbon nanotubes (CNTs) feature ultrafast waterflow rates which result in flow enhancements of 1 to 5 orders of magnitude compared to Hagen-Poiseuille predictions. In the present study, CNT-based coatings are considered to induce water flow enhancement in silica nanopores with different radius. We conduct atomistic simulations of pressurized water flow inside tubular silica nanopores with and without inner coaxial carbon nanotubes. In particular, we compute water density and velocity profiles, flow enhancement and slip lengths to understand the drag reduction capabilities of single- and multi-walled carbon nanotubes implemented as coating material in silica nanopores.

Cavitation instabilities between fibres in a metal matrix composite

Short fibre reinforced metal matrix composites (MMC) are studied here to investigate the possibility that a cavitation instability can develop in the metal matrix. The high stress levels needed for a cavitation instability may occur in metal–ceramic systems due to the constraint on plastic flow induced by bonding to the ceramics that only show elastic deformation. In an MMC the stress state in the metal matrix is highly non-uniform, varying between regions where shear stresses are dominant and regions where hydrostatic tension is strong. An Al–SiC whisker composite with a periodic pattern of transversely staggered fibres is here modelled by using an axisymmetric cell model analysis. First the critical stress level is determined for a cavitation instability in an infinite solid made of the Al matrix material. By studying composites with different distributions and aspect ratios of the fibres it is shown that regions between fibre ends may develop hydrostatic tensile stresses high enough to exceed the critical level for a cavitation instability. For cases where a void is located in such regions it is shown that unstable cavity growth develops when the void is initially much smaller than the highly stressed region of the material.
Ceramic tape casting: A review of current methods and trends with emphasis on rheological behaviour and flow analysis

Tape casting has been used to produce thin layers of ceramics that can be used as single layers or can be stacked and laminated into multilayered structures. Today, tape casting is the basic fabrication process that provides multilayered capacitors and multilayered ceramic packages. In tape casting the rheological behaviour of the slurry as well as the
Material flow during casting are of utmost importance since these phenomena to a large extent determine the final properties and hence the quality of the cast product. During the last decades this has led to an increasing number of works in literature within fluid flow analysis of tape casting. In the present paper a review of the development of the tape casting process with particular focus on the rheological classifications as well as modelling the material flow is hence presented and in this context the current status is examined and future potential discussed.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Energy Conversion and Storage, Electrofunctional materials, Nanyang Technological University, National Technical University of Athens
Authors: Jabbaribehnam, M. (Intern), Bulatova, R. (Intern), Tok, A. I. Y. (Ekstern), Bahl, C. (Intern), Mitsoulis, E. (Ekstern), Hattel, J. H. (Intern)
Pages: 39-61
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Main Research Area: Technical/natural sciences

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BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.4 SJR 0.706 SNIP 1.035
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.715 SNIP 1.092 CiteScore 2.31
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.795 SNIP 1.351 CiteScore 2.58
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.747 SNIP 1.226 CiteScore 2.11
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.777 SNIP 1.151 CiteScore 1.82
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.743 SNIP 1.065 CiteScore 1.66
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.9 SNIP 1.055
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.939 SNIP 1.183
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.922 SNIP 1.161
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.92 SNIP 1
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.822 SNIP 0.977
Scopus rating (2005): SJR 0.803 SNIP 0.989
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.731 SNIP 0.788
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.86 SNIP 0.831
Scopus rating (2002): SJR 0.793 SNIP 0.826
Scopus rating (2001): SJR 0.852 SNIP 0.835
CFD Applied for the Identification of Stiffness and Damping Properties for Smooth Annular Turbomachinery Seals in Multiphase Flow

This paper presents a first venture into quantifying stiffness and damping coefficients for turbomachinery seals in multiphase flow using Computational Fluid Dynamics (CFD). The study focuses on the simplest seal type: the smooth annular seal. The investigation is conducted for both wet-gas and bubbly flow regimes in which the primary phase is gas (air) and liquid (water), respectively. For the wet gas regime three different Liquid Volume Fraction (LVF) conditions are included in the study; 5%, 3% and 0%. Similarly for the bubbly flow regime three Gas Volume Fractions (GVF) conditions are included; 5%, 3% and 0%. An Eulerian-Eulerian modelling approach is taken, applying an inhomogeneous model, where the primary phase is treated as continuous and the secondary phase is included as dispersed. The Instationary Perturbation Method (IPM) is applied to identify the rotordynamic coefficients, in which the rotor is harmonically perturbed, and forces acting on the rotor are quantified through integration of the pressure and shear stresses. The perturbation is repeated for different frequencies to uncover any frequency dependence. The results presented in this paper are intended as an initial comparison basis for the experimental results to be obtained by applying the multiphase seal test facility currently in development, as part of a collaboration between Lloyd’s Register Consulting, the Technical University of Denmark, OneSubsea, TOTAL and Statoil.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Lloyd’s Register Consulting, Technical University of Denmark
Authors: Voigt, A. J. (Intern), Ludiciani, P. (Ekstern), Nielsen, K. K. (Ekstern), Santos, I. (Intern)
Number of pages: 15
Publication date: 2016

Host publication information
Title of host publication: Proceedings of ASME Turbo Expo 2016
Volume: Volume 7B: Structures and Dynamics
Publisher: American Society of Mechanical Engineers
Article number: GT2016-57905
Main Research Area: Technical/natural sciences
DOIs: 10.1115/GT2016-57905
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

CFD modelling of condensation process of water vapor in supersonic flows

The condensation phenomenon of vapor plays an important role in various industries, such as the steam flow in turbines and refrigeration system. A mathematical model is developed to predict the spontaneous condensing phenomenon in the supersonic conditions using the nucleation and droplet growth theories. The numerical approach is validated with the experimental data, which shows a good agreement between them. The condensation characteristics of water vapor in the Laval nozzle are studied numerically in this paper. The results show that the condensation process is a rapid variation of the vapor-liquid phase change both in space and in time. The spontaneous condensation of water vapor will not appear immediately when the steam reaches the saturation state. Instead, it occurs further downstream the nozzle throat, where the steam is in the state of supersaturation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, University of Nottingham, Changzhou University
Authors: Wen, C. (Intern), Walther, J. H. (Intern), Yan, Y. (Ekstern), Yang, Y. (Ekstern)
Number of pages: 8
Publication date: 2016
CFD Study on Effective Wake of Conventional and Tip-modified Propellers

Tip-modified propellers have been developed to improve propulsive efficiency and to lengthen the lifting-surface span. A hydrodynamic distinction of tip-modified propellers consistently shown in model tests is 5-15% higher effective wake fraction compared to conventional propellers. The effective wake fraction is not from direct measurements but from an estimation based on an open-water curve correlation at the same thrust or torque coefficient as in the self-propulsion test. Open-water tests are conducted at 2-4 times higher Reynolds number than that depending on Froude scaling in self-propulsion tests. The effects of different Reynolds number on higher effective wake fraction of tip-modified propellers are investigated by open-water simulations with varying the propeller speed and evaluations of effective wake extracted from self-propulsion simulations on tip-modified and conventional propellers. Open-water simulations show that the advance ratio at the design thrust is higher at a higher Reynolds number for both propellers and the advance ratio increase is smaller for the tip-modified propeller, which results in a higher effective wake fraction.

Effective wake fractions are evaluated by integrating velocity fields at a section 40% of the propeller radius upstream from the propeller plane in self-propulsion simulations. The difference of effective wake fraction from integrating velocity fields between tip-modified and conventional propellers is less than 1%. Based on the open-water simulation result and the effective wake fractions from integrating CFD velocity fields, 5-15% higher effective wake fractions of tip-modified propellers from the existing estimation method based on the open-water correlation at thrust or torque identity can be related mainly to the effects of Reynolds number. However, the effective wake fraction from integrating a total velocity field with excluding a propeller-induced flow is about 10% higher for the tip-modified propeller. The propeller-induced flow is estimated separately by open-water simulations. Further studies are necessary with a more sophisticated way to estimate the propeller-induced flow by taking into account interaction effects between propeller-induced flow and hull wake.

Challenges when evaluating Product/Service-Systems through Life Cycle Assessment

Life Cycle Assessment (LCA) is a state-of-the-art method for conducting environmental assessments of systems, whether these consist of goods or services, or a combination of the two. However, current LCA guidelines focus on assessing tangible products and lack specific attention to more complex systems, such as Product/Service-Systems (PSS), which also consist of intangible elements. PSS imply a shift in business paradigm from selling specific products to delivering a function, through a mix of products and services, thereby incentivising resource efficiency as well as user satisfaction. Despite their potential to reduce environmental impacts, PSS are not by default more environmentally benign compared to conventional systems, and quantifications of their environmental performance are called for. This paper contributes by showing that specific challenges need to be addressed when using LCA to evaluate the environmental performance of PSS. We identify a set of PSS characteristics that can challenge an LCA study. Three relevant scopes are distinguished, where LCA may be applied: (1) evaluating options within the PSS itself; (2) comparing a PSS with an alternative; and (3) modelling the actual contextual changes caused by the PSS. We derive three pronounced challenges when conducting LCA within the three scopes: (i) identifying and defining the reference system; (ii) defining the functional unit; and (iii) setting system boundaries. We elaborate on how these challenges are discussed in current literature. Recommended future work includes developing adapted guidelines and further empirical case studies that quantify the environmental
changes and impacts caused by introducing PSS.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Aalborg University
Authors: Kjær, L. L. (Intern), Pagoropoulos, A. (Intern), Schmidt, J. H. (Ekstern), McAloone, T. C. (Intern)
Pages: 95-104
Publication date: 2016
Main Research Area: Technical/natural sciences

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Volume: 120
ISSN (Print): 0959-6526
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- Web of Science (2018): Indexed yes
- BFI (2017): BFI-level 2
- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 5.83 SJR 1.615 SNIP 2.382
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.609 SNIP 2.383 CiteScore 5.57
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.661 SNIP 2.477 CiteScore 4.6
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.644 SNIP 2.581 CiteScore 4.47
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.706 SNIP 2.328 CiteScore 4.07
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.461 SNIP 1.825 CiteScore 3.19
- ISI indexed (2011): ISI indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.419 SNIP 1.742
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 0.942 SNIP 1.544
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 0.813 SNIP 1.354
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 0.942 SNIP 1.489
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.842 SNIP 1.543
- Scopus rating (2005): SJR 0.544 SNIP 1.357
- Scopus rating (2004): SJR 0.753 SNIP 1.818
- Scopus rating (2003): SJR 0.501 SNIP 1.152
- Web of Science (2003): Indexed yes
- Scopus rating (2002): SJR 0.481 SNIP 1.103
Characterization of Fibre-Direction Dependent Damping of Glass-Fibre Composites at Low Temperatures and Low Frequencies

This paper deals with the characterization of the fibre-direction dependent damping capability of glass fibre reinforced plastics (GFRP) to be used in electrical power transmission pylons. A fibre-direction dependent damping analysis of unidirectional (UD) GFRP samples was carried out using a Dynamic Mechanical Analysis (DMA) for five different fibre orientations (0˚ | 30˚ | 45˚ | 60˚ and 90˚) and two different matrix systems (epoxy and a vinyl ester resin). Based on the dynamic characteristics the damping performance of the various composite materials was studied at three temperatures (-10˚C, 0˚C and 10˚C) and three vibration frequencies (1 Hz, 10 Hz and 30 Hz). It was observed that the loss factor of Glass Fibre Reinforced Vinyl-Ester (GF-VE) was in general slightly higher compared to the Glass Fibre Reinforced Epoxy (GF-EP). The loss factor increased slightly with temperature, while an increase in frequency led to a decrease in the damping capability of the composite material.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technische Universität Dresden
Authors: Kliem, M. (Intern), Høgsberg, J. B. (Intern), Dannemann, M. (Ekstern)
Number of pages: 8
Publication date: 2016

Host publication information
Title of host publication: ECCM17 - Proceedings of the 17th European Conference on Composite Materials 2016
ISBN (Print): 978-300053387-7
Main Research Area: Technical/natural sciences
Conference: 17th European Conference on Composite Materials, Munich, Germany, 26/06/2016 - 26/06/2016
Glass-fibre composites, Damping, Loss factor, Dynamic analysis
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

CNT based thermal Brownian motor to pump water in nanodevices

Brownian molecular motors are nanoscale machines that exploit thermal fluctuations for directional motion by employing mechanisms such as the Feynman-Smoluchowski ratchet. In this study, using Non Equilibrium Molecular Dynamics, we propose a novel thermal Brownian motor for pumping water through Carbon Nanotubes (CNTs). To achieve this we impose a thermal gradient along the axis of a CNT filled with water and impose, in addition, a spatial asymmetry by fixing specific zones on the CNT in order to modify the vibrational modes of the CNT. We find that the temperature gradient and imposed spatial asymmetry drive the water ow in a preferential direction. We systematically modified the magnitude of the applied thermal gradient and the axial position of the fixed points. The analysis involves measurement of the vibrational modes in the CNTs using a Fast Fourier Transform (FFT) algorithm. We observed water ow in CNTs of 0.94, 1.4 and 2.0 nm in diameter, reaching a maximum velocity of 5 m/s for a thermal gradient of 3.3 K/nm. The proposed thermal motor is capable of delivering a continuous ow throughout a CNT, providing a useful tool for driving liquids in nanouidic devices by exploiting thermal gradients.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
Authors: Oyarzua, E. (Ekstern), Zambrano, H. (Ekstern), Walther, J. H. (Intern)
Number of pages: 1
Publication date: 2016
Cobalt release and complications resulting from the use of dental prostheses

BACKGROUND: Cobalt release from dental prostheses has been shown to elicit allergic reactions in cobalt-allergic patients. It is therefore important to investigate whether these prostheses are possible sources of sensitization.

OBJECTIVES: To assess (i) cobalt release from dental prostheses and (ii) allergic reactions to components of dental prostheses, and (iii) to investigate the oral mucosa for inflammation 1-5 years after insertion of the prostheses. METHOD: Clinical oral examination was conducted in 66 patients with 84 dental prostheses. Cobalt release from 84 functional (used) and 32 non-functional (new) prostheses was investigated with the cobalt spot test. Contact allergy was assessed by patch testing. Smear tests for Candida spp. were performed in patients showing signs of inflammation of the oral mucosa. The prostheses were assessed for biological and technical complications. RESULTS: None of the functional prostheses released cobalt, whereas this was observed in 24 of 32 non-functional prostheses. None of the patients had contact allergy to cobalt. Of the 66 patients, 11 showed signs of inflammation of the oral mucosa, 2 had oral candidiasis, 16 had ill-fitting prostheses, and all had insufficient oral hygiene. CONCLUSIONS: Dental prostheses released cobalt during the fabrication stages, but not 1-5 years after insertion. No allergic reactions were observed. Signs of inflammation were related to candidiasis, insufficient oral hygiene, and ill-fitting prostheses.
Cogenerative Performance of a Wind − Gas Turbine − Organic Rankine Cycle Integrated System for Offshore Applications

Gas Turbines (GT) are widely used for power generation in offshore oil and gas facilities, due to their high reliability, compactness and dynamic response capabilities. Small heavy-duty and aeroderivative units in multiple arrangements are typically used to offer larger load flexibility, but limited efficiency of such machines is the main drawback.

A solution to enhance the system performance, also in Combined Heat and Power (CHP) arrangement, is the implementation of Organic Rankine Cycle (ORC) systems at the bottom of the gas turbines. Moreover, the resulting GT-ORC combined cycle could be further integrated with additional renewable sources. Offshore wind technology is rapidly developing and floating wind turbines could be combined with offshore GT-ORC based power plants to satisfy the platform load. The pioneering stand alone power system, for an oil & gas platform, examined in this paper comprises a 10MW offshore wind farm and three gas turbines rated for 16.5MW, each one coupled with an 4.5MW ORC module. The ORC main parameters are observed under different wind power fluctuations. Due to the non-programmable availability of wind and power demand, the part-load and dynamic characteristics of the systems should be investigated. A dynamic model of the power system based on first principles is used, developed in the Modelica language. The model is integrated with a time series-based model of two offshore wind mills. Various thermodynamic indexes, available in the literature, are identified and evaluated to compare the actual combined heat and power performances of single components and of the overall integrated system in the considered wind scenarios.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Università di Bologna
Authors: Bianchi, M. (Ekstern), Branchini, L. (Ekstern), De Pascale, A. (Ekstern), Melino, F. (Ekstern), Orlandini, V. (Ekstern), Peretto, A. (Ekstern), Haglind, F. (Intern), Pierobon, L. (Intern)
Number of pages: 16
Publication date: 2016

Host publication information
Title of host publication: Proceedings of ASME Turbo Expo 2016
Publisher: American Society of Mechanical Engineers

Axial-flow turbines represent a well-established technology for a wide variety of power generation systems. Compactness, flexibility, reliability and high efficiency have been key factors for the extensive use of axial turbines in conventional power plants and, in the last decades, in organic Rankine cycle power systems. In this two-part paper, an overall cycle model and a model of an axial turbine were combined in order to provide a comprehensive preliminary design of the organic Rankine cycle unit, taking into account both cycle and turbine optimal designs. Part A presents the preliminary turbine design model, the details of the validation and a sensitivity analysis on the main parameters, in order to minimize the number of decision variables in the subsequent turbine design optimization. Part B analyzes the application of the combined turbine and cycle designs on a selected case study, which was performed in order to show the advantages of the adopted methodology. Part A presents a one-dimensional turbine model and the results of the validation using two experimental test cases from literature. The first case is a subsonic turbine operated with air and investigated at the University of Hannover. The second case is a small, supersonic turbine operated with an organic fluid and investigated by Verneau. In the first case, the results of the turbine model are also compared to those obtained using computational fluid dynamics simulations. The results of the validation suggest that the model can predict values of efficiency within ± 1.3%-points, which is in agreement with the reliability of classic turbine loss models such as the Craig and Cox correlations used in the present study. Values similar to computational fluid dynamics simulations at the midspan were obtained in the first case of validation. Discrepancy below 12% was obtained in the estimation of the flow velocities and turbine geometry. The values are considered to be within a reasonable range for a preliminary design tool. The sensitivity analysis on the turbine model suggests that two of twelve decision variables of the model can be disregarded, thus further reducing the computational requirements of the optimization.
Organic Rankine cycle (ORC), Axial turbine design, Combined optimization, Turbine experimental validation, Turbine sensitivity analysis

Electronic versions:
DOIs:
10.3390/en9050313

Bibliographical note
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Source: FindIt
Source-ID: 2303828066
Publication: Research - peer-review › Journal article – Annual report year: 2016

Combined Turbine and Cycle Optimization for Organic Rankine Cycle Power Systems—Part B: Application on a Case Study

Organic Rankine cycle (ORC) power systems have recently emerged as promising solutions for waste heat recovery in low- and medium-size power plants. Their performance and economic feasibility strongly depend on the expander. The design process and efficiency estimation are particularly challenging due to the peculiar physical properties of the working fluid and the gas-dynamic phenomena occurring in the machine. Unlike steam Rankine and Brayton engines, organic Rankine cycle expanders combine small enthalpy drops with large expansion ratios. These features yield turbine designs with few highly-loaded stages in supersonic flow regimes. Part A of this two-part paper has presented the implementation and validation of the simulation tool TURAX, which provides the optimal preliminary design of single-stage axial-flow turbines. The authors have also presented a sensitivity analysis on the decision variables affecting the turbine design. Part B of this two-part paper presents the first application of a design method where the thermodynamic cycle optimization is combined with calculations of the maximum expander performance using the mean-line design tool described in part A. The high computational cost of the turbine optimization is tackled by building a model which gives the optimal preliminary design of an axial-flow turbine as a function of the cycle conditions. This allows for estimating the optimal expander performance for each operating condition of interest. The test case is the preliminary design of an organic Rankine cycle turbogenerator to increase the overall energy efficiency of an offshore platform. For an increase in expander pressure ratio from 10 to 35, the results indicate up to 10% point reduction in expander performance. This corresponds to a relative reduction in net power output of 8.3% compared to the case when the turbine efficiency is assumed to be 80%. This work also demonstrates that this approach can support the plant designer in the selection of the optimal size of the organic Rankine cycle unit when multiple exhaust gas streams are available.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Politecnico di Milano
Authors: La Seta, A. (Intern), Meroni, A. (Intern), Andreasen, J. G. (Intern), Pierobon, L. (Intern), Persico, G. (Ekstern), Haglind, F. (Intern)
Number of pages: 17
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Energies
Volume: 9
Issue number: 6
Article number: 393
Comparing the photocatalytic activity of TiO$_2$ at macro- and microscopic scales

This study focuses on the characterization of photocatalytic TiO$_2$ coatings using Kelvin probe force microscopy. While most photocatalytic experiments are carried out at a macroscopic scale, Kelvin probe force microscopy is a microscopic technique that is surface sensitive. In order to link microscale results to macroscopic experiments, a simple method to establish the relation between Kelvin probe force microscopy and electrochemical measurements is presented by the calibration of a reference sample consisting of epitaxial deposited Cu-Ni-Au that is used as a transfer standard. The photocatalytic properties of TiO$_2$ at macro- and microscopic scales are investigated by comparing photocatalytic degradation of acetone and electrochemical experiments to Kelvin probe force microscopy. The good agreement between the macro- and microscopic experiments suggests that Kelvin probe force microscopy can be a valuable tool towards the understanding, standardization and design of TiO$_2$-based solutions in photocatalytic applications.
Comparison Between Stress Obtained by Numerical Analysis and In-Situ Measurements on a Flexible Pipe Subjected to In-Plane Bending Test

To predict the lifetime and long-term properties of tensile armour wires in a dynamically loaded pipe, it is essential to have a tool which allows detailed prediction of the stress variations in the tensile armour wires during global pipe loading. Furthermore, detailed understanding of the stress variations will allow for performance optimization of the armour layers. To study the detailed stress variations in flexible pipes during dynamic loading, a comprehensive three-dimensional implicit nonlinear finite element model has been developed. The predicted numerical stress variations will be compared to stress patterns obtained during in-situ OMS measurements carried out during an actual experimental inplane bending test. The study showed a good correlation between the stress variation predicted with the finite element model and the measured stress variation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, National Oilwell Varco Denmark I/S
Authors: Vestergaard Lukassen, T. (Ekstern), Glejbøl, K. (Ekstern), Lyckegaard, A. (Ekstern), Berggreen, C. (Intern)
Number of pages: 8
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the ASME 35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE 2016)
Volume: 5: Pipelines, Risers, and Subsea Systems
Publisher: American Society of Mechanical Engineers
Article number: OMAE2016-55060
BFI conference series: International Conference on Ocean, Offshore and Arctic Engineering (5010067)
Main Research Area: Technical/natural sciences
Conference: ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2016), Busan, Korea, Republic of, 19/06/2016 - 19/06/2016
DOIs: 10.1115/OMAE2016-55060
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Comparison of conventional Injection Mould Inserts to Additively Manufactured Inserts using Life Cycle Assessment

Polymer Additive Manufacturing can be used to produce soft tooling inserts for injection moulding. Compared to conventional tooling, the energy and time consumption during production are significantly lower. As the life time of such inserts is significantly shorter than the life time of traditional brass, aluminium, or steel inserts, multiple inserts might be needed to produce a large number of parts.

In an ongoing study, a simplified Life Cycle Assessment has been carried out in order to provide information on how the four alternative insert materials perform in comparison in terms of their potential environmental impact and yield throughout the development and pilot phase. Insert geometry is particularly advantageous for pilot production and small production sizes.

In this research, Life Cycle Assessment is used to compare the environmental impact of soft tooling by Additive Manufacturing (using Digital Light Processing) and three traditional methods for the manufacture of inserts (milling of brass, steel, and aluminium) for injection moulds during the pre-production phase.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Management Engineering, Quantitative Sustainability Assessment, Technical University of Denmark
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.

Comparison of measurements from optical CMM and focus-variation microscope of a μPIM mechanical part

Two sets of 5 green and 5 sintered mechanical parts, manufactured by micro powder injection moulding (μPIM), were measured using an optical coordinate measuring machine (OCMM) and a focus-variation microscope (FVM). The examined features of size, including diameter, radii and distances, span in the range of (10⁻¹–10¹) mm. Comparing the corresponding measurements from the two instruments, a relative maximum deviation of 8 % was found for the linear dimensions of the green parts and a relative maximum deviation of 6 % for the ones of the sintered parts. The maximum relative deviation of the radii was 17 % for the green parts and 30 % for the sintered parts (relative deviations have been evaluated considering focus-variation measurements as reference). OCMM showed some problems in the detection of the smallest dimensional features (above all radii) where the presence of defects on the edges, quite typical for parts
produced by μPIM, was particular critical for the measurements. The extraction of results obtained from FVM was less critical because performed with a dedicated post-processing software which allowed to better define the measured dimensions. Furthermore, the chance to measure other geometrical features, such as surface texture and flatness, may depict FVM measurements more attractive. However, measurements should be suitable for in-line quality control, in a production environment, where fast cycle time is required and measuring times are more compatible to those of the OCMM.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark
Authors: Quagliotti, D. (Intern), Salaga, J. (Ekstern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 2
Publication date: 2016

**Host publication information**

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Main Research Area: Technical/natural sciences
Conference: euspen’s 16th International Conference & Exhibition, Nottingham, United Kingdom, 30/05/2016 - 30/05/2016
Micro Powder Injection Moulding (μPIM), Quality Assurance, Focus-variation Microscope, Optical CMM
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

**Composition-dependent variation of magnetic properties and interstitial ordering in homogeneous expanded austenite**

The crystal structure and magnetic properties of austenitic stainless steel with a colossal interstitial content, so-called expanded austenite, are currently not completely understood. In the present work, the magnetic properties of homogeneous samples of expanded austenite, as prepared by lowerature nitriding of thin foils, were investigated with magnetometry and Mössbauer spectroscopy. At room temperature, expanded austenite is paramagnetic for relatively low and for relatively high nitrogen contents (\(y_N = 0.13\) and 0.55, respectively, where \(y_N\) is the interstitial nitrogen occupancy), while ferromagnetism is observed for intermediate nitrogen loads. Spontaneous volume magnetostriction was observed in the ferromagnetic state and the Curie temperature was found to depend strongly on the nitrogen content. For the first time, X-ray diffraction evidence for the occurrence of long-range interstitial order of nitrogen atoms in expanded austenite was observed for high nitrogen contents.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Chemistry, X-ray Crystallography, Department of Physics, Neutrons and X-rays for Materials Physics, Department of Micro- and Nanotechnology, Magnetic Systems
Authors: Brink, B. K. (Intern), Ståhl, K. (Intern), Christiansen, T. L. (Intern), Frandsen, C. (Intern), Hansen, M. F. (Intern), Somers, M. A. J. (Intern)
Number of pages: 8
Pages: 32-39
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

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Volume: 106
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 5.67 SJR 3.283 SNIP 2.674
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 3.542 SNIP 2.927 CiteScore 5.22
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 4.045 SNIP 3.348 CiteScore 5.16
Web of Science (2014): Indexed yes
Computation of Added Mass and Damping Coefficients of a Horizontal Circular Cylinder in Open Foam

This paper presents numerical computation of added mass and damping coefficients of a slender horizontal cylinder in the free surface zone, which typically serves as a fish cage floater. A fully viscous two phase flow solver in OpenFOAM was employed in the numerical computation. The purpose was to validate the capability of this solver and dynamic mesh functionality. A two-dimensional numerical wave tank was set up, and two wave relaxation zones were used to reduce the size of the computational domain. Harmonic forced oscillations of the cylinder were performed at different frequencies and amplitudes. The mesh at free surface zone was refined based on the radiated wave heights at different oscillation frequencies in order to properly resolve the radiated waves. The result shows that in most frequency ranges, the numerical computation agreed well with the experimental data and analytical solution. However at low frequency range for added mass coefficient in heave motion, deviations were observed, and it was due to the effect of finite water depth. In addition
for sway motion at high frequency range, the damping coefficient was underestimated comparing with analytical solution. This was believed to be as a result of high steepness of the radiated waves.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Chen, H. (Intern), Christensen, E. D. (Intern)
Number of pages: 8
Publication date: 2016

**Host publication information**

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Publisher: American Society of Mechanical Engineers
Article number: OMAE2016-54429
ISBN (Electronic): 978-0-7918-4993-4
BFI conference series: International Conference on Ocean, Offshore and Arctic Engineering (5010067)
Main Research Area: Technical/natural sciences
Conference: ASME 2016 35th International Conference on Ocean, Offshore and Arctic Engineering (OMAE2016), Busan, Korea, Republic of, 19/06/2016 - 19/06/2016
DOIs: 10.1115/OMAE2016-54429
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

**Computed Tomography characterization of the Green Fiber Bottle**

The work carried out in this research aims at identifying suitable ways for thorough characterization of the quality of paper bottles. Industrial X-ray Computed Tomography (XCT) is particularly advantageous in determining the quality of paper bottles and thus correlating it with the production process. The Green Fiber Bottle (GFB) is a freeform geometry consisting of cellulose fibers. Accurate dimensional measurements such as wall thickness of the GFB is not possible using Coordinate Measuring Machines (CMMs). XCT on one hand provides an effective means of measuring wall thickness and on the other hand it also helps in identifying voids in the order of 110 µm at any location in the bottle geometry.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Saxena, P. (Intern), Bissacco, G. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at Euspen Special Interest Group Meeting: Structured & Freeform Surfaces, Kgs. Lyngby, Denmark.
Main Research Area: Technical/natural sciences
Electronic versions:
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Publication: Research - peer-review › Poster – Annual report year: 2016

**Contact area measurements on structured surfaces**

In connection with the use of brass specimens featuring structured surfaces in a tribology test, an algorithm was developed for automatic measurement of the contact area by optical means.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics
Authors: Küçükyıldız, Ö. C. (Intern), Jensen, S. H. N. (Intern), De Chiffre, L. (Intern)
Number of pages: 1
Publication date: 2016
Event: Poster session presented at Euspen's S.I.G. Meeting, Copenhagen, Denmark.
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Source-ID: 128476167
Publication: Research - peer-review › Poster – Annual report year: 2017
Continuous vs. pulsating flow boiling. Part 1: Experimental comparison and visualization

This experimental study investigates an active method for flow boiling heat transfer enhancement by means of fluid flow pulsation. The hypothesis is that pulsations increase the flow boiling heat transfer by means of better bulk fluid mixing, increased wall wetting and flow-regime destabilization. The fluid pulsations are introduced by a fluid modulating expansion device and are compared with continuous flow by a stepper-motor expansion valve in terms of time-averaged heat transfer coefficient. The cycle time ranges from 1 s to 9 s for the pulsations. The time-averaged heat transfer coefficients are reduced from transient measurements immediately downstream of the expansion valves at low vapor qualities. The results show that the pulsations improve the time-averaged heat transfer coefficient by 3.2 % on average at low cycle time (1 s to 2) s, whereas the pulsations may reduce the time-averaged heat transfer coefficient by as much as 8 % at high heat flux (q ≥ 35 kW/m²) and cycle time (8 s). The latter reduction is adhered to the significant dry-out when the flow modulating expansion valve is closed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Fluid Mechanics, Coastal and Maritime Engineering, KTH - Royal Institute of Technology
Authors: Kærn, M. R. (Intern), Elmegaard, B. (Intern), Meyer, K. E. (Intern), Palm, B. (Ekstern)
Number of pages: 9
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 16th International Refrigeration and Air Conditioning Conference
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Conference: 16th International Refrigeration and Air Conditioning Conference, West Lafayette, IN, United States, 11/07/2016 - 11/07/2016
Electronic versions: purdue_paper_1_2016_v5_final.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Continuous vs. pulsating flow boiling. Part 2: Statistical comparison using response surface methodology

Response surface methodology is used to investigate an active method for flow boiling heat transfer enhancement by means of fluid flow pulsation. The flow pulsations are introduced by a fluid modulating expansion device and compared with the baseline continuous flow provided by a stepper-motor expansion valve. Two experimental designs (data point sets) are generated using a modified Central Composite Design for each valve and their response surfaces are compared using the quadratic model. Statistical information on the significant model terms are used to clarify whether the effect of fluid flow pulsations is statistically significant in terms of the time-averaged flow boiling heat transfer coefficient. The cycle time range from 1 s to 9 s for the pulsations. The results show that the effect of fluid flow pulsations is statistically significant, disregarding the lowest heat flux measurements. The response surface comparison reveals that the flow pulsations improves the time-averaged heat transfer coefficient by as much as 10 % at the smallest cycle time compared with continuous flow. On the other hand, at highest cycle time and heat flux, the reduction may be as much as 20 % due to significant dry-out when the valve is closed. These values are higher than reported in part 1 of the paper, but evaluated more consistently at equal heat flux using the response surfaces.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Fluid Mechanics, Coastal and Maritime Engineering, Danfoss Drives A/S, KTH - Royal Institute of Technology
Authors: Kærn, M. R. (Intern), Elmegaard, B. (Intern), Meyer, K. E. (Intern), Palm, B. (Ekstern), Holst, J. (Ekstern)
Number of pages: 9
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the 16th International Refrigeration and Air Conditioning Conference
Article number: 2514
Main Research Area: Technical/natural sciences
Conference: 16th International Refrigeration and Air Conditioning Conference, West Lafayette, IN, United States, 11/07/2016 - 11/07/2016
Electronic versions: purdue_paper_2_2016_v6_final.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
Convergence of near-field added resistance calculations using a high order finite-difference method

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Rensselaer Polytechnic Institute
Number of pages: 5
Publication date: 2016

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Title of host publication: Proceedings of the 13th International Symposium on Practical Design of Ships and Other Floating Structures (PRADS'2016)
Publisher: Technical University of Denmark (DTU)
Editors: Dam Nielsen, U., Juncher Jensen, J.
Main Research Area: Technical/natural sciences
Conference: 13th International Symposium on Practical Design of Ships and Other Floating Structures (PRADS'2016), Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Seakeeping, Linearized potential flow, Added resistance, Near-field, Finite-difference, Hyperbolic grid generation
Electronic versions:
PRADS_2016_Proceedings_ORBiT.pdf

Correction of systematic behaviour in topographical surface analysis
Four specimens in the sub-micrometre range and with different polishing were topographically investigated in five areas over their respective surfaces. Uncertainties were evaluated with and without correction for systematic behaviour and successively analysed by a design of experiment (DOE). Results showed that the correction for systematic behaviour allowed for a lower value of the estimated uncertainty when the correction was adequate to completely recognise the systematic effects. If not, the correction can produce an overestimation of the uncertainty.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Lego Group, Politecnico di Milano
Authors: Quagliotti, D. (Intern), Baruffi, F. (Intern), Tosello, G. (Intern), Gasparin, S. (Ekstern), Annoni, M. (Ekstern), Parenti, P. (Ekstern), Sobiecki, R. (Intern), Hansen, H. N. (Intern)
Pages: 277-280
Publication date: 2016

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ISBN (Print): 978-981-11-0749-8
Main Research Area: Technical/natural sciences
Systematics, Systematic effects, Surface analysis, Topography, DOE
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10.3850/978-981-11-0749-8 738
Source: PublicationPreSubmission
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Corrosion behavior of construction materials for ionic liquid hydrogen compressor
The corrosion behavior of various commercially available stainless steels and nickel-based alloys as possible construction materials for components which are in direct contact with one of five different ionic liquids was evaluated. The ionic liquids, namely: 1-ethyl-3-methylimidazolium triflate, 1-ethyl-3-methylimidazolium bis (trifluoromethylsulfonyl) imide, trihexyltetradecylphosphonium bis (trifluoromethylsulfonyl) imide, butyltrimethylammonium bis (trifluoromethylsulfonyl) imide, methyltrioctylammonium bis (trifluoromethylsulfonyl) imide have been identified, as performance fluids in an ionic liquid hydrogen compressor. An electrochemical cell was specially designed, and steady-state cyclic voltammetry was used to measure the corrosion resistance of the alloys in the ionic liquids at 23 °C, under atmospheric pressure.

The results showed a very high corrosion resistance and high stability for all the alloys tested. The two stainless steels, AISI 316L and AISI 347 showed higher corrosion resistance compared to AISI 321 in all the ionic liquids tested. It was
observed that small addition of molybdenum, tantalum, and niobium to the alloys increased the corrosion stability in the ionic liquids studied. Hastelloy® C-276 showed the poorest corrosion resistance in all the ionic liquids tested. AISI 316L with high corrosion resistance and the lowest cost is recommended as the most attractive construction material for all the components, in an ionic liquid hydrogen compressor, which are in direct contact with ionic liquids used in this study.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Energy Conversion and Storage, Proton conductors
Authors: Arjomand Kermani, N. (Intern), Petrushina, I. (Intern), Nikiforov, A. V. (Intern), Jensen, J. O. (Intern), Rokni, M. (Intern)
Pages: 16688-16695
Publication date: 2016
Main Research Area: Technical/natural sciences

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- Web of Science (2018): Indexed yes
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- Scopus rating (2016): CiteScore 3.74 SJR 1.142 SNIP 1.286
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 1.294 SNIP 1.319 CiteScore 3.46
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 1.212 SNIP 1.494 CiteScore 3.54
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 1.278 SNIP 1.467 CiteScore 3.38
- 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
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.456 SNIP 1.837 CiteScore 4.42
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.589 SNIP 1.871
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.333 SNIP 1.885
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.401 SNIP 2.096
- Web of Science (2008): Indexed yes
- Scopus rating (2007): SJR 1.279 SNIP 2.201
- Web of Science (2007): Indexed yes
CO₂-mitigation options for the offshore oil and gas sector

The offshore extraction of oil and gas is an energy-intensive process leading to the production of CO₂ and methane, discharged into the atmosphere, and of chemicals, rejected into the sea. The taxation of these emissions, in Norway, has encouraged the development of more energy-efficient and environmentally-friendly solutions, of which three are assessed in this paper: (i) the implementation of waste heat recovery, (ii) the installation of a CO₂-capture unit and (iii) the platform electrification. A North Sea platform is taken as a case study, and these three options are modelled, analysed and compared, using thermodynamic, economic and environmental indicators. The results indicate the benefits of all these options, as the total CO₂-emissions can be reduced by more than 15% in all cases, while the avoidance costs vary widely and are highly sensitive to the natural gas price and CO₂-tax.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Ecole Polytechnique Federale de Lausanne (EPFL), International Research Institute of Stavanger
Authors: Nguyen, T. (Intern), Tock, L. (Ekstern), Breuhaus, P. (Ekstern), Maréchal, F. (Ekstern), Elmegaard, B. (Intern)
Pages: 673–694
Publication date: 2016
Main Research Area: Technical/natural sciences

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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
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Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.164 SNIP 3.377 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
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.

**Coupled Acoustic-Mechanical Bandgaps**

**General information**

State: Published

Organisations: Department of Electrical Engineering, Acoustic Technology, Department of Mechanical Engineering

Authors: Jensen, J. S. (Intern), Kook, J. (Intern)

Number of pages: 12

Publication date: 2016

Main Research Area: Technical/natural sciences
Crack Tip Flipping Under Mode I/III Tearing

Crack tip flipping, where the fracture surface alternates from side to side in 45° shear bands, seems to be an overlooked propagation mode in Mode I sheet tearing often disregarded as “transitional” or tied to randomness in the material. In fact, such observations rarely make it to the literature. However, crack tip flipping is a true propagation mode, but unlike those already established: i) it never settles in a steady-state as the near tip stress/strain field continuously change, and ii) the mechanism governing failure evolves behind the leading crack tip. Recent research has revealed new insight into this intriguing behavior of a crack propagating by the void nucleation and growth mechanism, and the work presented compiles both published and unpublished experimental and numerical findings. E.g. in a recent attempt to gain control of the flipping crack a slight Mode III was imposed with interesting results.

Creating Materials with Negative Refraction Index using Topology Optimization

We apply topology optimization along with full modeling of the electromagnetic (acoustic) field to create metamaterials with negative refraction index. We believe that our approach can be used in the design of metamaterials with specific effective permittivity and permeability e.g. by adapting the approach presented in [1]. We model the problem in 2D in the frequency domain using the Helmholtz equation and discretize the model using the hybrid WBM-FEM method [2]. We consider a modulated plane wave incident at an angle on a slab consisting of a periodic array of identical design cells whose size is on the order of the wavelength. We seek a distribution of solid and air in the design cell yielding a prescribed negative refraction index for the slab.
Our objective is to minimize the difference in amplitude between the solution to the model problem and a prescribed modulated plane wave behind the slab. The direction of propagation for the prescribed wave is chosen to match the angle of incidence of the incoming plane wave and its position is used to select the refraction index for the slab. We introduce a continuous design field and apply The Method of Moving Asymptotes to perform the optimization. A filter is used for regularization and a projection step applied to obtain clean 0/1 designs. A continuation scheme is used to avoid stagnation in the optimization. Metamaterials with negative refraction index designed using this method are presented. The angular dependence of the refraction index and of the reflection and transmission coefficients are investigated.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Solid Mechanics  
Authors: Christiansen, R. E. (Intern), Sigmund, O. (Intern)  
Number of pages: 1  
Publication date: 2016  
Event: Abstract from 11th World Congress of Structural and Multidisciplinary Optimization, Sydney, Australia.  
Main Research Area: Technical/natural sciences  
Electronic versions:  
RaElCh_Abstract_WCSMO_2015_1_.pdf  
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Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

**Creation of a microstructured polymer optical fiber with UV Bragg grating inscription for the detection of extensions at temperatures up to 125°C**

We describe the fabrication of a polycarbonate (PC) micro-structured polymer optical fiber (mPOF) and the writing offiber Bragg gratings (FBGs) in it to enable strain and temperature measurements. We demonstrate the photosensitivity ofa dopant-free PC fiber by grating inscription using a UV laser. We further show that PC Bragg gratings can be extendedup to at least 3% without affecting the initial functionality of the micro-structured fiber. The response of PC FBGs to temperature up to 125°C is also investigated. Polycarbonate has good mechanical properties and its high temperatureresistance might extend the range of application of polymeric FBGs.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation, Federal Institute for Materials Research and Testing  
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Stajanca, P. (Ekstern), Markos, C. (Intern), Stefani, A. (Intern), Nielsen, K. (Intern), Rasmussen, H. K. (Intern), Krebber, K. (Ekstern), Bang, O. (Intern)  
Number of pages: 6  
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Source: PublicationPreSubmission
CT crown for on-machine scale calibration in Computed Tomography

A novel artefact for on-machine calibration of the scale in 3D X-ray Computed Tomography (CT) is presented. The artefact comprises an invar disc on which several reference ruby spheres are positioned at different heights using carbon fibre rods. The artefact is positioned and scanned together with the workpiece inside the CT scanner producing a 3D reference system for the measurement. The artefact allows a considerable reduction of time by compressing the workflow of calibration, scanning, measurement, and re-calibration. Furthermore, the method allows a considerable reduction of the amount of data generated from CT scanning. A prototype was calibrated on a tactile CMM and its applicability in CT scanning demonstrated using a calibrated workpiece.

Current Solid Mechanics Research

About thirty years ago James Lighthill wrote an essay on “What is Mechanics?” With that he also included some examples of the applications of mechanics. While his emphasis was on fluid mechanics, his own research area, he also included examples from research activities in solid mechanics.

Damage modeling in Small Punch Test specimens

Ductile damage modeling within the Small Punch Test (SPT) is extensively investigated. The capabilities of the SPT to reliably estimate fracture and damage properties are thoroughly discussed and emphasis is placed on the use of notched specimens. First, different notch profiles are analyzed and constraint conditions quantified. The role of the notch shape is comprehensively examined from both triaxiality and notch fabrication perspectives. Afterwards, a methodology is presented to extract the micromechanical-based ductile damage parameters from the load-displacement curve of notched SPT.
samples. Furthermore, Gurson-Tvergaard-Needleman model predictions from a top-down approach are employed to gain insight into the mechanisms governing crack initiation and subsequent propagation in small punch experiments. An accurate assessment of micromechanical toughness parameters from the SPT is of tremendous relevance when little material is available.

**General information**

- **State:** Published
- **Organisations:** Department of Mechanical Engineering, Solid Mechanics, Universidad de Burgos, Universidad de Oviedo
- **Authors:** Martínez Pañeda, E. (Intern), Cuesta, I. (Ekstern), Periuelas, I. (Ekstern), Diaz, A. R. (Ekstern), Alegre, J. (Ekstern)
- **Pages:** 51–60
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- **Main Research Area:** Technical/natural sciences

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  - Scopus rating (2016): CiteScore 2.42 SJR 1.145 SNIP 1.416
  - Web of Science (2016): Indexed yes
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  - Scopus rating (2015): SJR 0.828 SNIP 1.463 CiteScore 2.05
  - BFI (2014): BFI-level 1
  - Scopus rating (2014): SJR 0.553 SNIP 1.415 CiteScore 1.42
  - BFI (2013): BFI-level 1
  - Scopus rating (2013): SJR 1.089 SNIP 1.503 CiteScore 1.61
  - BFI (2012): BFI-level 1
  - Scopus rating (2012): SJR 0.769 SNIP 1.294 CiteScore 1.25
  - BFI (2011): BFI-level 1
  - Scopus rating (2011): SJR 1.017 SNIP 1.642 CiteScore 1.4
  - BFI (2010): BFI-level 1
  - Scopus rating (2010): SJR 1.126 SNIP 1.448
  - BFI (2009): BFI-level 1
  - Scopus rating (2009): SJR 0.958 SNIP 1.224
  - BFI (2008): BFI-level 1
  - Scopus rating (2008): SJR 1.316 SNIP 1.544
  - Scopus rating (2007): SJR 1.013 SNIP 1.062
  - Scopus rating (2006): SJR 0.973 SNIP 1.378
  - Scopus rating (2005): SJR 1.217 SNIP 1.461
  - Scopus rating (2004): SJR 1.255 SNIP 1.495
  - Scopus rating (2003): SJR 1.457 SNIP 1.502
  - Scopus rating (2002): SJR 1.295 SNIP 0.803
  - Scopus rating (2001): SJR 0.831 SNIP 1.056
  - Scopus rating (2000): SJR 0.532 SNIP 0.734
  - Scopus rating (1999): SJR 1.054 SNIP 1.001
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- **Small Punch Test, Fracture toughness, Ductile damage, Finite element method**

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**Source:** FindIt
Damping characteristics of a footbridge: Mysteries and truths
As a consequence of a paper presented by Michael Mistler at the VDI-Baudynamik-Tagung in Kassel, Germany, in April 2015, the authors checked the damping coefficients having been estimated for a footbridge in autumn 2014. Mistler stated that the critical damping ratio estimated from a halfpower bandwidth procedure to be dependent on frequency resolution for low frequency modes. Based on the data presented here this statement can be confirmed. The dependency on frequency resolution was found to be due to the leakage phenomenon on the spectral density. This fact may have been known in the academic world but not in the world of engineers applying OMA in practice. In this paper it is presented how the leakage on the spectral density estimate is affecting the damping estimation through OMA based frequency domain identification. Finally the paper compares the damping estimated in the time and frequency domain from ambient tests, with the damping estimated from the free decays. Unfortunately, bias error on damping values determined from analyses in the frequency domain is worst on low frequency modes usually being the most important ones when dealing with a resonance problem in practice.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Civil Engineering, Section for Structural Engineering, Centre for oil and gas – DTU, RCI Dynamics
Authors: Cantieni, R. (Ekstern), Bajric, A. (Intern), Brincker, R. (Intern)
Pages: 283-292
Publication date: 2016

Damping of Torsional Beam Vibrations by Control of Warping Displacement
Supplemental damping of torsional beam vibrations is considered by viscous bimoments acting on the axial warping displacement at the beam supports. The concept is illustrated by solving the governing eigenvalue problem for various support configurations with the applied bimoments represented as viscous boundary conditions. It is demonstrated that properly calibrated viscous bimoments introduce a significant level of supplemental damping to the targeted vibration mode and that the attainable damping can be accurately estimated from the two undamped problems associated with vanishing and infinite viscous parameters, respectively.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Rambøll Danmark A/S
Authors: Høgsberg, J. B. (Intern), Hoffmeyer, D. (Intern), Ejlersen, C. (Ekstern)
Number of pages: 5
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Vibration and Acoustics
Data Acquisition for Quality Loss Function Modelling

Quality loss functions can be a valuable tool when assessing the impact of variation on product quality. Typically, the input for the quality loss function would be a measure of the varying product performance and the output would be a measure of quality. While the unit of the input is given by the product function in focus, the quality output can be measured and quantified in a number of ways. In this article a structured approach for acquiring stakeholder satisfaction data for use in quality loss function modelling is introduced.
Decomposition of no-clean solder flux systems and their effects on the corrosion reliability of electronics

No-clean flux systems are used today for the soldering of electronic printed circuit board assemblies assuming that all the aggressive substances of the flux will vanish during the soldering process i.e. evaporate, decompose or being enclosed safely in the residues. However this is not true in most cases, as the flux residue left on a printed circuit board assembly is a key factor compromising the corrosion reliability under humid conditions. This investigation focuses on the chemical degradation of three kinds of solder flux systems based on adipic, succinic, and glutaric acid as a function of temperature, thus simulating the soldering process. Differential Scanning Calorimetry, Fourier Transform Infrared Spectroscopy, and Ion Chromatography were employed for decomposition and residue analysis. Aggressiveness of the residue was investigated using a pH indicator gel test and by acid value determination. Effect on corrosion reliability was investigated by exposing the test printed circuit board assemblies to humidity after pre-contaminating with pure acids and desired solder flux systems and measuring the charge transferred between electrodes under applied potential bias. Results showed that the fluxes do not decompose fully within the temperature regime of the soldering process, leaving behind significant level of weak organic acid residues. The residue depending on the type and amount can be can be very aggressive towards the corrosion on the printed circuit board assemblies. The glutaric acid based flux showed highest leakage current when exposed to humidity compared to the adipic and succinic based fluxes.
Defining Interactions and Interfaces in Engineering Design

This PhD thesis focuses on the understanding and definition of interactions and interfaces during the architectural decomposition of complex, multi-technological products. The Interaction and Interface Framework developed in this PhD project contribute to the field of engineering design research.

Developing complex, multi-technological products involves the joint effort of multiple engineering disciplines in order to arrive at an end product, which satisfies its requirements. A major challenge is however the fact that bringing together engineers from different technical backgrounds means that they have different conceptual viewpoints on the product and use different 'technical languages' to communicate. Some terms like an interface, is used frequently in engineering however with no commonly declared meaning and is thus subject to much interpretation across engineering disciplines. It is well-known that most problems arise at the interfaces during product development, which is why there is a need for a rigorous and multi-disciplinary treatment of the concept of interfaces as well as interactions.

On the basis of a two-year case study at a medical device manufacturer, the role of interactions and interfaces in product family development has been investigated. The case study showed that for this particular case, interaction and interface descriptions represents the rationales needed to reuse documentation across multiple product variants. The interaction
and interface descriptions thus become documents of legal matter and must therefore be unambiguously and completely described.

Following this observation, a comprehensive and systematic literature review has been performed in order to investigate the definition and perception of an interface. The review resulted in a classification revealing 13 dominant perceptions of what an interface is from an academic perspective including the observation of an apparent confusion between the terms interaction and interface. In addition, a case example of a solenoid valve was examined in order to reason out the likely causes of problems occurring at interfaces. The case example showed that interfaces that reside at the boundary between engineering disciplines are vulnerable to misinterpretation and rework.

Based on this understanding, this thesis presents a first principles, physics–based Interaction and Interface Framework, which provides a ‘common language’ across any engineering discipline for describing and communicating about interactions and interfaces in engineering design. The framework contains classifications of three key terms; interaction, interaction mechanism, and interface. Due to the first principles, physics–based approach to deriving the framework, it has been possible to arrive at a classification of interaction mechanism, which is mutually exclusive (no overlap) and collectively exhaustive (no gaps). This contribution changes the existing paradigm of reasoning about interactions and allows for an unambiguous architectural decomposition of a product.

The framework further proposes an 8-step architecting approach explicitly articulating how to systematically apply the framework top-down thus enabling complete and unambiguous descriptions of interactions and interfaces throughout the system. A tool called an Interaction Specification Wheel (ISW) is introduced to support consistency in writing requirements and specifications. All of the contributions have been evaluated in an initial test, which indicated a positive effect on their ability to capture interactions and unambiguously specify them. Further research is needed to obtain statistical significance. Future research may investigate how to incorporate the framework into practice and further evaluate the high level effects. This will most likely require two or more case studies in real-life projects.

General information
State: Published
Organisations: Engineering Design and Product Development, Department of Mechanical Engineering, Department of Management Engineering, Management Science, Radiometer Medical ApS
Authors: Parslov, J. F. (Intern), Mortensen, N. H. (Intern), Hvam, L. (Intern), Bysted, T. (Ekstern)
Number of pages: 183
Publication date: 2016

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Publication: Research › Ph.D. thesis – Annual report year: 2016

Defining the challenges for ecodesign implementation in companies: development and consolidation of a framework
This study addresses the problem of the slow take-up of ecodesign in industry by identifying and categorising the implementation challenges faced by practitioners. Case studies from nine manufacturing companies from five different countries are reported based on interviews with key ecodesign personnel. A literature-derived framework is used to analyse each case, allowing for robust cross-case analysis. Challenges are identified in five areas: strategy, tools, collaboration, management and knowledge. The management category of challenges is the most frequently mentioned by the companies sampled. The tools category is not as prominent as might have been expected given the on-going focus on tool development within this field. The main contributions of the study are the updating of the main challenges for ecodesign implementation faced by industry, and the development of a rich framework of challenges, including new challenges not previously mentioned in the literature. It is suggested that the framework can be used (and evolved) by other ecodesign researchers when developing surveys or questions for in-depth case study interviews as this will facilitate more robust comparisons between studies and support the development of a more consolidated body of knowledge in this field.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Universite de Technologie de Troyes, University of Bath
DeRisk - Accurate prediction of ULS wave loads. Outlook and first results

Loads from extreme waves can be dimensioning for the substructures of offshore wind turbines. The DeRisk project (2015-2019) aims at an improved load evaluation procedure for extreme waves through application of advanced wave models, laboratory tests of load effects, development of hydrodynamic load models, aero-elastic response calculations and statistical analysis. This first paper from the project outlines the content and philosophy behind DeRisk. Next, the first results from laboratory tests with irregular waves are presented, including results for 2D and 3D focused wave groups. The results of focused wave group tests and a 6-hour (full scale duration) test are reproduced numerically by re-application of the wave paddle signal in a fully nonlinear potential flow wave model. A good match for the free surface elevation and associated exceedance probability curve is obtained. Finally, the utilization of DeRisk’s results in practical design is discussed. (C) 2016 Published by Elsevier Ltd.

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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.16 SJR 0.467 SNIP 0.586
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.365 SNIP 0.561 CiteScore 0.92
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.433 SNIP 0.81 CiteScore 1.09
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.425 SNIP 0.785 CiteScore 1.02
ISI indexed (2013): ISI indexed no
Web of Science (2013): Indexed yes
Scopus rating (2012): SJR 0.425 SNIP 0.563 CiteScore 1.08
ISI indexed (2012): ISI indexed no
Web of Science (2012): Indexed yes
Scopus rating (2011): SJR 0.918 SNIP 1.505 CiteScore 2.42
Derivation and analysis of the analytical velocity and vortex stretching expressions for an $O(N \log N)$-FMM

In the current paper, a method for deriving the analytical expressions for the velocity and vortex stretching terms as a function of the spherical multipole expansion approximation of the vector potential is presented. These terms are essential in the context of 3D Lagrangian vortex particle methods combined with fast summation techniques. The convergence and computational efficiency of this approach is assessed in the framework of an $O(N \log N)$-type Fast Multipole Method (FMM), by using vorticity particles to simulate a system of coaxial vortex rings for which also the exact results are known. It is found that the current implementation converges rapidly to the exact solution with increasing expansion order and acceptance factor. An investigation into the computational efficiency demonstrated that the $O(N \log N)$-type FMM is already viable for a particle size of only several thousands and that this speedup increases significantly with the number of particles. Finally, it is shown that the implementation of the FMM with the current analytical expressions is at least twice as fast as when opting for using even the simplest implementation of finite differences instead.
Design and Calibration of a Full Scale Active Magnetic Bearing Based Test Facility for Investigating Rotordynamic Properties of Turbomachinery Seals in Multiphase Flow

The recent move towards subsea oil and gas production brings about a requirement to locate process equipment in deepwater installations. Furthermore, there is a drive towards omitting well stream separation functionality, as this adds complexity and cost to the subsea installation. This in turn leads to technical challenges for the subsea installed pumps and compressors that are now required to handle multiphase flow of varying gas to liquid ratios. This highlights the necessity for a strong research focus on multiphase flow impact on rotordynamic properties and thereby operational stability of the subsea installed rotating machinery. It is well known that careful design of turbomachinery seals, such as interstage and balance piston seals, is pivotal for the performance of pumps and compressors. Consequently, the ability to predict the complex interaction between fluid dynamics and rotordynamics within these seals is key. Numerical tools offering predictive capabilities for turbomachinery seals in multiphase flow are currently being developed and refined, however the lack of experimental data for multiphase seals renders bench marking and validation impossible. To this end, the Technical University of Denmark and Lloyd’s Register Consulting are currently establishing a purpose built state of the art multiphase seal test facility, which is divided into three modules. Module I consists of a full scale Active Magnetic Bearing (AMB) based rotor dynamic test bench. The internally designed custom AMBs are equipped with an embedded Hall sensor system enabling high precision non-contact seal force quantification. Module II is a fully automated calibration facility for the Hall sensor based force quantification system. Module III consists of the test seal housing assembly. This paper provides details on the design of the novel test facility and the calibration of the Hall sensor system employed to measure AMB forces. Calibration and validation results are presented, along with an uncertainty analysis on the force quantification capabilities.
Design and optimization of flexible multi-generation systems

This thesis focuses on the design of flexible multi-generation systems, which are dynamic and integrated energy conversion systems characterized by the ability to adjust operation in response to fluctuating operating conditions. It is the hypothesis that these systems may support the balancing of variable renewable energy sources in a cost-effective way by linking the different sectors in the energy system with local energy supply systems.

A key challenge faced in the development of flexible multi-generation system is the knowledge gap between process design practices, which simplify energy system variations and dynamics, and energy system analysis, which fails to consider process integration synergies in local systems. The primary objective of the thesis is to derive a methodology for linking process design practices with energy system analysis for enabling coherent and holistic design optimization of flexible multi-generation systems.

A methodology is presented for optimizing the design of flexible multi-generation systems which considers: Selection, dimensioning, location and integration of processes; operation optimization with respect to both hourly variations in operating conditions as well as long term energy system development; biomass supply chains and local resource availability; combined with global sensitivity and uncertainty analysis. The methodology includes a novel method for aggregating external operating condition datasets, named the CHOP method. In addition, three case studies focusing on integrating biomass processing and energy conversion technologies in existing combined heat and power plants in Denmark are conducted using the developed methods.

The outcomes of this thesis indicate that the developed design methodology is efficient in screening for promising designs of flexible multi-generation systems. In addition, the case study results emphasize the importance of considering flexible operation, systematic process integration, and systematic assessment of uncertainties in the design optimization. It is recommended that future research focus on assessing system impacts from flexible multi-generation systems and performance improvements from storage options.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Management Engineering, Systems Analysis
Authors: Lythcke-Jørgensen, C. E. (Intern), Haglind, F. (Intern), Clausen, L. R. (Intern), Münster, M. (Intern)
Number of pages: 298
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Biomass conversion, Design optimization, Energy conversion, Flexible multi-generation, Operation optimization, Polygeneration, Process integration, Smart energy

Electronic versions:
S218_Christoffer_Ernst_Lytcke_Jrgensen.pdf

Relations
Projects:
Design and optimization of flexible multi-generation systems
Publication: Research › Ph.D. thesis – Annual report year: 2017
Design for Additive Manufacturing: Trends, opportunities, considerations, and constraints

The past few decades have seen substantial growth in Additive Manufacturing (AM) technologies. However, this growth has mainly been process-driven. The evolution of engineering design to take advantage of the possibilities afforded by AM and to manage the constraints associated with the technology has lagged behind. This paper presents the major opportunities, constraints, and economic considerations for Design for Additive Manufacturing. It explores issues related to design and redesign for direct and indirect AM production. It also highlights key industrial applications, outlines future challenges, and identifies promising directions for research and the exploitation of AM's full potential in industry.
Design for Biodegradability: the case of the Green Fiber Bottle

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: McAloone, T. C. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
Sustain Abstract P-3
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Designing for Color in Additive Manufacturing
In this paper we present a color design pipeline for 3D printed or additively manufactured parts. We demonstrate how to characterize and calibrate a commercial printer and how to obtain its forward and backward color transformation models. We present results from our assistive color design tool, allowing for colorimetric accurate prints and visualization of the printed outcome, prior to print. Lastly, we demonstrate our pipeline by accurately reproducing a real physical object.

General information
State: Published
Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Manufacturing Engineering
Pages: 98-102
Publication date: 2016

Host publication information
Title of host publication: Proceedings of the ASPE/euspen 2016 Summer Topical Meeting on Dimensional Accuracy and Surface Finish in Additive Manufacturing
Designing Meta Material Slabs Exhibiting Negative Refraction Using Topology Optimization

This paper proposes a topology optimization based approach for designing meta materials exhibiting a desired negative refraction with high transmission at a given angle of incidence and frequency. The approach considers a finite slab of meta material consisting of axis-symmetric designable unit cells subjected to an exterior field. The unit cell is designed to achieve the desired properties based on tailoring the response of the meta material slab under the exterior field. The approach is directly applicable to physical problems modeled by the Helmholtz equation, such as acoustic, elastic and electromagnetic wave problems. Acoustic meta materials with unit cell size on the order of half the wavelength are considered as examples. Optimized designs are presented and their performance under varying frequency and angle of incidence is investigated.
Design of advanced materials for linear and nonlinear dynamics
The primary catalyst of this PhD project has been an ambition to design advanced materials and structural systems including, and possibly even exploiting, nonlinear phenomena such as nonlinear modal interaction leading to energy conversion between modes. An important prerequisite for efficient design is accurate and somewhat simple analysis tools, as well as a fundamental understanding of the physical phenomena responsible for the relevant effects. The emphasis of this work lies primarily in the investigation of various advanced material models, developing the necessary analytical tools to reveal the fundamental dynamic characteristics and thus the relevant design parameters. The thesis is built around the characterization of two one-dimensional, periodic material systems. The first is a nonlinear mass-spring chain with periodically varying material properties, representing a simple but general model of inhomogeneous structural materials with nonlinear material characteristics. The second material system is an “engineered” material in the sense that a classical structural element, a linear elastic and homogeneous rod, is “enhanced” by applying a mechanism on its surface, amplifying the inertia of the system, thus creating a new “material” with improved properties for wave attenuation. Both materials are investigated by Floquet-Bloch analysis, a powerful tool for determining the dynamic material characteristics of periodic materials. An asymptotic approach is utilized for the direct application of the Floquet-Bloch analysis on the nonlinear chain. The wave-characteristics are determined, exploring the effect of nonlinear modal interaction on the band structure as well as the potential for energy conversion through higher harmonic generation. While modal interaction definitely affects the band structure, the potential for energy conversion appears to be limited. The material with amplified inertia however, shows great promise for low-frequency and broadband wave attenuation, requiring a significantly lower mass than what is needed in comparable systems to obtain a similar effect. This is demonstrated both analytically, numerically and experimentally. This makes the material a strong candidate for mechanical filtering for sound and vibration isolation purposes, not least for systems with varying natural frequencies such as nonlinear structures or structures with variable mass due to, e.g., human loading.
Design of Bolted L-Flanged Connections
In wind turbine towers the preferred design is circular tubes that are connected to each other by a bolted flange joint. The design is typically that of an L-flange resulting in an eccentrically loaded bolted connection. The eccentricity results in a non-linear relationship between external load on the tower and the tensile force in the bolt. In the literature and also in design standards different models are presented for this important non-linear response. The present work presents a simplified expression for the non-linear force response based on finite element calculations using contact analysis. Secondly, focus is on simple modifications of the flange design that considerably improves the strength of the connection.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, N. L. (Intern)
Number of pages: 4
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

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Volume: 140
Issue number: 5
ISSN (Print): 0001-4966
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BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Design of serially connected ammonia-water hybrid absorption-compression heat pumps for district heating with the utilisation of a geothermal heat source

District heating (DH) can reduce the primary energy consumption in urban areas with significant heat demands. The design of a serially connected ammonia-water hybrid absorption-compression heat pump system was investigated for operation in the Greater Copenhagen DH network in Denmark, in order to supply 7.2 MW heat at 85 °C utilizing a geothermal heat source at 73 °C. Both the heat source and heat sink experience a large temperature change over the heat transfer process, of which a significant part may be achieved by direct heat exchange. First a generic study with a simple representation of the heat pump was used to investigate optimal system configurations. It was shown that using two heat pumps in series with direct heat exchange in parallel with the first heat pump could increase the performance compared to a base case using direct heat exchange and a single heat pump, under the assumption that the exergetic efficiencies of the heat pumps are similar. Next, ammonia-water hybrid absorption-compression heat pumps were selected as heat pump technology, since these may increase the performance due the non-isothermal phase change. Detailed thermodynamic models predict that an exergetic efficiency of the system of 0.5 to 0.65 is possible. The technical feasibility as well as the economic viability of this installation was investigated for a range of preferred solutions. The analysis recommends a heat pump configuration with an exergetic efficiency of 0.63 which was within 2 % of the theoretical economic optimum.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Jensen, J. K. (Intern), Ommen, T. S. (Intern), Markussen, W. B. (Intern), Elmegaard, B. (Intern)
Number of pages: 19
Publication date: 2016

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Main Research Area: Technical/natural sciences
Conference: 29th International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems, Portorož, Slovenia, 19/06/2016 - 19/06/2016
Heat pump, District heating, Hybrid absorption-compression, Technical constraints
Electronic versions:
P599_Design_of_serially_connected_ammonia_water_hybrid_absorption_compression_heat_pumps_for_district_heating_with_the_utilisation_of_a_geothermal_heat_source.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2017

Detection of fungal growth and its influence on gypsum wallboard – in the process of creating sustainable building materials

General information
State: Published
Organisations: Department of Systems Biology, Fungal Degradation, Department of Civil Engineering, Section for Indoor Climate and Building Physics, Department of Mechanical Engineering, Materials and Surface Engineering, Eukaryotic Molecular Cell Biology, University of Sydney, Aarhus University, Aalborg University
Authors: Lewinska, A. M. (Intern), Lilje, O. (Ekstern), Foley, M. (Ekstern), Trimby, P. (Ekstern), Bjerring, M. (Ekstern), Vosegaard, T. (Forskerdatabase), Peuhkuri, R. H. (Forskerdatabase), Rode, C. (Intern), Grumsen, F. B. (Intern), Hoof, J. B. (Intern), Anderson, B. (Intern)
Number of pages: 1
Publication date: 2016
Main Research Area: Technical/natural sciences
Links:
http://www.sustain.dtu.dk/

Bibliographical note
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Determination of Lubricant Bulk Modulus in Metal Forming by Means of a Simple Laboratory Test and Inverse FEM Analysis
The influence of workpiece surface topography on friction, lubrication and final surface equality in metal forming operations is well known and has been pointed out by many researchers. This is especially the case when liquid lubricants are applied in situations, where increased surface roughness facilitates the lubricant entrainment, pressurization and possible escape by micro-plasto-hydrodynamic lubrication. In order to model these mechanisms an important lubricant property designated as the bulk modulus is needed for characterizing the compressibility of the lubricant. The present paper describes a simple, practical test to determine the bulk modulus. Combination of the experimental upsetting of an axisymmetric metal workpiece containing a truncated conical surface pocket with an inverse finite element analysis of the test allows determining the lubricant bulk modulus. The finite element analysis couples lubricant flow with plastic deformation of the metal directly. Results show that the proposed procedure allows determining an approximate bulk modulus for the lubricant.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Instituto Superior Técnico
Authors: Hafis, S. M. (Intern), Christiansen, P. (Intern), Martins, P. A. F. (Ekstern), Bay, N. (Intern)
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Conference: 7th International Conference on Tribology in Manufacturing Processes (ICTMP 2016), Phuket, Thailand, 28/02/2016 - 28/02/2016
Metal forming, Lubricant, Bulk modulus
Source: PublicationPreSubmission
Source-ID: 122276009
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Determination of stamp deformation during imprinting on semi-spherical surfaces
We developed a process for double curved injection molding inserts presenting nanostructured surfaces. Line gratings with a line width and spacing of 500 nm as well as arrays of pillars, both up to an aspect ratio of unity, have been successfully transferred onto steel mold surfaces. A thin film of sol-gel was applied onto spherical injection mold inserts and subsequently imprinting using a flexible stamp. A hard curing step transformed the sol-gel into a quartz-like and durable material.

As an example, we present theory and results regarding the imprint of pillar nanostructures on semi-spherical mold surfaces. Imprints were realized on three different radii of circumference of the spherical mold: R = 0.5 mm, R = 1.0 mm, and R = 2 mm. After hard-curing of the imprinted sol-gel, the inserts were used for cold-mold as well as vario-therm injection molding. The polymer replicas and the inserts were characterized by analyzing the center-to-center distance of the pillars at several points across the spheres. From the measurements and the observed deviation of the distance of pillars, the stamp deformation was calculated. Finally, the experimentally determined deformation of the flexible stamp was compared with predictions provided by a geometrical model [1]. Simulated and experimental observations were in good accordance.

Future work will include the application of current results to design nanostructured patterns for which the stamp deformation will be compensated to achieve more reliable surface characteristics.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, InMold Biosystems A/S, Nanyang Technological University
Authors: Kafka, J. (Ekstern), Matschuk, M. (Ekstern), Pranov, H. (Ekstern), Kofod, G. (Ekstern), Taboryski, R. J. (Intern), Sonne, M. R. (Intern), Lam, Y. C. (Ekstern)
Number of pages: 1
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Main Research Area: Technical/natural sciences
Electronic versions: kafka_NNT2016.pdf
Source: PublicationPreSubmission
Source-ID: 126680103
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Development of a Simplified Process Integration Methodology for application in Medium-Size Industries
Achieving significant energy savings is fundamental for reaching the ambitious EU 20-20-20 environmental targets. Several methodologies based on the Pinch concept have proved to be highly effective for identifying and assessing
energy savings possibilities in the industrial sector. However, saving opportunities may be missed in the case of medium-size industries. Applying these methods may indeed be costly and time consuming, as it can require large engineering efforts, e.g., for data acquisition. This paper presents a methodology based on process integration techniques, termed “Specific Savings Potential method” (SSP), to depict and promote energy savings in intermediate-size industries for plant retrofit. It builds on the idea that only few of the process streams in a factory should be considered for efficiency measures implementation with regards to economic and operational aspects. Three screening tools are introduced. They are used to reduce the problem size before applying the traditional design procedure. They are based on engineering experience and simple mathematical criteria, including both thermodynamic and economic considerations. Moreover, possibility of using less accurate data or estimates is discussed, since data acquisition is a severely time-consuming task in retrofit projects. This novel methodology is applied to a Danish dairy factory: the results and the method itself are compared with conventional pinch analysis. The findings show that the SSP method is a tool able to simplify and shorten the conventional pinch technique, while depicting the most promising savings opportunities: in the case study a reduction in energy use of 24% is achieved when only considering 24 process streams out of 62. In this sense, it has the potential of promoting the application of PI tools in the industry, especially in medium-size industries where budgets for external consultants are generally low.

General information
State: Published
Organisations: Department of Management Engineering, Department of Mechanical Engineering, Thermal Energy
Authors: Bergamini, R. (Intern), Nguyen, T. (Intern), Bühler, F. (Intern), Elmegaard, B. (Intern), Elmegaard, B. (Intern)
Number of pages: 13
Publication date: 2016

Development of multi-component diesel surrogate fuel models – Part II: Validation of the integrated mechanisms in 0-D kinetic and 2-D CFD spray combustion simulations

The aim of this study is to develop compact yet comprehensive multi-component diesel surrogate fuel models for computational fluid dynamics (CFD) spray combustion modelling studies. The fuel constituent reduced mechanisms including n-hexadecane (HxN), 2,2,4,4,6,8,8-heptamethylnonane (HMN), cyclohexane(CHX) and toluene developed in Part I are applied in this work. They are combined to produce two different versions of multi-component diesel surrogate models in the form of MCDS1 (HxN + HMN) and MCDS2 (HxN + HMN + toluene + CHX). The integrated mechanisms are then comprehensively validated in zero-dimensional chemical kinetic simulations under a wide range of shock tube and jet-stirred reactor conditions. Subsequently, the fidelity of the surrogate models is further evaluated in two-dimensional CFD spray combustion simulations. Simulation results show that ignition delay (ID) prediction corresponds well to the change of fuel constituent mass fraction which is calculated to match the cetane number (CN). In addition, comparisons of the simulation results to the experimental data of #2 diesel fuel (D2) in a constant volume combustion chamber show that IDs and lift-off lengths are reasonably well replicated by the models. The MCDS2 model is also found to perform better in the soot formation prediction in D2 fuel combustion as the model contains aromatic and cyclo-alkane components which provide an additional pathway to the formation of rich species such as C2H2 and C6H6. Implementation of MCDS2 predicts an increase of maximum local soot volume fraction by a factor of 2.1 when the ambient temperature increases from 900 K to 1000 K, while the prediction by MCDS1 is lower at 1.6. This trend qualitatively agrees with the experimental observation. This work demonstrates that MCDS1 serves as a potential surrogate fuel model for diesel fuels with CN values ranging from 15 to 100. It also shows that MCDS2 is a more appropriate surrogate model for fuels with aromatics and cyclo-paraffinic contents, particularly when soot calculation is of main interest.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, University of Nottingham, Malaysia Campus
Authors: Poon, H. M. (Ekstern), Pang, K. M. (Intern), Ng, H. K. (Ekstern), Gan, S. (Ekstern), Schramm, J. (Intern)
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Publication date: 2016
Main Research Area: Technical/natural sciences

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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.9 SJR 1.744 SNIP 2.179
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.809 SNIP 2.125 CiteScore 4.46
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.667 SNIP 2.331 CiteScore 4.14
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.811 SNIP 2.595 CiteScore 4.31
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.852 SNIP 2.465 CiteScore 3.99
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.093 SNIP 2.427 CiteScore 4.1
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.984 SNIP 2.319
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.012 SNIP 2.277
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.635 SNIP 2.184
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.383 SNIP 1.86
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.278 SNIP 1.64
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.623 SNIP 1.73
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.273 SNIP 1.883
Scopus rating (2003): SJR 1.103 SNIP 1.481
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.13 SNIP 1.301
Scopus rating (2001): SJR 1.136 SNIP 1.264
Scopus rating (2000): SJR 1.047 SNIP 1.272
Web of Science (2000): Indexed yes
Development of multi-component diesel surrogate fuel models – Part I: Validation of reduced mechanisms of diesel fuel constituents in 0-D kinetic simulations

In the present work, development and validation of reduced chemical kinetic mechanisms for several different hydrocarbons are performed. These hydrocarbons are potential representative for practical diesel fuel constituents. n-Hexadecane (HXN), 2,2,4,4,6,8,8-heptamethylnonane (HMN), cyclohexane (CHX) and toluene are selected to represent straight-alkane, branched-alkane, cyclo-alkane and aromatic compounds in the diesel fuel. A five-stage chemical kinetic mechanism reduction scheme formulated in the previous work is applied to develop the reduced HMN and CHX models based on their respective detailed mechanisms. Alongside with the development of the reduced CHX model, a skeletal toluene sub-mechanism is constructed since the elementary reactions for toluene are subset of the detailed CHX mechanism. The final reduced HMN mechanism comprises 89 species with 319 elementary reactions, while the final reduced CHX mechanism which includes the toluene sub-mechanism consists of 80 species with 287 elementary reactions. Both reduced models are approximately 92% smaller than their respective detailed models in terms of total number of species and elementary reactions. Following that, both the newly developed fuel constituent reduced mechanisms, together with the formerly derived reduced HXN mechanism are comprehensively validated in zero-dimensional chemical kinetic simulations under a wide range of shock tube and jet-stirred reactor (JSR) conditions. Well agreement between the reduced and detailed mechanisms is achieved for ignition delay (ID) and species concentration predictions under both auto-ignition and JSR conditions, with a maximum relative error of 40%. In addition, the reduced models are further validated against the JSR experimental results for each diesel fuel constituents. The surrogate models are able to reasonably reproduce the experimental species concentration profiles in view of their simplified fuel chemistries. Deviations within one order of magnitude in the absolute values are recorded between the computations and measurements. Validation of these reduced models for each diesel fuel constituents in this work serves as a prerequisite for constructing a multicomponent diesel surrogate fuel model. The compact yet accurate chemical models proposed here aid to reduce the chemistry size of the final multi-component diesel surrogate model such that it remains computationally efficient when it is incorporated with multi-dimensional CFD simulations. The reduced mechanism of each fuel constituent can also be used individually for other CFD applications.
The aim of this paper is the understanding of the fiber orientation by investigations in respect to the inner configuration of a polylactic acid matrix reinforced with short carbon fibers after a fused deposition modeling extrusion process. The final parts were analyzed by X-ray, tomography, and magnetic resonance imaging allowing a resolved orientation of the fibers and distribution within the part. The research contributes to the understanding of the fiber orientation and fiber reinforcement of fused deposition modeling parts in additive manufacturing.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Vienna, Vienna University of Technology, University Hospital St. Pölten
Authors: Hofstätter, T. (Intern), W. Gutmann, I. (Ekstern), Koch, T. (Ekstern), Pedersen, D. B. (Intern), Tosello, G. (Intern), Heinz, G. (Ekstern), Hansen, H. N. (Intern)
Number of pages: 6
Drying of a tape-cast layer: Numerical modelling of the evaporation process in a graded/layered material

Evaporation of water from a ceramic layer is a key phenomenon in the drying process for the manufacturing of water-based tape cast ceramics. In this paper we present a coupled free-flow-porous-media model on the Representative Elementary Volume (REV) scale for coupling non-isothermal multi-phase compositional porous-media flow — for the ceramic layer — and single-phase compositional laminar free flow — for the air above it. The preliminary results show the typical expected evaporation behaviour from a porous medium initially saturated with water, and water–vapour transport to the free-flow region in accordance with the available results from the literature. We elaborate on and discuss the characteristic drying-rate curve for a single layer ceramic, and compare it with that of a graded/layered ceramic. We, moreover, show the influence of the mean diameter of particles of the porous medium (dp) — which directly affects the intrinsic permeability (K) based on the well-known Ergun’s equation — of each single ceramic layer on the drying behaviour of a graded/layered ceramic.
Ductile failure modeling

Ductile fracture of structural metals occurs mainly by the nucleation, growth and coalescence of voids. Here an overview of continuum models for this type of failure is given. The most widely used current framework is described and its limitations discussed. Much work has focused on extending void growth models to account for non-spherical initial void shapes and for shape changes during growth. This includes cases of very low stress triaxiality, where the voids can close up to micro-cracks during the failure process. The void growth models have also been extended to consider the effect of plastic anisotropy, or the influence of nonlocal effects that bring a material size scale into the models. Often the voids are not present in the material from the beginning, and realistic nucleation models are important. The final failure process by coalescence of neighboring voids is an issue that has been given much attention recently. At ductile fracture, localization of plastic flow is often important, leading to failure by a void-sheet mechanism. Various applications are presented to illustrate the models, including welded specimens, shear tests on butterfly specimens, and analyses of crack growth.
**Dynamic Length Metrology (DLM) for measurements with sub-micrometre uncertainty in a production environment**

Conventional length metrology for traceable accurate measurements requires costly temperature controlled facilities, long waiting time for part acclimatisation, and separate part material characterisation. This work describes a method called Dynamic Length Metrology (DLM) developed to achieve sub-micrometre accuracy on metal parts, or micrometre accuracy on polymer parts, directly in a production environment. The method consists in the simultaneous measurement of all quantities affecting dimensions of a part over time (dynamically), involving a number of sensors and reference artefacts, followed by mathematical or numerical modelling of the thermo-mechanical effects. It is hereby possible concurrently to predict condition-specific material properties as well as part dimensions at any point, time, temperature, humidity, etc. Knowing all systematic errors and influencing factors, and their combined effect, on a given length, it is possible to calculate the corrected length at 20°C, zero measuring force, etc. An estimation of the measurement uncertainty U can be obtained following the guidelines of the GUM, dimensional values and their uncertainties being the final result of the analysis. Preliminary investigations have indicated that the approach is viable, either using analytical modelling or FEM. An expanded uncertainty (k=2) lower than 0.4 μm was achieved using a steel gauge block as workpiece.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: De Chiffre, L. (Intern), Hansen, H. N. (Intern), Hattel, J. H. (Intern), Madruga, D. G. (Intern), Dalla Costa, G. (Intern), Sonne, M. R. (Intern), Mohammadi, A. (Intern)
Number of pages: 2
Publication date: 2016

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Main Research Area: Technical/natural sciences
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Metrology, Low uncertainty, Production environment
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

**Dynamic Modeling of Pavements with Application to Deflection Measurements**

Pavement surface deflection measurements are the primary means of evaluating the bearing capacity of a pavement. The most common type of device used for measuring pavement surface deflections is the Falling Weight Deflectometer (FWD). However, increasing attention has been given to the Rolling Wheel Deflectometer (RWD) type of device due to its ability to measure deflections continuously while driving at traffic speed. To be able to properly interpret deflection measurements from an RWD device, more knowledge about the structural behavior of a pavement when subjected to transient dynamic loads moving with different speeds is needed.

In this thesis a new Finite Element formulation for transient dynamic loading of a layered half space is developed. Equations are derived in 2D and 3D and include efficient absorbing boundary conditions in the form of the Perfectly Matched Layer (PML) which ensures capability of long time simulations without disruptions from the boundaries. The equations are formulated in a moving frame of reference such that the domain is following the load, which ensures that the size of the model is kept small regardless of simulation time frame. A parametric study for finding optimal PML parameters is conducted [P1]. The efficiency of the PML formulation is tested in a half space and in a layered halfspace. The effect of load speed is investigated as well as the influence of modulus ratio between surface layer and the underlying soil for different load speeds. Wave propagation is illustrated for various load speeds in both 2D and 3D. The differences in response magnitude and attenuation rate of 2D and 3D waves are illustrated as well.

The model is applied for backcalculation of mechanical properties from FWD experiments with load-time histories of various pulse durations and load magnitudes [P2]. For this purpose, a method for backcalculation of layer moduli and damping as well as geometric nonlinearity in the subgrade is developed.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Madsen, S. S. (Intern), Pedersen, N. L. (Intern)
Number of pages: 148
Publication date: 2016

**Publication information**

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Original language: English
Series: DCAMM Special Report
Number: S210
ISSN: 0903-1685
Dynamic performance of a novel offshore power system integrated with a wind farm

Offshore wind technology is rapidly developing and a wind farm can be integrated with offshore power stations. This paper considers as case study a futuristic platform powered by a wind farm and three combined cycle units consisting of a gas turbine and an ORC (organic Rankine cycle) module. The first aim of this paper is to identify the maximum amount of wind power that can be integrated into the system, without compromising the electric grid balance. The stability of the grid is tested using a dynamic model of the power system based on first principles. Additionally, the dynamics of the system is compared with a simplified plant consisting of three gas turbines and a wind farm, in order to identify benefits of the installation of the ORC system. The maximum allowable wind power is 10 MW for a nominal platform load of 30 MW. The results show that the presence of the ORC system allows decreasing frequency oscillations and fuel consumptions of the platform, with respect to the simplified configuration. On the other hand, the dynamic response of the combined cycle units is slower due to the thermal inertia of the heat transfer equipment.
Economic benefits of metrology in manufacturing

In streamlined manufacturing systems, the added value of inspection activities is often questioned, and metrology in particular is sometimes considered only as an avoidable expense. Documented quantification of economic benefits of metrology is generally not available. This work presents concrete examples from industrial production, in which the added value of metrology in manufacturing is discussed and quantified. Case studies include: general manufacturing, forging, machining, and related metrology. The focus of the paper is on the improved effectiveness of metrology when used at product and process design stages, as well as on the improved accuracy and efficiency of manufacturing through better measuring equipment and process chains with integrated metrology for process control.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Padua, Metrologic ApS
Authors: Savio, E. (Ekstern), De Chiffre, L. (Intern), Carmignato, S. (Ekstern), Meinertz, J. (Ekstern)
Pages: 495-498
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: C I R P Annals
Volume: 65
Issue number: 1
ISSN (Print): 0007-8506
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Editorial
After 12 years of distinguished service, Kaushik Bhattacharya has decided to step down as co-editor of the Journal of the Mechanics and Physics of Solids. A new editorial team, with Huajian Gao as editor and Basile Audoly, Pedro Ponte Castañeda, Ellen Kuhl, Christian Niordson and Pradeep Sharma as Associate Editors, will take over as of January 1, 2016. We would like to express the immense gratitude of our community to Kaushik for his effective and visionary guidance of the Journal during the past 12 years. He oversaw a period of major growth in the number of submissions and a revamping of the editorial board for the Journal. He wisely steered the Journal through a rapidly evolving research landscape with his personal dedication, fairness, scientific judgment and open-mindedness. While being an editor of JMPS, he maintained a prolific research activity and also took on significant leadership challenges at Caltech. We fully anticipate that Kaushik will continue to contribute to the journal, both as a researcher and as a senior editorial advisor.

With the new editorial structure, we are aiming to handle more effectively the increasing number of submissions and to minimize the review time, while maintaining the high standards of the Journal and continuing with the same simple goal to disseminate research of the highest quality in the Mechanics and Physics of Solids.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Ecole Polytechnique, University of Pennsylvania, Stanford University, University of Houston, Brown University
Authors: Audoly, B. (Ekstern), Castañeda, P. P. (Ekstern), Kuhl, E. (Ekstern), Niordson, C. (Intern), Sharma, P. (Ekstern), Gao, H. (Ekstern)
Pages: iii
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Journal of the Mechanics and Physics of Solids
Volume: 87
ISSN (Print): 0022-5096
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 4.33 SJR 2.155 SNIP 2.048
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.439 SNIP 2.157 CiteScore 4.29
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.677 SNIP 2.304 CiteScore 4.7
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 2.597 SNIP 2.304 CiteScore 4.43
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.284 SNIP 2.08 CiteScore 3.5
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.865 SNIP 2.267 CiteScore 3.6
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 3.34 SNIP 2.474
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Effect of delta wing on the particle flow in a novel gas supersonic separator

The present work presents numerical simulations of the complex particle motion in a supersonic separator with a delta wing located in the supersonic flow. The effect of the delta wing on the strong swirling flow is analysed using the Discrete Particle Method. The results show that the delta wings re-compress the upstream flow and the gas Mach number decreases correspondingly. However, the Mach number does not vary significantly from the small, medium and large delta wing configurations. The small delta wing generates a swirl near its surface, but has minor influences on the flow above it. On the contrary, the use of the large delta wing produces a strong swirling flow in the whole downstream region. For the large delta wing, the collection efficiency reaches 70% with 2 μm particles, indicating a good separation performance of the proposed supersonic separator.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, Changzhou University, CSIRO
Authors: Wen, C. (Intern), Yang, Y. (Ekstern), Walther, J. H. (Intern), Pang, K. M. (Intern), Feng, Y. (Ekstern)
Pages: 261-267
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: Powder Technology
Volume: 304
ISSN (Print): 0032-5910
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.16 SJR 0.983 SNIP 1.482
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Effect of Fe ion concentration on corrosion of carbon steel in CO2 environment

In this work, the corrosion behaviour of steel wires in solutions containing different concentrations of Fe2+ was investigated by the linear polarisation resistance method, while the evolution of pH was monitored in situ and changes of the Fe2+ concentration were monitored ex situ. Characterisation of the corrosion scales was performed using microscopic and diffraction techniques. Scale analysis revealed that the passivation of samples, exposed to initially highly Fe2+ supersaturated solution, occurred when a formation of a double layer took place, resulting in 30 times lower corrosion rate compared to samples tested in solutions without initial Fe2+.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Oilwell Varco Denmark I/S
Effect of Fe ion concentration on fatigue life of carbon steel in aqueous CO2 environment

In this work, the corrosion fatigue behaviour of steel armours used in the flexible pipes, in aqueous solutions initially containing different concentrations of Fe2+, was investigated by four-point bending testing under saturated 1 bar CO2 condition. Corrosion fatigue results were supported with ex situ measurements of Fe2+ and pH. Characterisation of the corrosion scales and crack formations was performed using microscopic and diffraction techniques. Fatigue results showed two times better fatigue life, at the stress range of 250 MPa, for samples tested in solutions containing the concentration of Fe2+ marginally above the solubility limit of FeCO3 compared to the samples tested in highly supersaturated solution of Fe2+. Results revealed that the impact of the alternating stresses on the corrosion behaviour of samples reduces with lowering the applied stresses. At the stress range of 100 MPa, fatigue samples experienced the same corrosion rate as samples that were not subjected to dynamic loading.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, National Oilwell Varco Denmark I/S
Authors: Rogowska, M. (Ekstern), Gudme, J. (Ekstern), Rubin, A. (Ekstern), Pantleon, K. (Intern), Ambat, R. (Intern)
Pages: 90-103
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Corrosion Engineering, Science and Technology
Volume: 51
Issue number: 2
ISSN (Print): 1478-422X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.86 SJR 0.382 SNIP 0.588
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.345 SNIP 0.673 CiteScore 0.92
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.38 SNIP 0.885 CiteScore 0.89
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.335 SNIP 0.608 CiteScore 0.62
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.284 SNIP 0.642 CiteScore 0.62
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.411 SNIP 1.058 CiteScore 0.72
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.333 SNIP 0.63
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.396 SNIP 0.786
Web of Science (2009): Indexed yes
Effect of Geometry In Frequency Response Modeling of Nanomechanical Resonators

The trend towards nanomechanical resonator sensors with increasing sensitivity raises the need to address challenges encountered in the modeling of their mechanical behavior. Selecting the best approach in mechanical response modeling amongst the various potential computational solid mechanics methods is subject to controversy. A guideline for the selection of the appropriate approach for a specific set of geometry and mechanical properties is needed. In this study, geometricallimitations in frequency response modeling of flexural nanomechanical resonators are investigated. Deviation of Euler and Timoshenko beam theories from numerical techniques including finite element modeling and Surface Cauchy-Born technique are studied. The results provide a limit beyond which surface energy contribution dominates the mechanical behavior. Using the Surface Cauchy-Born technique as the reference, a maximum error on the order of 50 % is reported for high-aspect ratio resonators.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Koc University
Authors: Esfahania, M. N. (Ekstern), Yilmaz, M. (Ekstern), Sonne, M. R. (Intern), Hattel, J. H. (Intern), Alaca, B. E. (Ekstern)
Number of pages: 4
Publication date: 2016
Main Research Area: Technical/natural sciences

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Journal: AIP Conference Proceedings
Volume: 1738
Article number: 030044
ISSN (Print): 0094-243X
Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.21 SJR 0.163 SNIP 0.236
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.179 SNIP 0.217 CiteScore 0.18
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.165 SNIP 0.191 CiteScore 0.17
Effect of Grain Boundary Character Distribution on the Impact Toughness of 410NiMo Weld Metal

Grain boundary character distributions in 410NiMo weld metal were studied in the as-welded, first-stage, and second-stage postweld heat treatment (PWHT) conditions, and these were correlated with the Charpy-V impact toughness values of the material. The high impact toughness values in the weld metal in the as-welded and first-stage PWHT conditions compared to that in the second-stage condition are attributed to the higher fraction of low-energy I pound boundaries. A higher volume fraction of retained austenite and coarser martensite after second-stage PWHT accompanied by the formation of the ideal cube component in the 2-hour heat-treated specimen led to a reduction in the toughness value. A subsequent increase in the PWHT duration at 873 K (600 A degrees C) enhanced the formation of (111)α0ε (c) 112 >, which impedes the adverse effect of the cubic component, resulting in an increase in the impact toughness. In addition to this, grain refinement during 4-hour PWHT in the second stage also increased the toughness of the weld metal.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Indira Gandhi Centre for Atomic Research, National Metallurgical Laboratory
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Journal: Metallurgical and Materials Transactions A - Physical Metallurgy and Materials Science
Volume: 47A
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.91 SJR 1.179 SNIP 1.179
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.231 SNIP 1.332 CiteScore 1.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.671 SNIP 1.877 CiteScore 2.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.481 SNIP 1.63 CiteScore 1.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.419 SNIP 1.706 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.508 SNIP 1.703 CiteScore 1.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.688 SNIP 1.802
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.608 SNIP 1.53
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.505 SNIP 1.536
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.314 SNIP 1.544
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.397 SNIP 1.653
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.183 SNIP 1.414
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.078 SNIP 1.607
Scopus rating (2002): SJR 2.057 SNIP 1.992
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.878 SNIP 1.784
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.844 SNIP 1.809
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.028 SNIP 1.905
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Effect of meniscus contact angle during early regimes of spontaneous capillarity in nanochannels

In capillary imbibition, the classical Lucas-Washburn equation predicts a singularity as the fluid enters the channel consisting in an anomalous infinite velocity of the capillary meniscus. The Bosanquets equation overcomes this problem by taking into account fluid inertia predicting an initial imbibition regime with constant velocity. Nevertheless, the initial constant velocity predicted by Bosanquet's equation is much greater than experimentally observed. In the present study, we conduct atomistic simulations to investigate capillary imbibition of water in silica nanochannels with heights between 4 and 18 nm. We also find that the meniscus contact angle remains constant during the inertial regime and its value depends upon the height of the channel. We also find that the meniscus velocity computed at the channel entrance is related to the particular value of the meniscus contact angle. Moreover, after the inertial regime, the meniscus contact angle is found to be time dependent for all the channels under study. We propose an expression for the time evolution of the dynamic contact angle in nanochannels which, when incorporated in Bosanquet's equation, satisfactorily explains the initial capillary rise.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
Authors: Karna, N. (Ekstern), Oyarzua, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. (Ekstern)
Number of pages: 1
Publication date: 2016

Effect of Micro Electrical Discharge Machining Process Conditions on Tool Wear Characteristics: Results of an Analytic Study

Micro electrical discharge machining is one of the established techniques to manufacture high aspect ratio features on electrically conductive materials. This paper presents the results and inferences of an analytical study for estimating the effect of process conditions on tool electrode wear characteristic in micro-EDM process. A new approach with two novel factors anticipated to directly control the material removal mechanism from the tool electrode are proposed; using discharge energy factor (DEf) and dielectric flushing factor (DFf). The results showed that the correlation between the tool wear rate (TWR) and the factors is poor. Thus, individual effects of each factor on TWR are analyzed. The factors selected for the study of individual effects are pulse on-time, discharge peak current, gap voltage and gap flushing pressure. The tool wear rate decreases linearly with an increase in the pulse on-time. A maximum increase of 28.57% has been observed between peak current of 1 and 1.5 A. TWR decreases with an increase in pressure by 19.6%.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, College of Engineering Thalassery
Authors: Puthumana, G. (Intern), P., R. (Ekstern)
Number of pages: 5
Publication date: 2016
Effect of Plastic Pre-straining on Residual Stress and Composition Profiles in Low-Temperature Surface-Hardened Austenitic Stainless Steel

The present work deals with the evaluation of the residual stress profiles in expanded austenite by applying grazing incidence X-ray diffraction (GI-XRD) combined with successive sublayer removal. Annealed and deformed ($\varepsilon_{eq}=0.5$) samples of stable stainless steel EN 1.4369 were nitrided or nitrocarburized. The residual stress profiles resulting from the thermochemical low-temperature surface treatment were measured. The results indicate high-residual compressive stresses of several GPa's in the nitrided region, while lower-compressive stresses are produced in the carburized case. Plastic deformation in the steel prior to thermochemical treatment has a hardly measurable influence on the nitrogen-rich zone, while it has a measurable effect on the stresses and depth of the carbon-rich zone.
Effect of process parameters on the dryness of molded pulp products
Molded pulp products are made from cellulose fibers dispersed in water then formed, drained and dried. As in the conventional papermaking process, the most energy-intensive operation (including time) is drying. To gain a better understanding of the process parameters involved and to investigate their influence on the final product’s dryness, two experimental plans were designed and analyzed by means of design of experiments (DOE). A numerical simulation of the heat model was developed with the aim of finding the process time window.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Didone, M. (Intern), Tosello, G. (Intern)
Number of pages: 4
Publication date: 2016

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Title of host publication: Proceedings of Progress in Paper Physics Seminar 2016
Main Research Area: Technical/natural sciences
Electronic versions:
Molded_pulp_products_manufacturing_characterization_of_the_drying_process.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Effect of Process Parameters on the Total Heat Damaged Zone (HDZ) during Micro-EDM of Plastic Mold Steel 1.2738
In micro electrical discharge machining, three subsurface layers are formed on the workpiece, they are; recast zone, heat affected zone and converted zone, primarily due to heating-quenching cycles. The HDZ in micro-EDM is characterized by cracks and weakness in the grain boundary and thermal residual stresses. This paper presents the effect of process parameters on the HDZ in micro-EDM of plastic mold steel 1.2738. As the energy of the sparks increases, the thickness of the HDZ increases and the average coefficient of correlation between energy and HDZ considering three different sections of the zone is 0.8099. Therefore, the effect of process parameters governing the discharge energy are analyzed; they are: average current (Ia), peak current (Ip) and pulse ‘on-time’ (Ton). An overall increase in heat-damaged zone thickness
by 105% is observed with an increase in pulse on time.

**Effect of swirling device on flow behavior in a supersonic separator for natural gas dehydration**

The supersonic separator is a revolutionary device to remove the condensable components from gas mixtures. One of the key issues for this novel technology is the complex supersonic swirling flow that is not well understood. A swirling device composed of an ellipsoid and several helical blades is designed for an annular supersonic separator. The supersonic swirling separation flow of natural gas is calculated using the Reynolds Stress model. The results show that the viscous heating and strong swirling flow cause the adverse pressure in the annular channel, which may negatively affect the separation performance. When the swirling flow passes through the annular nozzle, it will damage the expansion characteristics of the annular nozzle. The blade angles and numbers are both optimized by evaluating the swirling and expansion effects for the supersonic separation.
Effect of the meniscus contact angle during early regimes of spontaneous imbibition in nanochannels

Nanoscale capillarity has been extensively investigated; nevertheless, many fundamental questions remain open. In spontaneous imbibition, the classical Lucas-Washburn equation predicts a singularity as the fluid enters the channel consisting of an anomalous infinite velocity of the capillary meniscus. Bosanquet's equation overcomes this problem by taking into account fluid inertia predicting an initial imbibition regime with constant velocity. Nevertheless, the initial constant velocity as predicted by Bosanquet's equation is much greater than those observed experimentally. In the present study, large scale atomistic simulations are conducted to investigate capillary imbibition of water in slit silica nanochannels with heights between 4 and 18 nm. We find that the meniscus contact angle remains constant during the inertial regime and its value depends on the height of the channel. We also find that the meniscus velocity computed at the channel entrance is related to the particular value of the meniscus contact angle. Moreover, during the subsequent viscino-inertial regime, as the influence of viscosity increases, the meniscus contact angle is found to be time dependent for all the channels under study. Furthermore, we propose an expression for the time evolution of the dynamic contact angle in nanochannels which, when incorporated into Bosanquet's equation, satisfactorily explains the initial capillary rise.

General information

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Universidad de Concepcion
Authors: Karna, N. K. (Ekstern), Oyarzua, E. (Ekstern), Walther, J. H. (Intern), Zambrano, H. A. (Ekstern)
Effect of void cluster on ductile failure evolution

The behavior of a non-uniform void distribution in a ductile material is investigated by using a cell model analysis to study a material with a periodic pattern of void clusters. The special clusters considered consist of a number of uniformly spaced voids located along a plane perpendicular to the maximum principal tensile stress. A plane strain approximation is used, where the voids are parallel cylindrical holes. Clusters with different numbers of voids are compared with the growth of a single void, such that the total initial volume of the voids, and thus also the void volume fractions, are the same for the clusters and the single void. In the comparison it is essential that local void coalescence inside the clusters is accounted for, since this allows for considering the rate of growth of the single larger void that results from coalescence in the cluster.

To obtain a parametric understanding, different transverse stresses on the unit cell are considered to see the influence of different levels of stress triaxiality. Also considered are different initial ratios of the void spacing to the void radius inside the clusters. And results are shown for different levels of strain hardening in the material.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Tvergaard, V. (Intern)
Pages: 3097–3105
Publication date: 2016
Main Research Area: Technical/natural sciences

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Volume: 51
Issue number: 12
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Scopus rating (2016): CiteScore 2.05 SJR 0.876 SNIP 1.254
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.796 SNIP 1.269 CiteScore 1.81
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.912 SNIP 1.607 CiteScore 2.01
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.922 SNIP 1.62 CiteScore 1.99
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.872 SNIP 1.679 CiteScore 1.79
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.782 SNIP 1.617 CiteScore 1.65
ISI indexed (2011): ISI indexed yes
Effects of corrugation shape on frequency band-gaps for longitudinal wave motion in a periodic elastic layer

The paper concerns determining frequency band-gaps for longitudinal wave motion in a periodic waveguide. The waveguide may be considered either as an elastic layer with variable thickness or as a rod with variable cross section. As a result, widths and locations of all frequency band-gaps are determined by means of the method of varying amplitudes. For the general symmetric corrugation shape, the width of each odd band-gap is controlled only by one harmonic in the corrugation series with its number being equal to the number of the band-gap. Widths of even band-gaps, however, are influenced by all the harmonics involved in the corrugation series, so that the lower frequency band-gaps can emerge. These are band-gaps located below the frequency corresponding to the lowest harmonic in the corrugation series. For the general non-symmetric corrugation shape, the mth band-gap is controlled only by one, the mth, harmonic in the corrugation series. The revealed insights into the mechanism of band-gap formation can be used to predict locations and widths of all frequency band-gaps featured by any corrugation shape. These insights are general and can be valid also for other types of wave motion in periodic structures, e.g., transverse or torsional vibration.
Effects of quadratic and cubic nonlinearities on a perfectly tuned parametric amplifier

We consider the performance of a parametric amplifier with perfect tuning (two-to-one ratio between the parametric and direct excitation frequencies) and quadratic and cubic nonlinearities. A forced Duffing–Mathieu equation with appended quadratic nonlinearity is considered as the model system, and approximate analytical steady-state solutions and corresponding stabilities are obtained by the method of varying amplitudes. Some general effects of pure quadratic, and mixed quadratic and cubic nonlinearities on parametric amplification are shown. In particular, the effects of mixed quadratic and cubic nonlinearities may generate additional amplitude–frequency solutions. In this case an increased response and a more phase sensitive amplitude (phase between excitation frequencies) is obtained, as compared to the case with either pure quadratic or cubic nonlinearity. Furthermore, jumps and bi-stability in the amplitude–phase characteristics are predicted, supporting previously reported experimental observations.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Neumeyer, S. (Intern), Sorokin, V. (Intern), Thomsen, J. J. (Intern)
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Journal: Journal of Sound and Vibration
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.09 SJR 1.462 SNIP 2.162
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.391 SNIP 2.142 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.447 SNIP 2.38 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 2.992 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.441 SNIP 2.698 CiteScore 2.05
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.218 SNIP 2.069
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.384 SNIP 2.185
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.205 SNIP 1.96
Web of Science (2008): Indexed yes
Effects of weak nonlinearity on the dispersion relation and frequency band-gaps of a periodic Bernoulli–Euler beam

The paper deals with analytically predicting the effects of weak nonlinearity on the dispersion relation and frequency band-gaps of a periodic Bernoulli–Euler beam performing bending oscillations. Two cases are considered: (i) large transverse deflections, where nonlinear (true) curvature, nonlinear material and nonlinear inertia owing to longitudinal motions of the beam are taken into account, and (ii) midplane stretching nonlinearity. A novel approach is employed, the method of varying amplitudes. As a result, the isolated as well as combined effects of the considered sources of nonlinearities are revealed. It is shown that nonlinear inertia has the most substantial impact on the dispersion relation of a nonuniform beam by removing all frequency band-gaps. Explanations of the revealed effects are suggested, and validated by experiments and numerical simulation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Sorokin, V. S. (Intern), Thomsen, J. J. (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
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.85 SJR 0.754 SNIP 1.081
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.866 SNIP 1.279 CiteScore 2.07
Effects produced by oscillations applied to nonlinear dynamic systems: a general approach and examples

A general approach to study effects produced by oscillations applied to nonlinear dynamic systems is developed. It implies a transition from initial governing equations of motion to much more simple equations describing only the main slow component of motions (the vibro-transformed dynamics equations). The approach is named as the oscillatory strobodynamics, since motions are perceived as under a stroboscopic light. The vibro-transformed dynamics equations comprise terms that capture the averaged effect of oscillations. The method of direct separation of motions appears to be an efficient and simple tool to derive these equations. A modification of the method applicable to study problems that do not imply restrictions on the spectrum of excitation frequencies is proposed. It allows also to abandon other restrictions usually introduced when employing the classical asymptotic methods, e.g., the requirement for the involved nonlinearities to be weak. The approach is illustrated by several relevant examples from various fields of science, e.g., mechanics,
physics, chemistry and biophysics.

**General information**
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Russian Academy of Sciences
Authors: Blekhman, I. I. (Ekstern), Sorokin, V. S. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 2
Scopus rating (2016): SJR 1.202 SNIP 1.523 CiteScore 3.36
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.423 SNIP 1.533 CiteScore 3.06
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.235 SNIP 1.73 CiteScore 3.07
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.214 SNIP 1.638 CiteScore 2.85
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.9 SNIP 1.938 CiteScore 2.83
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.825 SNIP 1.436 CiteScore 1.8
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.881 SNIP 1.468
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 0.889 SNIP 1.451
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 0.961 SNIP 1.378
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.772 SNIP 1.205
Scopus rating (2006): SJR 0.835 SNIP 1.254
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.829 SNIP 1.3
Scopus rating (2004): SJR 0.885 SNIP 1.192
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.677 SNIP 1.23
Scopus rating (2002): SJR 1.106 SNIP 1.042
Scopus rating (2001): SJR 0.535 SNIP 0.991
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.
Elastic interaction between twins during tensile deformation of austenitic stainless steel

In austenite, the twin boundary normal is a common elastically stiff direction shared by the two twins, which may induce special interactions. By means of three-dimensional X-ray diffraction this elastic interaction has been analysed and compared to grains separated by conventional grain boundaries. However, the components of the Type II stress normal to the twin boundary plane exhibit the same large variations as for the grain boundaries. Elastic grain interactions are therefore complex and must involve the entire set of neighbouring grains. The elastic-regime stress along the tensile direction qualitatively depends on the grain orientation, but grain-to-grain variations are large.
Electron microscopy analysis of structural changes within white etching areas

In the present work, crack networks with white etching areas (WEAs) in cross-sections of bearings were investigated by a complementary use of SEM and TEM with the focus on the use of orientation contrast imaging and electron backscatter diffraction (EBSD). Orientation contrast imaging was used for the first time to give detailed insight into the microstructure of WEA. A significant difference between Nital-etched and polished WEA samples was observed. It was revealed that WEAs are composed of different areas with varying grain sizes. As a result of secondary transformation, needle-shaped grains were observed within WEAs. Using EBSD analysis, evidence was obtained that WEA formation and accompanying crack growth are without relation microstructural features. In addition, an inhomogeneous chemical structure of WEA as a result of carbide dissolution is revealed by analytical investigations.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, RWTH Aachen University, Oerlikon Leybold Vacuum GmbH
Authors: Diederichs, A. M. (Intern), Schwedt, A. (Ekstern), Mayer, J. (Ekstern), Dreifert, T. (Ekstern)
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Journal: Materials Science and Technology
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Web of Science (2017): Indexed Yes
Energy and environmental performance assessment of R744 booster supermarket refrigeration systems operating in warm climates

This paper presents a theoretical comparison among different commercial refrigeration systems in terms of annual energy consumption and environmental impact. Eight configurations were studied: a R744/R134a cascade refrigeration system (baseline), a conventional and an improved R744 booster system, two R744 booster solutions with dedicated mechanical...
subcooling, a R744 booster with parallel compression and two solutions which combined the parallel compression and the mechanical subcooling. The evaluation was based on the weather data in Valencia (Spain) and in Athens (Greece), as well as on the running modes of a conventional European supermarket. A transition zone, which occurred between subcritical and transcritical operations, was adopted. The results showed that all the enhanced configurations may achieve a comparable energy saving to the one of the baseline in both the selected locations. Furthermore, they allow reducing the Total Equivalent Warming Impact (TEWI) by at least 9.6% beside the cascade solution. (C) 2016 Elsevier Ltd and IIR. All rights reserved.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, University of Udine
Authors: Gullo, P. (Ekstern), Elmegaard, B. (Intern), Cortella, G. (Ekstern)
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 3.06 SJR 1.344 SNIP 1.598
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.396 SNIP 1.537 CiteScore 2.44
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.667 SNIP 2.117 CiteScore 2.6
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.461 SNIP 1.979 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.426 SNIP 1.908 CiteScore 2.09
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.308 SNIP 2.129 CiteScore 2.2
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.372 SNIP 1.786
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.569 SNIP 1.954
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.309 SNIP 1.737
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.841 SNIP 1.646
Scopus rating (2006): SJR 1.5 SNIP 1.629
Energy and Exergy Analyses of the Danish Industry Sector

A detailed analysis of the Danish industry is presented in this paper using the energy and exergy methods. For the 22 most energy-intensive process industries, which represent about 80% of the total primary energy use of the industrial sector, detailed end-use models were created and analyzed with data for the years 2006 and 2012. The sectoral energy and exergy losses, as well as the exergy destruction, were further established to quantify the potential for recovering and valorising heat otherwise lost. By also considering transformation processes occurring in the utility sector, the impact of using electricity and district heat in the industry is shown. The exergy efficiencies for each process industry were found to be in the range of 12% to 56% in 2012. However variations in the efficiencies within the sectors for individual process industries occur, underlining the need for detailed analyses. The exergy losses amounted to 3800 TJ for the same year. Meanwhile, the complete exergy losses, including the central production of heat and power, exceeded 8700 TJ. This analysis illustrates for the case study of Denmark how waste heat recovery potentials in the industrial sectors are found, by determining the sectors losses and exergy destruction. In addition the importance of applying a system analysis is shown, which corrects the site efficiencies for electricity and district heating use. The use of 22 industries, further highlights differences amongst industries belonging to the same sector.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Bühler, F. (Intern), Nguyen, T. (Intern), Elmegaard, B. (Intern)
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Journal: Applied Energy
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BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
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Energy efficiency measures for offshore oil and gas platforms

Oil and gas platforms are energy-intensive systems (each facility uses from a few to several hundreds MW of energy, depending on the petroleum properties, export specifications and field lifetime. Several technologies for increasing the energy efficiency of these plants are investigated in this work. They include: (i) the installation of multiple pressure levels in production manifolds, (ii) the implementation of multiphase expanders, (iii) the promotion of energy and process integration, (iv) the limitation of gas recirculation around the compressors, (v) the exploitation of low-temperature heat from the gas cooling steps, (vi) the downsizing or replacement of the existing gas turbines, and (vii) the use of the waste heat from the powerplant. The present study builds on four actual cases located in the North and Norwegian Seas, which differ by the type of oil processed, operating conditions and strategies. The benefits and practical limitations of each measure are discussed based on thermodynamic, economic and environmental factors. Significant energy savings and reductions in CO2-emissions are depicted, reaching up to 15-20%. However, they strongly differ from one facility to another, which suggests that generic improvements can hardly be proposed, and that thorough techno-economic analyses should be conducted for each plant.
Energy, Exergy and Advanced Exergy Analysis of a Milk Processing Factory

Energy, exergy and advanced exergy methods are used in this study to analyse a milk processing facility which is one of the largest energy consumers within the food industry in Denmark. While a conventional energy analysis maps the energy flows of the system and suggests opportunities for process integration, an exergy analysis pinpoints the locations, causes and magnitudes of thermodynamic losses. The advanced exergy analysis further identifies the real potential for thermodynamic improvements of the system by splitting exergy destruction into its avoidable and unavoidable parts, which are related to technological limitations, and into its endogenous and exogenous parts, which illustrate the interactions between the different sub-systems. This analysis is based on actual factory data from one of Europe’s largest dairy producers: the complete production line is modelled, and includes the production of milk, cream and milk powder. The results show the optimisation potential based on 1st and 2nd law analyses. An evaluation and comparison of the applicability of exergy methods, including advanced exergy methods, to the dairy industry is made. The comparison includes typical energy mappings conducted onsite, and discusses the benefits and challenges of applying advanced thermodynamic methods to industrial processes.

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Organisations: Department of Mechanical Engineering, Thermal Energy
Authors: Bühler, F. (Intern), Nguyen, T. (Intern), Jensen, J. K. (Intern), Elmegaard, B. (Intern)
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Energy Efficiency, Exergy Analysis, Advanced Exergy Analysis, Process Integration, Dairy Industry
Electronic versions:
Energy_Exergy_and_Advanced_Exergy_Analysis_of_a_Milk_Processing_factory.pdf
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016


The interaction between electrical and thermal energy demands represent a potential area for balancing supply and demand that could contribute to the integration of intermittent renewables in energy systems. To enable the interaction between thermal and electric energy, an innovative concept that consists of a ground-source heat pump with possibility of reversing operation as an ORC power cycle combined with solar heating in a single-family building is introduced. The ORC mode enables the use of solar energy in periods of no heat energy demand and reverses the heat pump cycle to supply electrical power. This paper combines a dynamic model based on empirical data of the HP/ORC system with lessons learned from 140 heat pump installations operating in real-life conditions in a cold climate. These installations were monitored for a period up to 5 years. Based on the aforementioned model and real-life conditions knowledge, the paper considers two different sensible energy storage (TES) configurations for the reversible heat pump/organic Rankine cycle (HP/ORC) system: a buffer tank for both space heating and domestic hot water and a hot water storage tank used exclusively for domestic hot water. The results with the two different configurations are simulated in the Modelica language and compared in terms of energy shift potential in order to optimize RES integration, as well as the economic feasibility of the system in a cold climate.
Enhancement of wear and corrosion resistance of beta titanium alloy by laser gas alloying with nitrogen

The relatively high elastic modulus coupled with the presence of toxic vanadium (V) in Ti6Al4V alloy has long been a concern in orthopaedic applications. To solve the problem, a variety of non-toxic and low modulus beta-titanium (beta-Ti) alloys have been developed. Among the beta-Ti alloy family, the quaternary Ti-Nb-Zr-Ta (TNZT) alloys have received the highest attention as a promising replacement for Ti6Al4V due to their lower elastic modulus and outstanding long term stability against corrosion in biological environments. However, the inferior wear resistance of TNZT is still a problem that must be resolved before commercialising in the orthopaedic market. In this work, a newly developed laser surface treatment technique was employed to improve the surface properties of Ti-35.3Nb-7.3Zr-5.7Ta alloy. The surface structure and composition of the laser-treated TNZT surface were examined by grazing incidence X-ray diffraction (GI-XRD) and X-ray photoelectron spectroscopy (XPS). The wear and corrosion resistance were evaluated by pin-on-plate sliding test and anodic polarisation test in Hanks' solution. The experimental results were compared with the untreated (or base) TNZT material. The research findings showed that the laser surface treatment technique reported in this work can effectively improve the wear and corrosion resistance of TNZT.
The paper is aimed at evaluating the performances of Minimum Quantity Lubrication (MQL), dry cutting and cryogenic cooling when applied to the micro-milling of Ti6Al4V titanium alloy samples obtained by Additive Manufacturing (AM) using the Electron Beam Melting (EBM) technology. The micro-milling tests were carried out on a high precision 5-axis micro-milling center, at varying cutting speed and feed per tooth. The performances of the different lubrication/cooling strategies were analyzed in terms of surface integrity, namely surface topography, nano-hardness and sub-surface microstructural alterations, in order to prove the impact of clean cutting conditions when applied to micro-machining of a AM titanium alloy of biomedical interest. It is shown that dry cutting assures the same performances of MQL, representing then the most suitable option to decrease the environmental impact of the machining process. (C) 2016 Elsevier Ltd. All rights reserved.
Erratum for "Simulation of Wave-Plus-Current Scour beneath Submarine Pipelines" by Bjarke Eltard Larsen, David R. Fuhrman, and B. Mutlu Sumer

Errors in reference citations introduced during composition by ASCE are being clarified in this erratum. The citations corresponding to the reference Fredsøe et al. (1992) were inadvertently changed to Fredsøe and Deigaard (1992) in four locations. The citations are being corrected in this paper, in the order of their appearance in the final published version. ASCE regrets these errors.

General information
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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Eltard-Larsen, B. (Intern), Fuhrman, D. R. (Intern), Sumer, B. M. (Intern)
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Web of Science (2017): Indexed Yes
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Scopus rating (2016): CiteScore 1.48 SJR 0.708 SNIP 1.139
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.915 SNIP 1.172 CiteScore 1.23
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.578 SNIP 1.248 CiteScore 1.05
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.562 SNIP 1.184 CiteScore 1.29
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.632 SNIP 0.964 CiteScore 0.83
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 0.761 SNIP 1.407 CiteScore 1.24
Establishing Reusable Requirements Derived from Laws and Regulations for Medical Device Development

For many industries a key activity in product development is to demonstrate legislative compliance by showing, explicitly, that all relevant requirements from regulatory documents have been identified and addressed. The analysis and interpretation of standards and regulations requires considerable skills and consumes significant effort in product development. Therefore initiating reuse from the analysis and elicitation of requirements from standards and regulations may provide promising potential for gaining efficiency in development and also for assuring sufficient quality of the work. In this paper, a method to manage requirements from standards, by establishing a reusable requirements catalogue, is suggested and a metamodel illustrating the information needed for tractability between derived requirements and legal texts, needed to facilitate reuse, is demonstrated. The paper presents a case study, where reusable requirements covering secondary packaging for medical injection devices were established, using a spreadsheet layout to capture and document the information presented in the metamodel.

General information

State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Novo Nordisk AS
Authors: Hauksdóttir, D. (Intern), Mortensen, N. H. (Intern), Ritsing, B. (Ekstern), Andersen, J. C. (Ekstern)
Number of pages: 9
Pages: 220-228
Publication date: 2016

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Publisher: IEEE
Main Research Area: Technical/natural sciences
Requirements engineering, Medical device development, Requirements reuse, Regulatory compliance
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10.1109/REW.2016.045
Estimation of wake propagation behind the rotors of wind-powered generators

The objectives of this work are to develop the experimental model of wake behind the wind-power generator rotor to estimate its propagation distance and the impact on the average and pulsation characteristics of incident flow with the possibility of further use of these data in the calculation models of wind and climate changes in the regions and to determine the optimal operation of wind turbines. For experimental modeling, the laboratory model of wind-powered generator with a horizontal axis was used that operated as wind turbine in optimal mode. The kinematic characteristics of flow and changes in the wake structure in the distance of more than 40 rotor diameters downstream with a slight level of turbulent pulsations (less than 2%) of free flow were investigated. A significant impact of external intense pulsations typical for natural atmospheric conditions was purposely excluded in the experimental research in order to define the degree of self-damping of perturbations generated by oneself wind-powered generator. The obtained experimental data for the wake dynamics behind the model of wind-powered generator allowed ascertaining its impact on slowing down of incident vortex flow and determining the distance at which its impact on the stream disappears, and the deceleration values are comparable to the level of pulsations of incident flow. This experimental model with the same degree of damping its velocity and pulsations can be used to adjust the theoretical approximation of the far wake. It is shown that the recovery of velocity of incident flow is faster than has been previously defined in the models of calculating the impact of wind electric power plants on the regional climate changes. Thus, existing wind loss calculated on the model of wake behind the wind-powered generator, adjusted in this study can be even less significant.

General information
State: Published
Organisations: Department of Wind Energy, Fluid Mechanics, Department of Mechanical Engineering, Russian Academy of Sciences
Authors: Naumov, I. V. (Ekstern), Mikkelsen, R. F. (Intern), Okulov, V. (Intern)
Number of pages: 6
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Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Thermal Engineering
Volume: 63
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Ratings:
Scopus rating (2016): SJR 0.328 SNIP 0.913 CiteScore 0.4
Scopus rating (2015): SJR 0.253 SNIP 0.886 CiteScore 0.21
Scopus rating (2014): SJR 0.209 SNIP 0.77 CiteScore 0.19
Scopus rating (2013): SJR 0.229 SNIP 0.775 CiteScore 0.15
Scopus rating (2012): SJR 0.199 SNIP 0.047 CiteScore 0.08
Scopus rating (2011): SJR 0.193 SNIP 0.05 CiteScore 0.05
Scopus rating (2010): SJR 0.156 SNIP 2.134
Scopus rating (2009): SJR 0.105 SNIP 0
Scopus rating (2008): SJR 0.105 SNIP 0
Scopus rating (2007): SJR 0.1
Scopus rating (2006): SJR 0.101
Scopus rating (2005): SJR 0.105 SNIP 0
Scopus rating (2004): SJR 0.1 SNIP 0
Scopus rating (2003): SJR 0.1 SNIP 0
Scopus rating (2002): SJR 0.1 SNIP 0
Scopus rating (2001): SJR 0.1 SNIP 0
Scopus rating (2000): SJR 0.143 SNIP 0.02
Scopus rating (1999): SJR 0.133 SNIP 0.022
Original language: English
Wind-power engineering, Wake behind the wind turbine rotor, Velocity deficit, Laser Doppler anemometry (LDA)
Electronic versions:
Estimation_of_Wake_Propagation.pdf
Estimation of Water Diffusion Coefficient into Polycarbonate at Different Temperatures Using Numerical Simulation

Nowadays, many electronic systems are exposed to harsh conditions of relative humidity and temperature. Mass transport properties of electronic packaging materials are needed in order to investigate the influence of moisture and temperature on reliability of electronic devices. Polycarbonate (PC) is widely used in the electronics industry. Thus, in this work the water diffusion coefficient into PC is investigated. Furthermore, numerical methods used for estimation of the diffusion coefficient and their assumptions are discussed. 1D and 3D numerical solutions are compared and based on this, it is shown how the estimated value can be different depending on the choice of dimensionality in the model.
Estimation of waves and ship responses using onboard measurements

This thesis focuses on estimation of waves and ship responses using ship-board measurements. This is useful for development of operational safety and performance efficiency in connection with the broader concept of onboard decision support systems.

Estimation of sea state is studied using a set of measured ship responses, a parametric description of directional wave spectra (a generalised JONSWAP model) and the transfer functions of the ship responses. The difference between the spectral moments of the measured ship responses and the corresponding theoretically calculated moments formulates a cost function. A set of wave parameters, characterising the directional wave spectrum, is estimated through an optimisation problem using global search basin with proper constraints. This approach applies a sequential partitioning procedure, which is able to classify swell and wind sea events using wind information.

The model is tested on simulated data based on known unimodal and bimodal wave scenarios. The wave parameters in the output are then compared with the true wave parameters. In addition to the numerical experiments, two sets of full-scale measurements from container ships are analysed. Herein, the validation of the estimation method is assessed by comparing the results with the wave data from other tools, such as wave radar data and hindcast data. The results show that the developed method is reasonably accurate.

Automatic selection of a set of responses to be used for wave estimation is also studied using a sensitivity analysis of the wave parameters. This selection depends on the waves and the operational condition of the ship. Therefore, the method can be utilised based on initial knowledge about the waves and the operational condition in a specific location.

A dynamic trend model is proposed for tracking the evolution of the wave parameters during the voyage. This provides a prediction of the wave parameters, e.g. 20 minutes ahead of the measurements. Given the predicted parameters, a wave spectrum model and the transfer functions, forecasts of different wave-induced responses are made. The predicted variances of the responses are compared with actual measurements. The relatively good agreement in this comparison validates the model and the optimisation method. Finally, an uncertainty analysis of the presented approach is implemented to assess the reliability of the method.
**Estimation of wind sea and swell using shipboard measurements – A refined parametric modelling approach**

Shipboard wave estimation has been of interest in recent years for the purpose of decision support. In this paper, estimation of sea state is studied using ship responses and a parametric description of directional wave spectra. A set of parameters, characterising a given wave spectrum is estimated through an optimisation problem using global search basin with proper constraints. The cost function is established based on the difference between the energies of a set of measured ship responses and the corresponding theoretical spectral moments. A partitioning procedure is applied, which is able to separate swell components from wind seas.

**General information**

State: Published  
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering  
Authors: Montazeri, N. (Intern), Nielsen, U. D. (Intern), Jensen, J. J. (Intern)  
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Main Research Area: Technical/natural sciences

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BFI (2018): BFI-level 1  
Web of Science (2018): Indexed yes  
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Web of Science (2017): Indexed Yes  
BFI (2016): BFI-level 1  
Web of Science (2016): Indexed yes  
BFI (2015): BFI-level 1  
Scopus rating (2015): SJR 1.245 SNIP 1.999 CiteScore 2.1  
Web of Science (2015): Indexed yes  
BFI (2014): BFI-level 1  
Scopus rating (2014): SJR 1.442 SNIP 2.244 CiteScore 1.91  
BFI (2013): BFI-level 1  
Scopus rating (2013): SJR 1.243 SNIP 2.332 CiteScore 1.84  
ISI indexed (2013): ISI indexed yes  
BFI (2012): BFI-level 1  
Scopus rating (2012): SJR 1.234 SNIP 1.922 CiteScore 1.46  
ISI indexed (2012): ISI indexed yes  
Web of Science (2012): Indexed yes  
BFI (2011): BFI-level 1  
Scopus rating (2011): SJR 1.496 SNIP 1.975 CiteScore 1.73  
ISI indexed (2011): ISI indexed yes  
BFI (2010): BFI-level 1  
Scopus rating (2010): SJR 1.112 SNIP 1.485  
Web of Science (2010): Indexed yes  
BFI (2009): BFI-level 1  
Scopus rating (2009): SJR 1.012 SNIP 1.69  
BFI (2008): BFI-level 1  
Scopus rating (2008): SJR 1.404 SNIP 2.344  
Web of Science (2008): 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.

Evolution of Surface Texture and Cracks During Injection Molding of Fiber-Reinforced, Additively-Manufactured, Injection Molding Inserts

This paper investigates the lifetime and surfacedeterioration of additively-manufactured, injection-moulding inserts. The inserts were produced using digital light processing and were reinforced with oriented short carbon fibers. The inserts were used during injection molding of low-density polyethylene until their failure. The molded products were used to analyse the development of the surface roughness and wear. By enhancing the lifetime of injection-molding inserts this work contributes to the establishment of additively manufactured inserts in pilot production.
Experimental and numerical study of wave-induced backfilling beneath submarine pipelines
This paper presents results of complementary experimental and numerical studies involving wave-induced backfilling of current-generated scour holes beneath submarine pipelines. The laboratory experiments are conducted in a wave-plus-current flume, utilizing Laser Doppler Anemometry to measure velocities, synchronized flow visualizations using digital image technology, along with live-bed scour and backfilling measurements. Each experiment is based on a two-stage process: (1) initial scour induced by a pure current, followed by: (2) backfilling induced by pure waves (either regular or irregular). The time series of scour depths are closely monitored through video recordings. Systematic analysis of these has resulted in an closed form expression for the backfilling time scale, which is demonstrated to be a full order of magnitude greater than the well-known time scale of scour (with both governed primarily by the Shields parameter). The developed expression is strictly valid for the current-to-wave backfilling scenarios considered, while likely serving as an upper limit for more general wave-induced backfilling circumstances. The experiments are complemented by similar backfilling simulations utilizing a fully-coupled hydrodynamic and morphodynamic CFD model. The numerical simulations demonstrate the ability of the model to predict backfilling towards expected equilibrium scour depths based on the new wave climate, with time scales reasonably inline with experimental expectations.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark
Authors: Bayraktar, D. (Ekstern), Ahmad, J. (Ekstern), Eltard-Larsen, B. (Intern), Carstensen, S. (Intern), Fuhrman, D. R. (Intern)
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Main Research Area: Technical/natural sciences

Publication information
Journal: Coastal Engineering
Volume: 118
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.44 SJR 1.98 SNIP 2.252
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.925 SNIP 2.097 CiteScore 2.9
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.785 SNIP 2.123 CiteScore 2.55
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.727 SNIP 2.264 CiteScore 2.58
ISI indexed (2013): ISI indexed yes
Experimental and Numerical Study of Wave-Induced Backfilling Beneath Submarine Pipelines

Through complementary experimental and numerical efforts, the present paper aims to make a significant contribution to the overall understanding of backfilling processes beneath submarine pipelines. For this purpose, we aim to simplify the experimental backfilling process to an elementary two-stage process: (1) initial scour induced by a pure current, followed by: (2) backfilling induced by pure waves. A steady current is introduced via a re-circulating pump, and is kept constant with a cross-sectional velocity of \( V = 0.48 \) m/s until an initial equilibrium scour depth, \( S_0 \), is reached. Then, the current is stopped and waves (characterized by their Keulegan-Carpener number \( KC \) and Shields parameter \( \theta \)) are introduced to initiate the backfilling process, which is maintained until a new equilibrium scour depth, \( S_f \), is reached. The time at which waves are introduced will be denoted as \( t = 0 \). For the backfilling process both regular and irregular waves are used during the experiments. As a demonstration of the initiated two-stage (scour followed by backfilling) process, bed profiles based on video recordings from a case having \( KC = 9.7 \) and \( \theta = 0.195 \) are depicted at selected stages in Figure 1. Figure 1 (upper left) depicts the current-induced equilibrium scour hole in the near vicinity of the pipe at \( t = 0 \), with the profile approximated as the dashed red line. Similarly, Figure 1 (upper right) depicts the new equilibrium scour profile (approximated as the full blue line) that has developed under wave-induced backfilling, corresponding to \( t = 60 \) min. To ease comparison, the dashed red and full blue lines from these plots are additionally combined onto Figure 1 (bottom). The experimental campaign has additionally been complemented with similar numerical simulations (using regular waves), based on a fully-
coupled hydrodynamic and morphodynamic CFD model (Jacobsen et al., 2014), extending previous pipeline scour-related applications of Fuhrman et al. (2014) and Larsen et al. (2016). Comparison of the numerical and experimental results demonstrate the ability of the CFD model to reasonably simulate the current-to-wave backfilling process, both in terms of the achieved new wave induced equilibrium scour depths as well as the corresponding backfilling timescales. Figure 2 depicts a summary of both experimental and numerical backfilling time scale $T_b$ versus Shields parameter $\theta$. As can be seen, both experimental as well as numerical results match the regression equation: $T_b = 0.3 \theta^{-5/3}$ quite closely (solid line in Figure 2).

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark
Authors: Bayraktar, D. (Ekstern), Ahmad, J. (Ekstern), Eltard-Larsen, B. (Intern), Carstensen, S. (Intern), Fuhrman, D. R. (Intern)
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Publication date: 2016
Event: Abstract from 35th International Conference on Coastal Engineering (ICCE’16), Antalya, Turkey.
Main Research Area: Technical/natural sciences
Electronic versions: 1317.pdf
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

**Experimental identification of dynamic coefficients of lightly loaded tilting-pad bearings under several lubrication regimes**

This paper presents the identified dynamic coefficients of a lightly loaded actively lubricated bearing under three lubrication regimes: passive, hybrid and feedback-controlled. The goal is to experimentally demonstrate the feasibility of modifying the bearing dynamic properties via active lubrication. Dominated by the latest two regimes, the bearing properties become adjustable or controllable due to the injection of either a constant or variable pressurized oil flow. Such a flow is regulated by a hydraulic control system composed of (a) a high-pressure oil supply unit, (b) servovalves, (c) radial injection nozzles, (d) displacement sensors and (e) well-tuned digital controllers. A scaled-down industrial rotor featuring active lubrication, composed of a flexible rotor supported by a four-rocker load-between-pads tilting-pad bearing under light load condition, is used for this objective. The experimental identification is performed by means of measured frequency response functions and a rotor finite element model. Predicted coefficients are also provided for benchmarking. Comparing results between the different regimes, presented along with their expanded uncertainty, provides the experimental evidence of the bearing properties modification via active lubrication.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Salazar, J. G. (Intern), Santos, I. F. (Intern)
Number of pages: 16
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Main Research Area: Technical/natural sciences

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ISSN (Print): 1350-6501
Ratings:
BFI (2018): BFI-level 1
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BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.18 SJR 0.634 SNIP 0.819
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.61 SNIP 0.858 CiteScore 0.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.581 SNIP 0.917 CiteScore 0.89
Experimental Investigation of Comparative Process Capabilities of Metal and Ceramic Injection Molding for Precision Applications

The purpose of this paper is to make a comparative study on the process capabilities of the two branches of the powder injection molding (PIM) process—metal injection molding (MIM) and ceramic injection molding (CIM), for high-end precision applications. The state-of-the-art literature does not make a clear comparative picture of the process capabilities of MIM and CIM. The current paper systematically characterizes the MIM and CIM processes and presents the process capabilities in terms of part shrinkage, surface replication, tolerance capability, and morphological fidelity. The results and discussion presented in the paper will be useful for thorough understanding of the MIM and CIM processes and to select the right material and process for the right application or even to combine metal and ceramic materials by molding to produce metal–ceramic hybrid components.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology
Authors: Islam, A. (Intern), Giannekas, N. (Intern), Marhöfer, D. M. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Pages: 1-9
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication Information
Journal: Journal of Micro and Nano-Manufacturing
Experimental investigation of surface determination process on multi-material components for dimensional computed tomography

The possibility of measuring multi-material components, while assessing inner and outer features simultaneously makes X-ray computed tomography (CT) the latest evolution in the field of coordinate measurement systems (CMSs). However, the difficulty in selecting suitable scanning parameters and suitable surface determination settings, limits a better acceptance of CT as a CMS. Moreover, standard CT users are subject to the algorithms and boundary conditions implied by the use of commercial analysis software. In this context, this paper is concerned with the experimental evaluation of the influence of surface determination process on multi-material measurements, using functions available in the commercial CT data analysis software Volume Graphics VGStudio Max 2.2.6. Calibrated step gauges made of different materials, i.e. PEEK, PPS, and Al were used as reference standards. The step gauges were assembled in such a way as to have different multi-material X-ray absorption ratios. Comparative measurements of mono-material assemblies were performed as well. Different segmentation processes were considered (e.g. ISO-50%, local threshold, region growing, etc.), patch-based bidirectional length analyses were carried out to perform in-material measurements on the assemblies. This work discusses the different approaches based on real CT scans, and aims to provide advice on the segmentation process for multi-material measurements.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Physikalisch-Technische Bundesanstalt
Authors: Borges de Oliveira, F. (Ekstern), Stolfi, A. (Intern), Bartscher, M. (Ekstern), De Chiffre, L. (Intern)
Number of pages: 13
Pages: 93–103
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Case Studies in Nondestructive Testing and Evaluation
Volume: 6
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Original language: English
Surface determination, Segmentation, Computed tomography, Dimensional metrology, Multi-material measurement,
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Alessandro_2016.pdf
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Experimental investigation of the thickness effect for large as-welded SAW S355 steel specimens
The presented work aims to investigate and establish a precise, thorough and detailed database from series of experimental testing of submerged arc welded (SAW) specimens of various thicknesses typically applied in ships and offshore structures and foundations. Welded structures of all sizes and shapes exhibit fatigue failure primarily in the welded region, rather than in the base material, due to imperfections and flaws relating to the welding procedure. The welded region has therefore received much attention from universities, research institutions along with industry as it is of significant practical importance for all fatigue loaded structures, such as e.g. marine structures.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Fluid Mechanics, Coastal and Maritime Engineering
Authors: Ólafsson, Ó. M. (Intern), Jensen, J. J. (Intern), Berggreen, C. (Intern)
Number of pages: 7
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Publisher: Technical University of Denmark (DTU)
Editors: Dam Nielsen, U., Juncher Jensen, J.
Main Research Area: Technical/natural sciences
Conference: 13th International Symposium on Practical Design of Ships and Other Floating Structures (PRADS'2016), Copenhagen, Denmark, 04/09/2016 - 04/09/2016
Welded steel joints, Submerged arc welding (SAW), Fatigue testing, Thickness effect, S-N curves, Standard recommendations
Electronic versions:
Experimental_Investigation_of_the_Thickness_Effect_for_Large_As_Welded_SAW_S355_Steel_Specimens.pdf. Embargo ended: 08/09/2016
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Experimental results for hydrocarbon refrigerant vaporization inside brazed plate heat exchangers at high pressure
In recent years the interest in small capacity organic Rankine cycle (ORC) power systems for harvesting low quality waste thermal energy from industrial processes has been steadily growing. Micro ORC systems are normally equipped with brazed plate heat exchangers which allows for efficient heat transfer with a compact design. An accurate prediction of the heat transfer process characterizing these devices is required from the design phase to the development of model based control strategies. The current literature is lacking experimental data and validated correlations for vaporization of organic fluids at typical working conditions of ORC systems for low temperature waste heat recovery (WHR) applications. Based on these premises, a novel test rig has been recently designed and built at the Technical University of Denmark to simulate the evaporating condition occurring in a small capacity ORC power unit. In this contribution the preliminary experimental results obtained from the first experimental campaign carried out on the rig are reported. HFC-134a was selected as working fluid. The experiments were carried out at saturation temperature of 60, 70 and 80 °C and inlet and outlet qualities ranging between 0.1-0.4 and 0.6-0.95 respectively. The heat flux ranged between 19.4 and 43.1 kW m⁻². The results are presented in terms of refrigerant side heat transfer coefficient and pressure drop. The heat transfer coefficient showed significant sensitivity to the saturation temperature and was characterized by a decreasing trend with respect to the mean evaporator quality. The frictional pressure drop showed a linear dependence on the mean quality value and increased as the saturation temperature decreased. The experimental heat transfer coefficients were compared with a well-known correlation for nucleate boiling which significantly underestimated the founded values.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Institute for Product Development, University of Liege, University of Liège
Authors: Desideri, A. (Ekstern), Ommen, T. S. (Intern), Wronski, J. (Intern), Quoilin, S. (Ekstern), Lemort, V. (Ekstern), Haglind, F. (Intern)
Number of pages: 9
Publication date: 2016

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Article number: 2106
Main Research Area: Technical/natural sciences
Experimental skin deposition of chromium on the hands following handling of samples of leather and metal

Background: Chromium is an important skin sensitizer. Exposure to it has been regulated in cement, and recently in leather. Studies on the deposition of chromium ions on the skin as a result of handling different chromium-containing materials are sparse, but could improve the risk assessment of contact sensitization and allergic contact dermatitis caused by chromium. Objectives: To determine whether the handling of chromium-containing samples of leather and metal results in the deposition of chromium onto the skin. Methods: Five healthy volunteers participated. For 30 min, they handled samples of leather and metal known to contain and release chromium. Skin deposition of chromium was assessed with the acid wipe sampling technique. Results: Acid wipe sampling of the participants' fingers showed chromium deposition on the skin in all participants who had been exposed to leather (range 0.01–0.20 µg/cm²) and in 3 of 5 participants after they had manually handled metal discs (range 0.02–0.04 µg/cm²). Conclusions: We found that samples of leather and metal had the ability to deposit chromium on the skin at significant levels, in spite of a short duration of exposure.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Copenhagen University Hospital, Gentofte University Hospital
Authors: Bregnbak, D. (Ekstern), Thyssen, J. P. (Ekstern), Jellesen, M. S. (Intern), Zachariae, C. (Ekstern), Johansen, J. D. (Ekstern)
Pages: 89-95
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Contact Dermatitis
Volume: 75
Issue number: 2
ISSN (Print): 0105-1873
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.47 SJR 0.829 SNIP 1.59
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1 SNIP 1.468 CiteScore 2.85
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 0.874 SNIP 1.677 CiteScore 2.02
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 0.796 SNIP 1.409 CiteScore 1.87
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 0.87 SNIP 1.361 CiteScore 1.98
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.03 SNIP 1.145 CiteScore 1.91
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 0.811 SNIP 1.173
Experimental study of humidity distribution inside electronic enclosure and effect of Internal heating

Corrosion reliability of electronic products is a key factor for electronics industry, and today there is a large demand for performance reliability in a wide range of temperature and humidity during day and night time periods. Corrosion failures are still a challenge due to the combined effects of temperature, humidity and corrosion accelerating species in the atmosphere. Moreover the surface region of printed circuit board assemblies is often contaminated by various aggressive chemical species. This study describes the overall effect of the exposure to severe climate conditions and internal heat cycles on the humidity and temperature profile inside typical electronic enclosures. Defined parameters include external temperature and humidity conditions, temperature and time of the internal heat cycle, thermal mass, and ports/openings size. The effect of the internal humidity on electronic reliability has been tested by measuring the leakage current on inter-digitated test comb patterns which are pre-contaminated with sodium chloride and placed inside the enclosure. Results showed that exposure to cycling temperature leads to a significant change of internal water vapour concentration, where the maximum value was function of the opening size and the presence of thermal mass inside the enclosure. A pumping effect was observed and the increase of the level of absolute humidity at each cycle lead to condensation, corresponding to a sudden increase in leakage current of the test patterns pre-contaminated with sodium chloride. The changes of internal temperature and humidity can lead to water condensation and evaporation cycles which can cause electrical failures.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Conseil, H. (Intern), Jellesen, M. S. (Intern), Ambat, R. (Intern)
Number of pages: 12
Publication date: 2016

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Title of host publication: Proceedings of the European Corrosion Congress : EUROCORR 2015
Main Research Area: Technical/natural sciences
Conference: The European Corrosion Congress - EUROCORR 2015, Graz, Austria, 06/09/2015 - 06/09/2015
Humidity, Temperature, Electronic materials, Enclosures, Internal climate, Electronic reliability
Electronic versions:
Helene_Eurocorr_2015.pdf
Source: PublicationPreSubmission
Source-ID: 123637735
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Experimental Study of Liquid Fuel Spray Combustion
This PhD dissertation was carried out at the Technical University of Denmark in the Department of Mechanical Engineering and has been supervised by Associate Professor Anders Ivarsson and co-supervised by Professor Jesper Schramm. The project has been a part of the RADIAD project funded by the Danish Council for Strategic Research.
Experimental validation of systematically designed acoustic hyperbolic meta material slab exhibiting negative refraction

This Letter reports on the experimental validation of a two-dimensional acoustic hyperbolic metamaterial slab optimized to exhibit negative refractive behavior. The slab was designed using a topology optimization based systematic design method allowing for tailoring the refractive behavior. The experimental results confirm the predicted refractive capability as well as the predicted transmission at an interface. The study simultaneously provides an estimate of the attenuation inside the slab stemming from the boundary layer effects—insight which can be utilized in the further design of the metamaterial slabs. The capability of tailoring the refractive behavior opens possibilities for different applications. For instance, a slab...
exhibiting zero refraction across a wide angular range is capable of funneling acoustic energy through it, while a material
exhibiting the negative refractive behavior across a wide angular range provides lensing and collimating capabilities.
Experimentelle Bestimmung der Dämpfung eines Bauwerkes am Beispiel einer Fußgängerbrücke - Worauf man achten sollte

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Civil Engineering, Section for Structural Engineering, Ingenieurbüro für Baudynamik
Authors: Cantieni, R. (Ekstern), Bajric, A. (Intern), Brincker, R. (Intern)
Number of pages: 8
Pages: S2-S9
Publication date: 2016
Main Research Area: Technical/natural sciences

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Scopus rating (2010): SJR 0.238 SNIP 0.211
Explicit solution for the natural frequency of structures with partial viscoelastic treatment

The free vibration characteristics of structures with viscoelastic treatment are represented by the complex-valued natural frequencies. The assumed single mode representation associated with the low-frequency stiffness of the viscoelastic treatment is modified by a correction term representing the influence from residual vibration modes. The correction term is eliminated in terms of the corresponding natural frequency associated with the high-frequency stiffness of the viscoelastic treatment, whereby an expression is obtained for the complex-valued natural frequency, which only requires the solution of two real-valued eigenvalue problems.
Exploiting Additive Manufacturing Infill in Topology Optimization for Improved Buckling Load

Additive manufacturing (AM) permits the fabrication of functionally optimized components with high geometrical complexity. The opportunity of using porous infill as an integrated part of the manufacturing process is an example of a unique AM feature. Automated design methods are still incapable of fully exploiting this design freedom. In this work, we show how the so-called coating approach to topology optimization provides a means for designing infill-based components that possess a strongly improved buckling load and, as a result, improved structural stability. The suggested approach thereby addresses an important inadequacy of the standard minimum compliance topology optimization approach, in which buckling is rarely accounted for; rather, a satisfactory buckling load is usually assured through a post-processing step that may lead to sub-optimal components. The present work compares the standard and coating approaches to topology optimization for the MBB beam benchmark case. The optimized structures are additively manufactured using a filamentary technique. This experimental study validates the numerical model used in the coating approach. Depending on the properties of the infill material, the buckling load may be more than four times higher than that of solid structures optimized under the same conditions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Clausen, A. (Intern), Aage, N. (Intern), Sigmund, O. (Intern)
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Main Research Area: Technical/natural sciences

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Source-ID: 2306829651
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Exploration of the Barriers to Implementing Different Types of Sustainability Approaches

Integrating sustainability into business is gaining increased attention. Yet, implementing long-lasting sustainability approaches remains a complex task. Many empirical studies have identified the barriers to such implementation but the variation in challenges faced by companies, depending on the focus of the approach being implemented, is not addressed. The aim of this paper is i) to explore the barriers related to implementing different types of sustainability approaches and ii) to look for indications of similarities and differences across types of approaches. The research builds on data about the barriers, collected from a sample of twenty-two empirical studies in academic research and additional reports. The findings show that performance measurement systems and access to industry-specific information, benchmark or reference cases are common areas of difficulty across all types. The main variation is an increase in barriers beyond the company's boundaries, when shifting from a production to a value proposition focus. The results are limited by the unbalanced distribution of studies and the variety in methodologies present in the sample. Further research on barrier identification, prioritization and influential parameters is recommended.

General information
State: Published
Organisations: Department of Management Engineering, Quantitative Sustainability Assessment, Department of Mechanical Engineering, Norwegian University of Science and Technology
Authors: Stewart, R. M. M. (Intern), Bey, N. (Intern), Boks, C. (Ekstern)
Number of pages: 6
Pages: 22-27
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Conference: 23rd CIRP Conference on Life Cycle Engineering, Berlin, Germany, 22/05/2016 - 22/05/2016
Main Research Area: Technical/natural sciences

Exploring the dynamic and complex integration of sustainability performance measurement into product development

In order to deal with the complex and dynamic nature of sustainability integration into the product development process, this research explore the use of a qualitative System Dynamics approach by using the causal loop diagram (CLD) tool. A literature analysis was followed by a case study, aiming to depict the structure of the used sustainability indicators and their relationships. The results showed the main information feedback loops and were discussed in terms of the CLD’s advantages and limitations, and how this exploratory study could lead to a more comprehensive modelling approach.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Rodrigues, V. P. (Intern), Morioka, S. (Ekstern), Pigosso, D. C. A. (Intern), Carvalho, M. (Ekstern), McAloone, T. C. (Intern)
Pages: 433-442
Publication date: 2016
Exposure to ultrafine particles, intracellular production of reactive oxygen species in leukocytes and altered levels of endothelial progenitor cells

Exposure to particles in the fine and ultrafine size range has been linked to induction of low-grade systemic inflammation, oxidative stress and development of cardiovascular diseases. Declining levels of endothelial progenitor cells within systemic circulation have likewise been linked to progression of cardiovascular diseases. The objective was to determine if exposure to fine and ultrafine particles from indoor and outdoor sources, assessed by personal and residential indoor monitoring, is associated with altered levels of endothelial progenitor cells, and whether such effects are related to leukocyte-mediated oxidative stress. The study utilized a cross sectional design performed in 58 study participants from a larger cohort. Levels of circulating endothelial progenitor cells, defined as either late (CD34(+)KDR(+) cells) or early (CD34(+)CD133(+)KDR(+) cells) subsets were measured using polychromatic flow cytometry. We additionally measured production of reactive oxygen species in leukocyte subsets (lymphocytes, monocytes and granulocytes) by flow cytometry using intracellular 2',7'-dichlorofluoroscein. The measurements encompassed both basal levels of reactive oxygen species production and capacity for reactive oxygen species production for each leukocyte subset. We found that the late endothelial progenitor subset was negatively associated with levels of ultrafine particles measured within the participant residences and with reactive oxygen species production capacity in lymphocytes. Additionally, the early endothelial progenitor cell levels were positively associated with a personalised measure of ultrafine particle exposure and negatively associated with both basal and capacity for reactive oxygen species production in lymphocytes and granulocytes, respectively. Our results indicate that exposure to fine and ultrafine particles derived from indoor sources may have adverse effects on human vascular health.
Extension of the Method of Direct Separation of Motions for Problems of Oscillating Action on Dynamical Systems

A general approach to study oscillating action on nonlinear dynamical systems is developed. It implies a transition from initial governing equations of motion to much more simple equations describing only the main slow component of motions (the vibro-transformed dynamics equations). The approach is named as the Oscillatory Strobodynamics, since motions are perceived as under a stroboscopic light. The vibro-transformed dynamics equations comprise terms that represent the averaged effect of the oscillating action. The method of direct separation of motions (MDSM) appears to be an efficient and simple tool to derive these equations. A modification of the method applicable to study problems that do not imply restrictions on the spectrum of excitation frequencies is proposed. It allows also to abandon other restrictions usually introduced when employing the classical asymptotic methods, e.g. the requirement for the involved nonlinearities to be weak. Several relevant examples from Mechanics, Physics, Chemistry, and Biophysics are considered by means of the conventional MDSM and, in more details, by the modified MDSM, illustrating the efficiency the methods.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Russian Academy of Sciences
Fabrication and characterization of polycarbonate microstructured polymer optical fibers for high-temperature-resistant fiber Bragg grating strain sensors

Here we present the fabrication of a solid-core microstructured polymer optical fiber (mPOF) made of polycarbonate (PC), and report the first experimental demonstration of a fiber Bragg grating (FBG) written in a PC optical fiber. The PC used in this work has a glass transition temperature of 145°C. We also characterize the mPOF optically and mechanically, and further test the sensitivity of the PC FBG to strain and temperature. We demonstrate that the PC FBG can bear temperatures as high as 125°C without malfunctioning. In contrast, polymethyl methacrylate-based FBG technology is generally limited to temperatures below 90°C.
Fast Mold Temperature Evolution on Micro Features Replication Quality during Injection Molding

The growing demand to manufacture, with high accuracy, functional structures in the micro and sub-micro meter range polymer based microsystem products calls for reliable mass production processes. Being injection molding (IM) the preferential technology employed for polymer mass fabrication and mold temperature one of the most relevant process parameter to enhance polymer replication at the micro meter scale, the present study investigates effects of fast mold temperature evolution on final replication quality of produced injection molded parts. Micro features master geometries were produced by UV lithography and subsequent nickel electroplating. The mold temperature was controlled by a thin heating device (composed by polyimide as insulating layer and polyimide carbon black loaded aselectrical conductive layer) able to increase the temperature on mold surface in a few seconds (40°C/s) by Joule effect and let the surface to cool down soon after. This heating device allowed to maintain mold temperature at a constant value for a time that could be equal to the filling time or longer. A fully characterized isotactic polypropylene was used as the polymer material during the injection molding experiments. The experiments revealed that the replication was mostly sensitive to cavity pressure and mold temperature. In particular, an increase of holding pressure and mold temperature enhanced the replication. Also the heating time increased the replication quality.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Salerno
Authors: Liparoti, S. (Ekstern), Calaon, M. (Intern), Speranza, V. (Ekstern), Tosello, G. (Intern), Pantani, R. (Ekstern), Hansen, H. N. (Intern), Titomanlio, G. (Ekstern)
Number of pages: 5
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Main Research Area: Technical/natural sciences
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Fatigue characterization of Poly Vinyl Chloride (PVC) foam core sandwich composite using the G-control method

This paper presents experimental results from cyclic crack propagation tests performed on sandwich specimens with glass/epoxy face sheets and Poly Vinyl Chloride (PVC) foam cores using the G-controlled cyclic energy release rate (ΔG) test procedure. The face material was tested in tension, compression and shear to determine in-plane and out-of-plane mechanical properties, such as Young’s modulus, Poisson’s ratio and shear modulus. These properties were then used in an analytical model of the mixed-mode bending sandwich specimen to calculate compliance and energy release rate. Finite element analysis was used to determine the mode-mixity of the crack loading. Experimental crack growth cyclic tests were carried out on pre-cracked mixed-mode bending sandwich specimens with H45, H100 and H160 PVC foam cores under two mode-mixities (mode I and mode II dominant). Post-mortem analysis was performed on tested specimens, highlighting the influence of mode mixity and foam density on the crack path. Crack propagation diagrams showing da/dN versus ΔG curves were obtained to establish the Paris-Erdogan relation for each material combination tested at the two mode-mixities. Results showed constant crack growth rates for all the materials tested and revealed the influence on mode-mixity on crack propagation speed and foam density (higher foam density, slower crack propagation).

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Florida Atlantic University
Authors: Manca, M. (Intern), Berggreen, C. (Intern), Carlsson, L. A. (Ekstern), Bortolotti, P. (Intern)
Fault diagnosis of active magnetic bearings based on Gaussian GLRT detector

Active magnetic bearings are progressively replacing conventional bearings in many industrial applications, particularly in the energy sector. Magnetic bearings have many advantages such as contactless support and clean operation; however their use also poses some challenges connected to their inherent open loop instability. Occurrence of faults in one or more components of an active magnetic bearing may lead to loss of control of the rotor. Timely detection and isolation of faults in an active magnetic bearing could prevent hazardous system behaviour by enabling proper reconfiguration of the control system. A structural model of the bearing-rotor system is presented and used to perform a detectability and isolability analysis of faults in the magnetic actuator. Structural detectability and group-wise isolability is concluded for single and multiple faults in the actuators. A Gaussian generalized likelihood ratio test is proposed for detecting faults striking the electromagnet. The detector is capable of detecting and isolating the occurrence of faults in e.g. the windings of bearing by tracking changes in the mean value of a Gaussian distribution. The statistical distribution of the residuals in non faulty condition is characterized by experimental data of a full-scale bearing-rotor system. Verification of the detection performance is done through simulated data of a nonlinear model of the magnetic bearing calibrated against the real system.

General information
State: Published
Organisations: Department of Electrical Engineering, Automation and Control, Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Authors: Nagel, L. (Ekstern), Galeazzi, R. (Intern), Voigt, A. J. (Intern), Santos, I. (Intern)
Pages: 540-547
Publication date: 2016

Feasibility study of injection mouldable conductive plastic for the hearing aid applications

Electrically conductive polymers can combine the advantage of plastic processing with the unique electrical properties which are usually found in metals. This article presents a feasibility study of an electrically conductive plastic for hearing aid antennas. Focus will be placed to critically analyse the electrical properties of the potential conductive plastic in a two component injection moulding process chain. The purpose of this experimental study is to mimic the real scenario in a hearing aid device and conclude the antenna’s efficiency based on the results obtained with OTA (over the air) 3D measuring system in comparison with an ideal copper antenna at 2.4 GHz. An analysis of the association between the conductive plastic processing parameters in regards to its electrical performance is discussed and evaluated.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, Technical University of Denmark, GN Store Nord
Authors: Merca, T. D. (Ekstern), Lindberg, T. (Ekstern), Islam, A. (Intern)
Pages: 4
Publication date: 2016
Finite strain analyses of deformations in polymer specimens

Analyses of the stress and strain state in test specimens or structural components made of polymer are discussed. This includes the Izod impact test, based on full 3D transient analyses. Also a long thin polymer tube under internal pressure has been studied, where instabilities develop, such as bulging or necking. An axisymmetric bulge develops on the tube followed by necking in the bulge, and neck propagation is observed in both the circumferential and the axial directions. Analyses of indentation tests have been carried out, with focus on the effect of the material parameters characterizing viscoplastic flow on the indentation response. Also, the ability of the simpler expanding spherical cavity model to reproduce the trends from the 3D finite element solutions has been assessed.
Framework for measuring the sustainability performance of ecodesign implementation

Companies and academic studies are consistently reporting several potential business benefits gained from ecodesign implementation, such as increased innovation potential, development of new markets and business models, reduction in environmental liability, risks and costs, improvement of organizational brand and legal compliance, among others. However, there is a number of challenges that still hamper corporate adoption of ecodesign, mainly regarding the capture and measurement of the estimated business benefits. Furthermore, ecodesign efforts have been primarily evaluated in terms of environmental performance and product-related (technical) measures, such as shape, material and energy consumption. Because the ecodesign business benefits go beyond the pure environmental performance and its implementation should follow a consistent process-oriented integration, an approach based on the triple bottom line and focused on the managerial perspective is required to deriving a consistent business case for ecodesign.

This research aims at proposing a simulation-based framework geared towards laying out the fundamental rationale of the business case for ecodesign implementation. The study particularly builds upon the EcodesignMaturity Model (EcoM2), a management framework that offers a systematic, step-by-step approach for the integration of ecodesign into product development processes. With more than 600 ecodesign practices systematized and organized according to maturity levels, the EcoM2 offers an application method with 4 steps, organized in two phases (Figure 1). The simulation framework draws upon the current and desired capabilities of ecodesign practices, and offers an integrative outlook into how capability building will potentially affect corporate indicators over time, such as revenue, market share, expenses, risk, employee productivity, among others. It is expected that decision makers use the business case simulator to assess the potential benefits of ecodesign and test multiple scenarios (what-if questions) with a view to deriving more robust implementation policies, in alignment with corporate sustainability strategy and main drivers.

General information

State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Rodrigues, V. P. (Intern), Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
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Publication date: 2016
Main Research Area: Technical/natural sciences
Electronic versions:
Sustain2016abstract_Rodrigues_Pigosso_McAloone.pdf
Free-form nanostructured tools for plastic injection moulding

We present results on a recently developed process to provide nanostructured surfaces on curved free-form injection moulding tools. The nanostructures are prepared using a sol-gel type coating, which can be applied by various means. Nanostructures are transferred from master structures originated typically by lithography. The nanostructures are imprinted by means of flexible stamps. After imprinting, nanostructures in the sol-gel are cured by baking, by which the material is converted to a quartz-like substance. Line patterns with depths up to about 500 nm and aspect ratio of up to 1 have been realized and successfully transferred to plastic parts during injection moulding. As an example, we present theory and results regarding the imprint of pillar nanostructures on a semi-spherical mold surface, followed by injection moulding of the same. The deformation of the flexible stamp is characterized by measurement of inter-pillar distance on various points on the sphere, and compared to predictions provided by a geometrical model. Moulded plastic parts show good replication of the pillar structure. There are various practical advantages to the new process: the application of the coating is possible on both flat, single-curved and double-curved surfaces; the coating and the baking step is compatible with typical steel types in common usage for injection moulding; the coating is conformal with a relativity high surface roughness up to Ra ≤ 100 nm, accommodating several surface finishing methods such as fine milling and diamond polishing; the coating has slightly insulating properties, which improves the nanostructure transfer properties compared to metal nanostructures; several durability studies have shown that the nanostructures on the injection moulding tool surface are unaffected for at least 100,000 injection moulding cycles; the imprinting of nanostructures has been successfully attempted with several types of thermoplastic polymer, including PS, ABS, PE, PP, COC (Topaz), and PA (Nylon), showing that most polymers are compatible, while some may require an increase in mold temperature for full transfer of nanostructure depth. In conclusion, the process for nanostructured surfaces on double-curved or free-form injection moulding tools relies on flexible stamps, giving rise to predictable deformation of the pattern. The sol-gel process provides for a durable tool with accommodation of imperfect injection tool surface.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Micro- and Nanotechnology, Polymer Micro & Nano Engineering, Technical University of Denmark, Nanyang Technological University, InMold Biosystems A/S
Authors: Kafka, J. (Ekstern), Sonne, M. R. (Intern), Lam, Y. C. (Ekstern), Matschuk, M. (Ekstern), Pranov, H. (Ekstern), Taboryski, R. J. (Intern), Kofod, G. (Ekstern)
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Friction Compensation in the Upsetting of Cylindrical Test Specimens

This manuscript presents a combined numerical and experimental methodology for determining the stress-strain curve of metallic materials from the measurements of force and displacement obtained in the axial compression of cylindrical test specimens with friction between the specimens and the platens. The methodology is based on minimizing the error between the average surface pressure obtained from the experimental measurements of the force and displacement and that obtained from the slab method of analysis of metal plasticity. Three different friction models based on Coulomb friction, the constant friction model or combined friction models are utilized. Experimental results obtained from cylindrical and Rastegaev test specimens with different lubricants combined with the experimental determination of friction by means of ring compression tests allows compensating the effect of friction in the determination of the material flow curve. Comparison with the flow curves determined without friction compensation shows the viability of the proposed methodology. The proposed methodology is a simple and effective alternative to other solutions available in the literature and the pseudo-code supplied in the Appendix is provided for those readers interested in utilizing the associated numerical algorithm for determining the stress strain curves of metallic materials.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Instituto Superior Técnico
Authors: Christiansen, P. (Intern), Martins, P. A. F. (Ekstern), Bay, N. O. (Intern)
Pages: 1271–1279
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Main Research Area: Technical/natural sciences
From mechatronic systems to cyber-physical systems: Demands for a new design methodology?

Mechatronics may be defined as an interdisciplinary field of engineering science which aims to mutually integrate and interconnect mechanical engineering, electrical engineering/electronics and computer science (also often called...
Gate Design in Injection Molding of Microfluidic Components Using Process Simulations

Just as in conventional injection molding of plastics, process simulations are an effective and interesting tool in the area of microinjection molding. They can be applied in order to optimize and assist the design of the microplastic part, the mold, and the actual process. Available simulation software is however actually made for macroscopic injection molding. By means of the correct implementation and careful modeling strategy though, it can also be applied to microplastic parts, as it is shown in the present work. Process simulations were applied to two microfluidic devices (a microfluidic distributor and a mixer). The paper describes how the two devices were meshed in the simulations software to obtain a proper simulation model and where the challenges arose. One of the main goals of the simulations was the investigation of the filling of the parts. Great emphasis was also on the optimization of selected gate designs for both plastic parts. Subsequently, the simulation results were used to answer the question which gate design was the most appropriate with regard to the process window, polymer flow, and part quality. This finally led to an optimization of the design and the realization of this design in practice as actual steel mold. Additionally, the simulation results were critically discussed and possible improvements and limitations of the gained results and the deployed software were described. Ultimately, the simulation results were validated by cross-checking the flow front behavior of the polymer flow predicted by the simulation with the actual flow front at different time steps. These were realized by molding short shots with the realized molds and were compared to the simulations at the global, i.e., part level and at the local, i.e., feature level.
**General Friction Model Extended by the Effect of Strain Hardening**

An extension to the general friction model proposed by Wanheim and Bay [1] to include the effect of strain hardening is proposed. The friction model relates the friction stress to the fraction of real contact area by a friction factor under steady state sliding. The original model for the real contact area as function of the normalized contact pressure is based on slip-line analysis and hence on the assumption of rigid-ideally plastic material behavior. In the present work, a general finite element model is established to, firstly, reproduce the original model under the assumption of rigid-ideally plastic material, and secondly, to extend the solution by the influence of material strain hardening. This corresponds to adding a new variable and, therefore, a new axis to the general friction model. The resulting model is presented in a combined function suitable for e.g. finite element modeling of friction in metal forming, where the material generally strain hardens. The extension of the model to cover strain hardening materials is validated by comparison to previously published experimental data.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universidade de Lisboa
Authors: Nielsen, C. V. (Intern), Martins, P. A. (Ekstern), Bay, N. (Intern)
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**Generalization of first-principles thermodynamic model: Application to hexagonal close-packed ε-Fe₃N**

A complete first-principles thermodynamic model was developed and applied to hexagonal close-packed structure ε-Fe₃N. The electronic structure was calculated using density functional theory and the quasiharmonic phonon approximation to determine macroscopic thermodynamic properties at finite temperatures was generalized in terms of the partition function for any lattice of interest. Specially, thermal expansion of the hexagonal close-packed ε phase with two independent lattice parameters was studied by means of the present model and first-principles phonon calculations. The present predictions of thermal expansion of ε-Fe₃N are in good agreement with experimental data.

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Pennsylvania State University
Authors: Bakkedal, M. B. (Intern), Shang, S. L. (Ekstern), Liu, Z. (Ekstern), Somers, M. A. J. (Intern)
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Web of Science (2015): Indexed yes
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Web of Science (2014): Indexed yes
Green Fiber Bottle: the fully biodegradable packaging

The ambition of the Green Fiber Bottle (GFB) project is to manufacture a fully biodegradable bottle. Carlsberg is the intended end user, and they aim to package their beer in the new bottle. The new product is intended to replace the existing plastic and glass bottles, and thus reducing their impact on the environment, especially the oceans. For example, the life span of a plastic bottle in the ocean is 500 years, and during its degradation, the plastic is reduced to micro pieces, which causes the starvation of several marine animals.

The new bottle is completely made from molded paper pulp, which is a renewable resource. Nevertheless, due to food and drugs limitations, only virgin paper fibers must be employed in the production. The bottle could then be left to biodegrade in nature or enter a recycle system, along with other paper-based product. In order to contain the liquid, the bottle has to have an inner coating barrier. The most reliable solution proposed is to coat the inner walls with silicon dioxide, which is not biodegradable but rather environmentally inert.

To enhance the environmental footprint and sustainability of the bottle, and to be competitive with the existing technologies, the manufacturing technology for the production of the bottle has to offer the possibility of significant energy savings. Molded pulp products are made from wood fibers dispersed in water, and then they are formed, drained and
dried. A relatively large quantity of resources (i.e. energy and time) is consumed during the drying process. It is in this
process stage that an innovative way of drying the products can be exploited by using the concept of impulse drying.
Impulse drying is an advance drying technique in which water is removed from a wet paper pulp by the combination of
mechanical pressure and intense heat. In this process, the wet pulp is exposed to pressures ranging from 30 bar to 50 bar
and temperatures typically between 200 °C and 400 °C. At these intense conditions, the wet pulp is dried in the order of
seconds.

Many challenges must be dealt with to enable the use of such improvement in the production of the GFB. One of the
research topics currently under investigation is the understanding and modelling of the impulse drying effect. Experimental
evidence proves that a part of the liquid content in the paper pulp transforms into steam, and the correlated expansion
eases the movement of the water out of the product. This secondary effect should be at the base of the reason why the
drying takes place in a considerable short time. Nevertheless, a complete understanding of the phenomena has not been
achieved, and thus a complete control of the drying mechanism is yet to be realized. The need of a physical model is thus
clear in order to enable the use of impulse drying in a production environment.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Didone, M. (Intern), Tosello, G. (Intern)
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Growth-Prediction Model for Blue Mussels (Mytilus edulis) on Future Optimally Thinned Farm-Ropes in Great Belt
(Denmark)
A recently developed BioEnergetic Growth (BEG) model for blue mussels (Mytilus edulis), valid for juvenile mussels, has
been further developed to an ‘extended model’ and an alternative ‘ad hoc BEG model’ valid for post-metamorphic
mussels, where the latter accounts for changing ambient chl a concentration. It was used to predict the growth of M. edulis
on optimally thinned farm-ropes in Great Belt (Denmark), from newly settled post-metamorphic mussels of an initial shell
dee size of 0.8 mm to marketable juvenile 30–35 mm ‘mini-mussels’. Such mussels will presumably in the near future be
introduced as a new Danish, smaller-sized consumer product. Field data for actual growth (from Day 0 = 14 June 2011)
showed that size of ‘mini-mussel’ was reached on Day 109 (Oct 1) and length 38 mm on Day 178 (Dec 9) while the
corresponding predictions using the extended model were Day 121 (Oct 13) and Day 159 (Nov 20). Similar results were
obtained by use of the ad hoc BEG model which also demonstrated the sensitivity of growth prediction to levels of chl a
concentration, but less to temperature. The results suggest that it is possible (when the conditions are optimal, i.e., no
intraspecific competition ensured by sufficient thinning) to produce ‘mini-mussels’ in Great Belt during one season, but not
the usual marketable 45-mm mussels. We suggest that the prediction model may be used as a practical instrument to
evaluate to what degree the actual growth of mussels on farm ropes due to intraspecific competition may deviate from the
potential (optimal) growth under specified chl a and temperature conditions, and this implies that the effect of thinning to
optimize the individual growth by eliminating intraspecific competition can be rationally evaluated.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, University of
Southern Denmark
Authors: Larsen, P. S. (Intern), Riisgård, H. (Ekstern)
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Article number: 42
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Heat exchanger selection and design analyses for metal hydride heat pump systems

This study presents a design analysis for the development of highly efficient heat exchangers within stationary metal hydride heat pumps. The design constraints and selected performance criteria are applied to three representative heat exchangers. The proposed thermal model can be applied to select the most efficient heat exchanger design and provides outcomes generally valid in a pre-design stage. Heat transfer effectiveness is the principal performance parameter guiding the selection analysis, the results of which appear to be mildly (up to 13%) affected by the specific Nusselt correlation used. The thermo-physical properties of the heat transfer medium and geometrical parameters are varied in the sensitivity analysis, suggesting that the length of independent tubes is the physical parameter that influences the performance of the heat exchangers the most. The practical operative regions for each heat exchanger are identified by finding the conditions over which the heat removal from the solid bed enables a complete and continuous hydriding reaction. The most efficient solution is a design example that achieves the target effectiveness of 95%. Copyright (C) 2016, Hydrogen Energy Publications, LLC. Published by Elsevier Ltd. All rights reserved.
High accuracy and precision micro injection moulding of thermoplastic elastomers micro ring production

The mass-replication nature of the process calls for fast monitoring of process parameters and product geometrical characteristics. In this direction, the present study addresses the possibility to develop a micro manufacturing platform for micro assembly injection moulding with real-time process/product monitoring and metrology. The study represent a new concept yet to be developed with great potential for high precision mass-manufacturing of highly functional 3D multi-material (i.e. including metal/soft polymer) micro components. The activities related to HINMICO project objectives proves the importance of using tool geometries as reference calibrated artefacts to establish effective process technology development and control. The results allow identifying the correct process windows for optimal part quality reducing product dimensional variation in the micrometer dimensional range. The proposed metrological approach enabled to quantify product dimensional variations based on process and tooling capabilities.
High frequency pulse anodising of magnetron sputtered Al–Zr and Al–Ti Coatings

High frequency pulse anodising of Al–Zr and Al–Ti coatings is studied as a surface finishing technique and compared to conventional decorative DC anodising. The Al–Zr and Al–Ti coatings were deposited using DC magnetron sputtering and were heat treated after deposition to generate a multiphase microstructure with Al3Zr and Al3Ti intermetallic phases in α-Al matrix. The effect of the Zr/Ti content and the anodising potential on the anodising rate, the optical appearance and the microstructure is investigated. Characterisation of the surfaces was performed using transmission electron microscopy, grazing incidence X-ray diffraction and the optical appearance was quantified using an integrating sphere-spectrometer setup. The anodising rate and the surface reflectance of the anodised surfaces were found to be increasing with anodising potential. Anodised layer was more homogeneous in terms of degree of oxidation of the intermetallic phases for high frequency pulse anodising when compared to conventional DC anodising.

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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Danish Technological Institute
Authors: Gudla, V. C. (Intern), Bordo, K. (Intern), Engberg, S. (Intern), Rechendorff, K. (Ekstern), Ambat, R. (Intern)
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High temperature absorption compression heat pump for industrial waste heat

Heat pumps are currently receiving extensive interest because they may be able to support the integration of large shares of fluctuating electricity production based on renewable sources, and they have the potential for the utilization of low temperature waste heat from industry. In most industries, the needed temperature levels often range from 100°C and up, but until now, it has been quite difficult to find heat pump technologies that reach this level, and thereby opening up the large-scale heat recovery in the industry. Absorption compression heat pumps can reach temperatures above 100°C, and they have proved themselves a very efficient and reliable technology for applications that have large temperature changes on the heat sink and/or heat source. The concept of Carnot and Lorenz efficiency and its use in the analysis of system integration is shown. A 1.25 MW system having a Carnot efficiency higher than 82% by the better temperature match of the process to the heat sink and source is reported. Another major benefit of using ammonia and water as working pair is the possibility of reaching quite high temperatures at a significantly lower operating pressure, which makes it possible to reach a temperature of 108°C using standard industrial refrigeration equipment as described in the three included realized systems.

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Organizations: Department of Mechanical Engineering, Thermal Energy, Danish Technological Institute, Hybrid Energy A/S, Innoterm A/S
Authors: Reinholdt, L. (Ekstern), Horntvedt, B. (Ekstern), Nordtvedt, S. R. (Ekstern), Elmegaard, B. (Intern), Jensen, J. K. (Intern), Lemminger, T. L. (Ekstern)
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High temperature and high pressure gas cell for quantitative spectroscopic measurements

A high temperature and high pressure gas cell (HTPGC) has been manufactured for quantitative spectroscopic measurements in the pressure range 1-200 bar and temperature range 300-1300 K. In the present work the cell was employed at up to 100 bar and 1000 K, and measured absorption coefficients of a CO$_2$-N$_2$ mixture at 100 bar and 1000 K are revealed for the first time, exceeding the high temperature and pressure combinations previously reported. This paper discusses the design considerations involved in the construction of the cell and presents validation measurements compared against simulated spectra, as well as published experimental data. (C) 2015 Elsevier Ltd. All rights reserved.

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Organisations: Department of Mechanical Engineering, Department of Chemical and Biochemical Engineering, CHEC Research Centre
Authors: Christiansen, C. (Intern), Stolberg-Rohr, T. (Intern), Fateev, A. (Intern), Clausen, S. (Intern)
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High Temperature Corrosion on Biodust Firing

The high content of alkali metals and chlorine in biomass gives rise to fouling/slagging and corrosion of heat exchange components, such as superheaters, in biomass fired power plants. Increasing the lifetime of these components, and in addition, preventing unwarranted plant shutdowns due to their failure, requires understanding of the complex corrosion mechanisms, as well as development of materials that are resistant to corrosion under biomass firing conditions, thereby motivating the current work.

To understand the mechanisms of corrosion attack, comprehensive analysis of corrosion products was necessary. In the present work, two complementary methodologies based on analysis of cross sections and plan views were applied to achieve comprehensive characterization of corrosion products. The suitability of these methods for both laboratory scale and full scale corrosion investigations was demonstrated by the combined use of complementary information from microscopy, energy dispersive X-ray spectroscopy and various X-ray diffraction characterization techniques.

In light of the wide variation in operating conditions in biomass fired power plants, systematic and well-controlled, but realistic laboratory scale exposures were carried out to understand the effect of process parameters such as gas phase chemistry, time and temperature variations, on the corrosion process. By conducting corrosion exposures under: oxidizing, oxidizing-chlorinating, oxidizing-sulphidizing and oxidizing-chlorinating-sulphidizing gas mixtures, it was possible to observe the contributions of chlorination, sulphation and sulphidation on the complex corrosion mechanisms. Comparative exposure of KCl-coated and KCl-free samples under each of the gas atmospheres revealed that the corrosion attack due to the presence of a deposit overrules the effect of the gas phase chemistry. Further, using the oxidizing-chlorinating-sulphidizing gas mixture corresponding to straw-firing conditions, the evolution of corrosion with time and temperature variation was studied. Corrosion attack does not decrease with time after longer exposures under isothermal conditions and is accelerated once the material encounters a higher temperature.

For the investigated austenitic stainless steels, FeCrAl alloys and Ni-based superalloy, the formation of a protective oxide layer that suppressed corrosion attack was not observed. However, it was established that among the alloying elements present in these alloys, Ni exhibits a relatively greater resistance to corrosion attack. Surface modification approaches with the aim to form resistant oxides or coatings on superheater surfaces were evaluated. This included preoxidation to obtain Al2O3 and Ti-Cr-rich oxides, as well as formation of SiOx coating, Ni electroplating and NiAl coatings on commercial alloys. For most of the modified surfaces, in particular α-Al2O3 obtained by preoxidation, poor mechanical integrity of the oxide layer nullifies its otherwise excellent chemical integrity towards corrosion attack. Nonetheless, corrosion attack on most of the modified surfaces was substantially lower than attack on the virgin alloys. Thus, with further optimization, these approaches may provide alternative corrosion resistant materials for application in biomass fired power plants.
High Throughput Integrated Technologies for Multimaterial Functional Micro Components (EU FP7 HINMICO 2013-2016)

The objective of the HINMICO project is the development and optimization of manufacturing processes for the production of high-added value high quality multi-material micro-components, with the possibility of additional, functionalities, through more integrated, efficient and cost-effective process chains.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Ik4-Tekniker, University of Birmingham, EuroOrthodencia, Mondragon Assembly, Ortofon AS, Tekniker Technological Center, Eibar (Spain), Flann Microwave Limited, French Technical Centre for Plastic and Composites
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Homogenization of long fiber reinforced composites including fiber bending effects
This paper presents a homogenization method, which accounts for intrinsic size effects related to the fiber diameter in long fiber reinforced composite materials with two independent constitutive models for the matrix and fiber materials. A new choice of internal kinematic variables allows to maintain the kinematics of the two material phases independent from the assumed constitutive models, so that stress-deformation relationships, can be expressed in the framework of hyper-elasticity and hyper-elastoplasticity for the fiber and the matrix materials respectively. The bending stiffness of the reinforcing fibers is captured by higher order strain terms, resulting in an accurate representation of the micro-mechanical behavior of the composite. Numerical examples show that the accuracy of the proposed model is very close to a non-homogenized finite-element model with an explicit discretization of the matrix and the fibers.

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State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Poulios, K. (Intern), Niordson, C. F. (Intern)
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House Owners' Interests and Actions in Relation to Indoor Temperature, Air Quality and Energy Use

In order to make better and more realistic predictions of energy consumption in dwellings, more knowledge is needed about how individuals and households control the indoor environment. A questionnaire survey was conducted with the objective of studying the interest and actions taken in relation to indoor temperature, air quality and energy consumption by Danish house owners living in single-family detached houses with district heating. The house owners state that they are interested in, and concerned about, the indoor temperature and air quality and that it is an important element in caring for each other in the family. Actions are taken in relation to the temperature in the way that house owners are trying to keep different temperatures in differently heated rooms, e.g. to sleep in a cool bedroom or to save heat. Besides they wear warmer clothing, slippers or thick socks indoors during the winter compared with the rest of the year. Actions are taken to improve the air quality by the majority of the house owners by opening windows. The most frequent reasons for opening windows once or several times a day was “to get fresh air” and “in relation to showering”. House owners are interested in saving energy for the sake of the environment and for their own economy, and quite a lot of households indicate that they know their own energy consumption, though only few follow it closely. Thus being concerned about energy is not necessarily related to an interest in detailed feedback on one’s own energy consumption. Results show that well-planned communication about feedback possibilities is important. Women and men answer slightly differently to some of the questions, e.g. women are more active in airing, and they wear warmer clothing, whereas men are more actively following their energy consumption.

How to evaluate the environmental performance of Product/Service-Systems (PSS)?

Popular concepts such as “circular economy”, “sharing economy”, and “service economy”, often promote that more sustainable businesses can be created when offering product performance (e.g. lighting as a service) rather than selling products (e.g. light bulbs). These types of offerings are often termed Product/Service-Systems (PSS). However, offering or buying a PSS does not necessarily lead to environmental improvements, as highlighted by several examples (such as car sharing). Due to a set of challenges with the current methodologies, the actual environmental performance of PSS is traditionally rarely quantified. The guidelines developed in this research (Figure 1) are intended to support studies that aim to explore if or when a PSS is leading to environmental improvements.

The guidelines are built on Life Cycle Assessment (LCA) and can be applied at different stages and by different users, e.g. designers and decisionmakers. They aim at guiding the user to perform a study, where the environmental performance of a PSS is objectively evaluated and quantified; taking a holistic perspective when comparing different options for needs fulfilment. Focus is on analysing the environmental impact changes when a PSS is compared to a reference system.
How to mature the abilities of companies to a successful transition to Circular Economy?

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Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
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Hull-Propeller Interaction and Its Effect on Propeller Cavitation
In order to predict the required propulsion power for a ship reliably and accurately, it is not sufficient to only evaluate the resistance of the hull and the propeller performance in open water alone. Interaction effects between hull and propeller can even be a decisive factor in ship powering prediction and design optimization. The hull-propeller interaction coefficients of effective wake fraction, thrust deduction factor, and relative rotative efficiency are traditionally determined by model tests.

Self-propulsion model tests consistently show an increase in effective wake fractions when using a Kappel propeller (propellers with a tip smoothly curved towards the suction side of the blade) instead of a propeller with conventional geometry. The effective wake field, i.e. the propeller inflow when it is running behind the ship, but excluding the propeller-induced velocities, can not be measured directly and only its mean value can be determined experimentally from self-propulsion tests.

In the present work the effective wake field is computed using a hybrid simulation method, known as RANS-BEM coupling, where the flow around the ship is computed by numerically solving the Reynolds-averaged Navier–Stokes equations, while the flow around the propeller is computed by a Boundary Element Method. The velocities induced by the propeller working behind the ship are known explicitly in such method, which allows to directly compute the complete effective flow field by subtracting the induced velocities from the total velocities. This offers an opportunity for additional insight into hull-propeller interaction and the propeller's actual operating condition behind the ship, as the actual (effective) inflow is computed.

Self-propulsion simulations at model and full scale were carried out for a bulk carrier, once with a conventional propeller, and once with a Kappel propeller. However, in contrast to the experimental results, neither a significant difference in effective wake fraction nor other notable differences in effective flow were observed in the simulations. It is therefore concluded that the differences observed in model tests are not due to the different radial load distributions of the two propellers. One hypothesis is that the differences are a consequence of the geometry of the vortices shed from the propeller blades. The shape and alignment of these trailing vortices were modeled in a relatively simple way, which presumably does not reflect the differences between the propellers sufficiently.

Obtaining effective wake fields using the hybrid RANS-BEM approach at model and full scale also provides the opportunity to investigate the behind-ship cavitation performance of propellers with comparably low computational effort. The boundary element method for propeller analysis includes a partially nonlinear cavitation model, which is able to predict partial sheet cavitation and supercavitation. The cavitation behaviour of the conventional propeller and the Kappel propeller from the earlier simulations was investigated in the behind-ship condition using this model, focusing on the influence of the velocity distribution of the inflow field. Generally, the results agree well with experiments and the calculations are able to reproduce the differences between conventional and Kappel propellers seen in previous experiments. Nominal and effective wake fields at model and full scale were uniformly scaled to reach the same axial wake fraction, so that the only difference lies in the distribution of axial of velocities and in-plane velocity components. Calculations show that details of the velocity distribution have a major effect on propeller cavitation, signifying the importance of using the correct inflow, i.e. the effective wake field when evaluating propeller cavitation performance.
Humidity Build-Up in a Typical Electronic Enclosure Exposed to Cycling Conditions and Effect on Corrosion Reliability
The design of electronic device enclosures plays a major role in determining the humidity build-up inside the device as a response to the varying external humidity. Therefore, the corrosion reliability of electronic devices has direct connection to the enclosure design. This paper describes the internal humidity build-up in a typical enclosure prescribed for electronic applications as a function of external humidity conditions and enclosure-related parameters. Investigated parameters include external temperature and humidity conditions, the temperature and time of the internal heating cycle, thermal mass, and port/opening size. The effect of the internal humidity build-up on corrosion reliability has been evaluated by measuring the leakage current (LC) on interdigitated test comb patterns, which are precontaminated with sodium chloride and placed inside the enclosure. The results showed that the exposure to cycling temperature causes significant change of internal water vapor concentration. The maximum value of humidity reached was a function of the opening size and the presence of thermal mass inside the enclosure. A pumping effect was observed due to cycling temperature, and the increase in the level of absolute humidity at each cycle led to condensation, which caused a sudden increase in LC.
Hybrid damper with stroke amplification for damping of offshore wind turbines

The magnitude of tower vibrations of offshore wind turbines is a key design driver for the feasibility of the monopile support structure. A novel control concept for the damping of these tower vibrations is proposed, where viscous-type hybrid dampers are installed at the bottom of the wind turbine tower. The proposed hybrid damper consists of a passive viscous dashpot placed in series with a load cell and an active actuator. By integrated force feedback control of the actuator motion, the associated displacement amplitude over the viscous damper can be increased compared with the passive viscous case, hereby significantly increasing the feasibility of viscous dampers acting at the bottom of the wind turbine tower. To avoid drift in the actuator displacement, a filtered time integration of the measured force signal is introduced. Numerical examples demonstrate that the filtered time integration control leads to performance similar to that of passive viscous damping and substantial amplification of the damper deformation without actuator drift. Copyright © 2016 John Wiley & Sons, Ltd.
Hybrid viscous damper with filtered integral force feedback control

In hybrid damper systems active control devices are usually introduced to enhance the performance of otherwise passive dampers. In the present paper a hybrid damper concept is comprised of a passive viscous damper placed in series with an active actuator and a force sensor. The actuator motion is controlled by a filtered integral force feedback strategy, where the main feature is the filter, which is designed to render a damper force that in a phase-plane representation operates in front of the corresponding damper velocity. It is demonstrated that in the specific parameter regime where the damper force leads velocity the control is stable and yields a significant improvement in damping performance compared to the pure viscous damper.

General information
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Authors: Høgsberg, J. (Intern), Brodersen, M. L. (Intern)
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Hydrogen Silsesquioxane based silica glass coatings for the corrosion protection of austenitic stainless steel

The application of stainless steels in hostile environments, such as concentrated acid or hot sea water, requires additional surface treatments, considering that the native surface oxide does not guarantee sufficient corrosion protection under these conditions. In the present work, silica-like thin-film barrier coatings were deposited on AISI 316L grade austenitic stainless steel with 2B surface finish from Hydrogen Silsesquioxane (HSQ) spin-on-glass precursor and thermally cured to tailor the film properties. Results showed that curing at 500 °C resulted in a film-structure with a polymerized siloxane backbone and a reduced amount of Si-H moieties. The coatings showed good substrate coverage and the average thickness was between 200 and 400 nm on the rough substrate surface, however, film thicknesses of > 1400 nm were observed at substrate defects. Deposition of these films significantly improved the barrier-properties by showing a 1000 times higher modulus while an ionic transport over the coating was also observed.
HySDeP: a computational platform for on-board hydrogen storage systems – hybrid high-pressure solid-state and gaseous storage

A computational platform is developed in the Modelica® language within the Dymola™ environment to provide a tool for the design and performance comparison of on-board hydrogen storage systems. The platform has been coupled with an open source library for hydrogen fueling stations to investigate the vehicular tank within the frame of a complete refueling system. The two technologies that are integrated in the platform are solid-state hydrogen storage in the form of metal hydrides and compressed gas systems. In this work the computational platform is used to compare the storage performance of two tank designs based on the tubular tank configuration with Ti1.1CrMn as the absorbing alloy. Results show that a shell and tube layout with metal hydride tubes of 2 mm inner diameter achieves the desired refueling time of 3 min and store a maximum of 3.1 kg of hydrogen in a 126 L tank, corresponding to a storage capacity four times larger than a tube-in-tube solution of the same size. The volumetric and gravimetric densities of the shell and tube are 2.46% and 1.25% respectively. The dehydriding ability of this solution is proven to withstand intense discharging conditions.

Identification of Parameters in Active Magnetic Bearing Systems

A method for identifying uncertain parameters in Active Magnetic Bearing (AMB) based rotodynamic systems is introduced and adapted for experimental application. The Closed Loop Identification (CLI) method is utilised to estimate the current/force factors $K_i$ and the displacement/force factors $K_s$ as well as a time constant $T_e$ for a first order approximation of unknown actuator dynamics. To assess the precision with which CLI method can be employed to estimate AMB parameters the factors $K_i$, estimated using the CLI method, is compared to $K_i$ factors attained through a Static
Loading(SL) method. The CLI method and SL method produce similar results, indicating that the CLI method is able to perform closed loop identification of uncertain AMB parameters.

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Authors: Lauridsen, J. S. (Intern), Voigt, A. J. (Intern), Mandrup-Poulsen, C. (Intern), Nielsen, K. K. (Ekstern), Santos, I. (Intern)
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In Situ Techniques for the Investigation of the Kinetics of Austenitization of Supermartensitic Stainless Steel
The austenitization and inter-critical annealing of X4CrNiMo16-5-1 (1.4418) supermartensitic stainless steel were investigated in-situ with synchrotron X-ray diffraction (XRD), dilatometry and differential scanning calorimetry (DSC) under isochronal heating conditions. Austenitization occurred in two stages: the austenitization started at approx. 600 °C, decelerated at approx. 700 °C at 60 to 75 v.% of transformed austenite, and first resumed after heating for approx. 100 °C. This plateau in the transformation curve was more dominant for faster heating rates. Intercritical annealing at 675 and 700 °C revealed, that austenite cannot be stabilized to room-temperature. There was good agreement for the transformation curves yielded by dilatometry and XRD. Some deviation occurred due to the different applied heating principles, different temperature monitoring and the impact of surface martensite formation on the XRD measurement. The applicable temperature range for DSC as well as the close proximity of the $A_{c1}$- and the Curietemperature limited the usage of the technique in the present case.

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Organisations: Centre for oil and gas – DTU, Department of Mechanical Engineering, Materials and Surface Engineering, Helmholtz-Zentrum für Materialien und Energie, University of Rostock
Authors: Nießen, F. (Intern), Villa, M. (Intern), Apel, D. (Ekstern), Keßler, O. (Ekstern), Reich, M. (Ekstern), Hald, J. (Intern), Somers, M. A. J. (Intern)
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Impact of groyne fields on the littoral drift: A hybrid morphological modelling study

This paper concerns numerical modelling of the impact on the littoral drift and the shoreline from groynes forming a field of equidistant and identical groynes. The most important effect of a groyne on the shoreline morphology is that the littoral drift is blocked completely or partially. A local reduction in the littoral drift around the groyne introduces alongshore gradients in the alongshore sediment transport and sedimentation and erosion around the groyne which will cause re-orientation of the bed contours towards the prevailing wave direction until an equilibrium is reached. A discussion of this mechanism is presented including effects of scales, e.g. the effect of the relative length of the groynes (compared to the width of the surf zone). The model results indicate a strong dependency of the reduction in littoral drift on the initial geometric bypass ratio \( Q_{geo} \), which is defined from the groyne length and the littoral transport on the undisturbed coastline \( Q_{geo} \). The transport occurring outside the tip of the groynes divided by the total transport. It is found that the sensitivity of the littoral drift to variations in groyne spacing and the angle, of the approaching waves, is inversely proportional to \( Q_{geo} \).

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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, DHI Denmark
Importance of Vanadium-Catalyzed Oxidation of SO₂ to SO₃ in Two-Stroke Marine Diesel Engines

Low-speed marine diesel engines are mostly operated on heavy fuel oils, which have a high content of sulfur and ash, including trace amounts of vanadium, nickel, and aluminum. In particular, vanadium oxides could catalyze incylinder oxidation of SO₂ to SO₃, promoting the formation of sulfuric acid and enhancing problems of corrosion. In the present work, the kinetics of the catalyzed oxidation was studied in a fixed-bed reactor at atmospheric pressure. Vanadium oxide nanoparticles were synthesized by spray flame pyrolysis, i.e., by a mechanism similar to the mechanism leading to the formation of the catalytic species within the engine. Experiments with different particle compositions (vanadium/sodium ratio) and temperatures (300–800 °C) show that both the temperature and sodium content have a major impact on the oxidation rate. Kinetic parameters for the catalyzed reaction are determined, and the proposed kinetic model fits well with the experimental data. The impact of the catalytic reaction is studied with a phenomenological zero-dimensional (0D) engine model, where fuel oxidation and SOX formation is modeled with a comprehensive gas-phase reaction mechanism. Results indicate that the oxidation of SO₂ to SO₃ in the cylinder is dominated by gas-phase reactions and that the vanadium-catalyzed reaction is at most a very minor pathway.
Improved blade element momentum theory for wind turbine aerodynamic computations

Blade element momentum (BEM) theory is widely used in aerodynamic performance predictions and design applications for wind turbines. However, the classic BEM method is not quite accurate which often tends to under-predict the aerodynamic forces near root and over-predict its performance near tip. The reliability of the aerodynamic calculations and design optimizations is greatly reduced due to this problem. To improve the momentum theory, in this paper the influence of pressure drop due to wake rotation and the effect of radial velocity at the rotor disc in the momentum theory are considered. Thus the axial induction factor in far downstream is not simply twice of the induction factor at disc. To calculate the performance of wind turbine rotors, the improved momentum theory is considered together with both Glauert's tip correction and Shen's tip correction. Numerical tests have been performed for the MEXICO rotor. Results show that the improved BEM theory gives a better prediction than the classic BEM method, especially in the blade tip region, when comparing to the MEXICO measurements. (C) 2016 Elsevier Ltd. All rights reserved.

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Organisations: Department of Energy Engineering, Department of Mechanical Engineering, Department of Wind Energy, Fluid Mechanics, Chongqing University
Authors: Sun, Z. (Ekstern), Chen, J. (Ekstern), Shen, W. Z. (Intern), Zhu, W. J. (Intern)
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Improved design bases of welded joints in seawater

The presented work aims to investigate and establish a precise, thorough and detailed database from series of experimental testing of submerged arc welded, SAW, specimens of various thicknesses typically applied in offshore structures and foundations. Additionally, the testing was performed in two different environments, i.e. under in-air conditions and in a corrosion environment. Welded structures of all sizes and shapes exhibit fatigue failure primarily in the welded region, rather than in the base material, due to imperfections and flaws relating to the welding procedure. The welded region has therefore received much attention from universities, research institutions along with industry as it is of significant practical importance for all fatigue loaded structures, such as e.g. marine structures.

As-welded SAW specimens of three different thicknesses, manufactured by Lindoe Welding Technology A/S and Bladt Industries A/S, were subjected to uni-axial tension loading at relatively high R-ratios in order to simulate tensile residual stresses of yield magnitude. The main goal was to confirm the thickness effect for the specific case of large butt joints in the as-welded condition as well as to validate whether the thickness correction factor according to recommendations, codes and guidelines is too conservative when it comes to butt-welded joints. A conservative thickness effect factor results in larger, heavier and more expensive structures. The thickness effect considers the influence of the plate thickness on the fatigue resistance of welded joints and is generally included in design rules by scaling the fatigue strength with a recommended factor. The existing database of experiments that relate to the thickness effect is comprehensive and the effect is well proven experimentally and theoretically for various types of welded joints. However, in the case of large butt-welded joints there is room for improvement as details, quality and precise data which can influence the fatigue life of the welded joint is often lacking and severely lacking in truly thick joints.

Additionally, as-welded SAW specimens were tested in a corrosion environment with cathodic protection. The specimens were subjected to high fatigue loading at the same stress ratio as the tests performed in-air. A direct comparison to the specimens tested under in-air conditions was performed in order to evaluate the effects of the corrosion environment on fatigue resistance.

Furthermore, novelty 25 mm thick steel laser-hybrid welded specimens in the as-welded condition were subjected to experimental testing. A fatigue resistance S-N curve was established for the laser hybrid welded joints in addition to a more detailed analysis. The laser hybrid welded joints were thereafter compared directly to the traditional SAW specimens in order to investigate the two different welding techniques. The laser hybrid welding technique offers great potential in lowering the cost of energy associated with offshore structures.

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Improved Friction Joint With Self-Locking Grips
Flexible risers are used in the oil industry to transport liquids and gas from the seafloor to extraction and production equipment at the sea surface. Ongoing research aims at using composite materials instead of steel, in order to reduce weight and increase stiffness. Ensuring an optimal load transfer between the composite and metal components is very important. This paper presents an improved method for anchoring a flat fiber reinforced tendon using a double grip system with self-locking grips. The novelty is the combination of new experimental results and finite element (FE) analysis to
develop a superior dry friction grip. Experimental results are carried using a dedicated test setup, through which the test parameters can be accurately controlled. The efficiency of the grip system during pullout is superior to results obtained with flat grips. Numerical results offer an in-depth understanding of the influence between friction, geometrical parameters, and performance, making it possible to optimize the design. Results show that this grip system offers immediate technical applications, in a variety of conditions.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics, Manufacturing Engineering, National Oilwell Varco Denmark I/S
Authors: Costache, A. (Intern), Glejzbøl, K. (Ekstern), Sivebæk, I. M. (Intern), Berggreen, C. (Intern)
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Scopus rating (2010): SJR 0.471 SNIP 1.191
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Scopus rating (2005): SJR 0.57 SNIP 0.757
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Scopus rating (2003): SJR 0.346 SNIP 0.549
Scopus rating (2002): SJR 0.458 SNIP 0.345
**Improved Wave-vessel Transfer Functions by Uncertainty Modelling**

This paper deals with uncertainty modelling of wave-vessel transfer functions used to calculate or predict wave-induced responses of a ship in a seaway. Although transfer functions, in theory, can be calculated to exactly reflect the behaviour of the ship when exposed to waves, uncertainty in input variables, notably speed, draft and relative wave heading, often compromises results. In this study, uncertainty is applied to improve theoretically calculated transfer functions, so they better fit the corresponding experimental, full-scale ones. Based on a vast amount of full-scale measurements data, it is shown that uncertainty modelling can be successfully used to improve accuracy (and reliability) of theoretical transfer functions.

**General information**

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Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Technical University of Denmark, Tokyo University of Marine Science and Technology  
Authors: Nielsen, U. D. (Intern), Fønss Bach, K. (Ekstern), Iseki, T. (Ekstern)  
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**Improvement in Surface Characteristics of Polymers for Subsequent Electroless Plating Using Liquid Assisted Laser Processing**

Metallization of polymers is a widely used process in the electronic industry that involves their surface modification as a pre-treatment step. Laser-based surface modification is one of the commonly used techniques for polymers due to its speed and precision. The process involves laser heating of the polymer surface to generate a rough or porous surface. Laser processing in liquid generates superior surface characteristics that result in better metal deposition. In this study, a
comparison of the surface characteristics obtained by laser processing in water vis-à-vis air along with the deposition characteristics are presented. In addition, a numerical model based on the finite volume method is developed to predict the temperature profile during the process. Based on the model results, it is hypothesized that physical phenomena such as vapor bubble generation and plasma formation may occur in the presence of water, and it is because of these effects that causes an increase in surface porosity.

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**Improving accuracy of overhanging structures for selective laser melting through reliability characterization of single track formation on thick powder beds**
Repeatability and reproducibility of parts produced by selective laser melting is a standing issue, and coupled with a lack of standardized quality control presents a major hindrance towards maturing of selective laser melting as an industrial scale process. Consequently, numerical process modelling has been adopted towards improving the predictability of the outputs from the selective laser melting process. Establishing the reliability of the process, however, is still a challenge, especially in components having overhanging structures. In this paper, a systematic approach towards establishing reliability of overhanging structure production by selective laser melting has been adopted. A calibrated, fast, multiscale thermal model is used to simulate the single track formation on a thick powder bed. Single tracks are manufactured on a thick powder bed using same processing parameters, but at different locations in a powder bed and in different laser scanning directions. The difference in melt track widths and depths captures the effect of changes in incident beam power distribution due to location and processing direction. The experimental results are used in combination with numerical model, and subjected to uncertainty and reliability analysis. Cumulative probability distribution functions obtained for melt track widths and depths are found to be coherent with observed experimental values. The technique is subsequently extended for reliability characterization of single layers produced on a thick powder bed without support structures, by
Improving intrinsic corrosion reliability of printed circuit board assembly

Corrosion reliability is a serious issue today for electronic devices, components, and bare printed circuit boards (PCBs) due to factors such as miniaturization, globalized manufacturing practices, and global usage. Electronic components and devices are exposed to a wide variety of climatic conditions, therefore the protection of electronic devices is becoming a critical factor in system design. Humidity and local condensation inside electronic enclosures can significantly alter the performance of electronic devices. The presence of moisture in a PCB alters its quality, functionality, thermal performance, and thermo-mechanical properties, while condensation on the surface of printed circuit board assemblies (PCBAs) can lead to electrical failures, like electrochemical migration. The result is reduced life span for electronic products and heavy economic loss due to failures.

Improving topology optimization intuition through games

This paper describes the educational game, TopOpt Game, which invites the player to solve various optimization challenges. The main purpose of gamifying topology optimization is to create a supplemental educational tool which can be used to introduce concepts of topology optimization to newcomers as well as train human intuition of topology optimization. The players are challenged to solve the standard minimum compliance problem in 2D by distributing material in a design domain given a number of loads and supports with a material constraint. A statistical analysis of the gameplay
data shows that players achieve higher scores the more they play the game. The game is freely available for the iOS platform at Apple's App Store and at http://www.topopt.dtu.dk/?q=node/909 for Windows and OSX. 

**General information**

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**Organisations:** Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, Department of Mechanical Engineering, Solid Mechanics, Acoustic Technology  
**Authors:** Nobel-Jørgensen, M. (Intern), Malmgren-Hansen, D. (Intern), Bærentzen, J. A. (Intern), Sigmund, O. (Intern), Aage, N. (Intern)  
**Pages:** 775–781  
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BFI (2015): BFI-level 2  
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Web of Science (2013): Indexed yes  
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Scopus rating (2012): CiteScore 2.08  
ISI indexed (2012): ISI indexed yes  
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Scopus rating (2011): CiteScore 1.85  
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Web of Science (2004): Indexed yes  
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Web of Science (2001): Indexed yes
Indentation of pressurized viscoplastic polymer spherical shells

The indentation response of polymer spherical shells is investigated. Finite deformation analyses are carried out with the polymer characterized as a viscoelastic/viscoplastic solid. Both pressurized and unpressurized shells are considered. Attention is restricted to axisymmetric deformations with a conical indenter. The response is analyzed for various values of the shell thickness to radius ratio and various values of the internal pressure. Two sets of material parameters are considered: one set having network stiffening at a moderate strain and the other having no network stiffening until very large strains are attained. The transition from an indentation type mode of deformation to a structural mode of deformation involving bending that occurs as the indentation depth increases is studied. The results show the effects of shell thickness, internal pressure and polymer constitutive characterization on this transition and on the deformation modes in each of these regimes.

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Organisations: Department of Mechanical Engineering, Solid Mechanics, Texas A&M University
Authors: Tvergaard, V. (Intern), Needleman, A. (Ekstern)
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Scopus rating (2016): CiteScore 4.33 SJR 2.155 SNIP 2.048
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Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 2.677 SNIP 2.304 CiteScore 4.7
Web of Science (2014): Indexed yes
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Scopus rating (2013): SJR 2.597 SNIP 2.304 CiteScore 4.43
ISI indexed (2013): ISI indexed yes
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BFI (2012): BFI-level 2
Scopus rating (2012): SJR 2.284 SNIP 2.08 CiteScore 3.5
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 2.865 SNIP 2.267 CiteScore 3.6
ISI indexed (2011): ISI indexed yes
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BFI (2010): BFI-level 2
This paper presents an industrial application of topology optimization for combined conductive and convective heat transfer problems. The solution is based on a synergy of computer aided design and engineering software tools from Dassault Systemes. The considered physical problem of steady-state heat transfer under convection is simulated using SIMULIA-Abaqus. A corresponding topology optimization feature is provided by SIMULIA-Tosca. By following a standard workflow of design optimization, the proposed solution is able to accommodate practical design scenarios and results in efficient conceptual design proposals. Several design examples with verification results are presented to demonstrate the applicability.
Industrial heat pumps for high temperature process applications.: A numerical study of the ammonia-water hybrid absorption-compression heat pump

Industrial processes often consume large quantities of heat, while of-ten dissipating large quantities of waste heat to the ambient. The main energy source for industrial heat supply is fossil fuels, either oil or nat-ural gas. Thus, the heat consumption of industrial processes often entail large CO2 emissions as well as emission of other harmful pollutants. As heat pumps can upgrade low temperature waste heat to a high temperature heat supply using only a fraction of primary energy, heat pumps may be applied to improve the energy efficiency of industrial processes. Further, Replacing oil or gas burners with heat pumps could lead to a reduction of the emissions, especially in a future energy system with a high penetration of renewable energy sources.

Many industrial heat pumps have been installed with a heat supply temperature ranging from 50 - 90 °C. The lack of installation in the temperature domain in excess of 90 °C is believed to be caused by the lack of cost efficient heat pumps, rather than a limited demand. Com-mercial components for industrial heat pumps are limited to a working pressure of 28
bar, although high pressure alternatives do exist for ammonia (50 bar) and CO₂ (140 bar). Most commercial compressors are not durable at compressor discharge temperature above 180 °C. Using these components, vapour compression heat pumps (VCHP) are limited to heat supply temperatures between 80 - 90 °C. Developing heat pumps that are capable of delivering temperatures above 90 °C may therefore allow heat pump implementation in more industrial processes than is currently possible.

The ammonia-water hybrid absorption-compression heat pump (HAC-HP) is of specific interest for development of high temperature heat pumps due to two properties inherent to the zeotropic working fluid: 1. Increased efficiency due to the reduction of thermal irreversibilities in the heat transfer processes between the working fluid and the external streams. 2. The reduction of vapour pressure compared to the vapour pressure of pure ammonia. The HACHP can therefore deliver higher temperatures at higher efficiencies than conventional VCHP.

To investigate the possibility of developing high temperature HACHP, numerical models are developed for the one-stage cycle and several identified two-stage compression configurations. The design of the HAC-HP is governed by two extra degrees of freedom compared to the VCHP. These can be set by many criterion but is in this study set by the choice of the rich ammonia mass fraction and the circulation ratio. The influence of these parameters on the performance and size of the system is investigated. The performance and size of the identified two-stage compression configurations are compared to the one-stage cycle. One two-stage compression cycle performs better than the remaining, both in terms of increased efficiency, reduction of discharge temperature and needed compressor volume.

For the one-stage and the best two-stage cycle the constraints of commercial components are imposed on the choice of rich ammonia mass fraction and the circulation ratio at a number of supply temperatures. This showed that the 28 bar one-stage HACHP allow temperatures up to 111 °C, 50 bar up to 129 °C, and 140 bar up to 147 °C. For the two-stage HACHP, 28 bar components allow temperatures up to 126 °C, 50 bar up to 145 °C, and 140 bar up to 160 °C.

To determine the sources of thermodynamic irreversibilities as well as the formation of cost and environmental impact an advanced exergy-based analysis is applied to the HACHP. An exergy-based analysis consists of three steps: an exergy analysis is conducted to identify the exergy streams in the system and the thermodynamic irreversibilities (exergy destruction). Subsequently, an economic analysis is conducted and combined with the exergy analysis such that cost is associated with each stream of exergy and consequently, the cost of exergy destruction is determined. This is known as an exergoeconomic analysis. Further, a life cycle assessment is performed and combined with the exergy analysis to associate environmental impact to all streams of exergy and thereby determine the environmental impact of exergy destruction. This is known as an exergoenvironmental analysis. The advanced exergy-based analysis differs from the conventional analysis by accounting for component interdependencies as well as reduction potential. The highest rate of avoidable exergy destruction was associated with the desorber while the highest rate of avoidable cost was associated with the absorber. It is found that the cost of most components are evenly distributed between operational and capital investment cost. The highest rate of avoidable environmental impact stems from the compressor. It is shown that the environmental impact of construction, transportation and disposal was negligible compared to the environmental impact related to the operation of the HACHP.

The working domain of the HACHP is investigated by imposing all technical constraints of commercial components to a variation of the heat supply temperature and temperature lift. An economic analysis is applied to the same variation such that the net present value in all points is attained. For all combinations it is evaluated whether the solution complies with the technical and economic constraint (net present value >0) and thus whether the heat pump implementation is feasible. A similar analysis is conducted for VCHP, which allows a comparison, not only on which temperature levels and lift are attainable by the two technologies but also which technology is the more viable solution in the domain where both compete. This showed that the HACHP can be used to heat supply temperatures of 150 °C and temperatures up to 60K. This increases the working domain of industrial heat pump. For the temperature range where the HACHP competes with ammonia VCHP: the HACHP is the most viable solution at low temperature lifts while VCHP are more profitable at high lifts. For the range where the HACHP competes with iso-butane or CO₂ the HACHP is always the more viable solution.
Inertial amplification of continuous structures: Large band gaps from small masses

We investigate wave motion in a continuous elastic rod with a periodically attached inertial amplification mechanism. The mechanism has properties similar to an “inert” typically used in vehicle suspensions, however here it is constructed and utilized in a manner that alters the intrinsic properties of a continuous structure. The elastodynamic band structure of the hybrid rod-mechanism structure yields band gaps that are exceedingly wide and deep when compared to what can be obtained using standard local resonators, while still being low in frequency. With this concept, a large band gap may be realized with as much as twenty times less added mass compared to what is needed in a standard local resonator configuration. The emerging inertially enhanced continuous structure also exhibits unique qualitative features in its dispersion curves. These include the existence of a characteristic double-peak in the attenuation constant profile within gaps and the possibility of coalescence of two neighbouring gaps creating a large contiguous gap.
In this work the suitability of a dual layer membrane, consisting of a non-woven Polypropylene (PP) support and a membrane layer made out of Polystyrene Terephthalate (PET) for Micro Film Insert Molding (μFIM) was investigated. The emergence of blisters at the surface of the PET-membrane layer was observed for some combinations of the process parameters used in this investigation. Since these blisters are not only an optical issue but can also deteriorate the functionality of the membrane, a blister free over moulding of the membrane is required. In particular the mold and the barrel temperature were found to influence this blister creation. The influence of these two parameters on the amount of blisters and the blister height, characterized by the a real surface topography parameters peak material portion (Smr₁) and reduced peak height (Spk), is presented in this paper.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Acoustic Technology, University of Bradford
Authors: Wöhner, T. (Intern), R. Whiteside, B. (Ekstern), Tosello, G. (Intern), Hansen, H. N. (Intern), Islam, A. (Intern)
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Injection molding of micro pillars on vertical side walls using polyether-ether-ketone (PEEK)

This paper investigates the replication of microstructures on a vertical wall by PEEK injection molding. A 4-cavity insert was used in the injection molding. Pre-fabricated nickel plates with ø 4 μm micro holes on the surface were glued on vertical walls in the cavities. 3 cavities were coated by CrN, TiN and TiB2 respectively, the remaining one was not coated as a reference. The effect of coating was compared via the morphology of the micropillars on the polymer parts. 4000 injection molding cycles were repeated. The roughness of the coated surface was measured. The reasons for the demolding result were discussed.

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Authors: Zhang, Y. (Intern), Hansen, H. N. (Intern), Sørensen, S. (Ekstern)
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Injection moulding and selective metallisation technologies for polymer Microsystems
The present paper describes how developing and optimizing high-throughput integrated technologies for the production of miniaturised multi-material and multi-functional components at industrial scale. Based on 2 industrial demonstrators (a band diplexer and a micro aeraulic device), the paper shows that many technologies have to be combined to succeed: injection moulding process, copper plating, laser ablation, laser welding, glue welding...

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, French Technical Centre for Plastic and Composites, Ik4-Tekniker, Flann Microwave Limited, FLOWDIT SAS, Ernst Wittner GmbH, University of Birmingham, Karlsruhe Institute of Technology KIT, Alicona Imaging GmbH
Authors: Tenchine, L. (Ekstern), Gout, S. (Ekstern), Dessors, S. (Ekstern), Azcarate, S. (Ekstern), Tosello, G. (Intern), Calao, M. (Intern), Miller, N. (Ekstern), Brown, B. (Ekstern), Edouard, C. (Ekstern), Müller, T. (Ekstern), Wittner, W. (Ekstern), Prantl, M. (Ekstern), Shang, X. (Ekstern), Batal, A. (Ekstern)
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10.3850/978-981-11-0749-8 688
In-Situ Monitoring in Additive Manufacturing Using Contact Image Sensors

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In-situ TEM investigation of microstructural evolution in magnetron sputtered Al-Zr and Al-Zr-Si coatings during heat treatment

The magnetron sputtered Al–Zr and Al–Zr–Si coatings were heat treated in-situ in a transmission electron microscope as well as ex-situ to observe their annealing behaviour and phase transformations. The samples were heated up to a temperature of 550 °C and then cooled to room temperature. A layered structure with alternating layers of Al and Zr/Si rich Al was found for the as deposited sputter coatings. During in-situ heat treatment, the phases formed in the coatings were analysed using selective area electron diffraction and energy dispersive Xrayspectroscopy. For the Al–Zr sputtered coatings, metastable L1_2 Al_3Zr nucleated initially by splitting of Zr rich Al layers followed by transformation to equilibrium DO_{23} Al_3Zr. Addition of Si to the Al–Zr sputtered coating resulted in the formation of DO_{22} Al_{2.6}Si_{0.4}Zr phase instead of the DO_{23} Al_3Zr phase. The lattice parameters and compositions of different phases formed are measured and presented.

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Center for Electron Nanoscopy, Danish Technological Institute
Authors: Gudla, V. C. (Intern), Rechendorff, K. (Ekstern), Balogh, Z. I. (Intern), Kasama, T. (Intern), Ambat, R. (Intern)
Pages: 1071-1078
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 2.418 SNIP 3.474 CiteScore 4.36
Web of Science (2014): Indexed yes
Integrating Product and Technology Development: A Proposed Reference Model for Dual Innovation

Although dual innovation projects, defined in this article as the concurrent development of products and technologies, often occur in industry, these are only scarcely supported methodologically. Limited research has been done about dual innovation projects and their inherent challenges (e.g. managing dependencies) and opportunities (e.g. streamlining development). This paper presents five existing reference models for technology development (TD), which were identified via a systematic literature review, where their possible integration with product development (PD) reference models was investigated. Based on the specific characteristics desired for dual innovation projects, such as integrated product development and coverage of multiple development stages, a set of selection criteria was employed to select suitable PD and TD reference models. The integration and adaptation of the selected models has led to a proposed integrated reference model for dual innovation that is currently being instantiated in the context of an ongoing action research project.
Integration of large-scale heat pumps in the district heating systems of Greater Copenhagen

This study analyses the technical and private economic aspects of integrating a large capacity of electric driven HP (heat pumps) in the Greater Copenhagen DH (district heating) system, which is an example of a state-of-the-art large district heating system with many consumers and suppliers. The analysis was based on using the energy model Balmorl to determine the optimum dispatch of HPs in the system. The potential heat sources in Copenhagen for use in HPs were determined based on data related to temperatures, flows, and hydrography at different locations, while respecting technical constraints. The Balmorl model was developed further in order to provide a better representation of HPs, for analysing the seasonal variations of COP (Coefficient of Performance), and to represent the difference in performance of HPs connected to either distribution or transmission networks. The optimization yields roughly 3500 FLH (full load hours) for the HPs connected to the DH distribution networks when considering a current scenario. In a zero carbon-dioxide emission scenario expected in year 2025, approximately 4000 FLH, are achieved. In the case where HPs are connected to the DH transmission network at elevated temperatures, their operation decreases by roughly 1000 FLH. No significant impact was found when comparing fixed and varying operation characteristics of the HP.

General information

State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Management Engineering, Department of Applied Mathematics and Computer Science, Dynamical Systems, Technical University of Denmark, EA Energy Analysis A/S
Authors: Bach, B. (Ekstern), Werling, J. (Ekstern), Ommen, T. S. (Intern), Münster, M. (Intern), Morales González, J. M. (Intern), Elmegaard, B. (Intern)
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Web of Science (2017): Indexed yes
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Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798
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Integration of phase change materials in compressed hydrogen gas systems: Modelling and parametric analysis

A dynamic fueling model is built to simulate the fueling process of a hydrogen tank with an integrated passive cooling system. The study investigates the possibility of absorbing a part of the heat of compression in the high latent-heat material during melting, with the aim of saving the monetary and energy resources spent at the refueling station to cool the gas prior to tank filling. This is done while respecting the technical constraint of keeping the walls below the critical temperature of 85°C to ensure the mechanical stability of the storage system even when the gas is fueled at ambient temperature. Results show that a 10-mm-thick layer of paraffin wax can absorb enough heat to reduce the adiabatic temperature by 20 K when compared to a standard Type IV tank, but its influence on the hydrogen peak temperature that
occurs at the end of refueling is modest. The heat transfer from the gas to the phase change material, mainly occurs after
the fueling is completed, resulting in a hydrogen peak temperature higher than 85°C and a lower fueled mass than a gas-
cooled system. Such a mass reduction accounts for 12% with respect to the case of a standard tank system fueled at 40
°C. A parametric analysis that embraces the main thermal properties of the heat-absorbing material as well as the major
design parameters is here carried out to determine possible solutions. It is found that the improvement of a single thermal
property does not provide any significant benefit and that the most effective strategy consists in augmenting the heat
transfer area by employing extended surfaces or the encapsulation technique.

General information
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Aarhus University
Authors: Mazzucco, A. (Intern), Rothuizen, E. (Intern), Jørgensen, J. (Forskerdatabase), Jensen, T. (Ekstern), Rokni, M.
(Intern)
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BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.589 SNIP 1.871
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.333 SNIP 1.885
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.401 SNIP 2.096
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.279 SNIP 2.201
Integration of space heating and hot water supply in low temperature district heating

District heating may supply many consumers efficiently, but the heat loss from the pipes to the ground is a challenge. The heat loss may be lowered by decreasing the network temperatures for which reason low temperature networks are proposed for future district heating. The heating demand of the consumers involves both domestic hot water and space heating. Space heating may be provided at low temperature in low energy buildings. Domestic hot water, however, needs sufficient temperatures to avoid growth of legionella. If the network temperature is below the demand temperature, supplementary heating is required by the consumer. We study conventional district heating at different temperatures and compare the energy and exergetic efficiency and annual heating cost to solutions that utilize electricity for supplementary heating of domestic hot water in low temperature district heating. This includes direct electric heating and three heat pump solutions applying R134a and R744. The results show that conventional solutions at lowest possible temperature have the highest exergetic efficiency of 28% and lowest annual cost of € 690 for a 159 m2 house. The best low temperature system is an R134a heat pump with hot water storage on the district heating side, which reaches 25% exergetic efficiency.
Interaction of porcine gastric mucin with various polycations and its influence on the boundary lubrication properties

The interaction of porcine gastric mucin (PGM) with polycations possessing amine functional groups, including polyallylamine hydrochloride (PAH), poly-l-lysine (PLL) and polyethylenimine (PEI), was examined from a tribological standpoint at a self-mated polydimethylsiloxane (PDMS) interface. In all cases, PGM interacted with the cationic polymers, leading to a smaller size of the aggregates compared to PGM, surface charge compensation, and distortion of the PGM protein conformation. But, a synergistic lubrication effect was clearly observed only from the 1/1 (w/w) mixture of PGM with branched PEI (BPEI) where the friction coefficient was reduced by two orders of magnitude compared to neat PGM or BPEI in the speed range of 0.25 to 100 mm/s. This was attributed to the smallest hydrodynamic size and "sphere-like" conformation of B-PEI due to high degree of branching, which favors tenacious complexation with PGM, fast surface adsorption, and continuous reformation of the lubricating layer under cyclical stress in pin-on-disc tribometry.
An interlaboratory comparison on industrial X-ray Computed Tomography (CT) was organized by the Centre for Geometrical Metrology (CGM), Department of Mechanical Engineering, Technical University of Denmark (DTU) and carried as part of the Marie Curie ESR Project INTEGRACT. In the comparison, 22 laboratories from 7 countries were involved, and two assemblies, Assembly 1 and Assembly 2, having different materials and sizes were circulated. Assembly 1 is a physical item while Assembly 2 is a CT scan of industrial assembly. Various measurands are considered, encompassing lengths, diameters, roundness and concentricity. A multi-material length is also included in the comparison. Two different scanning approaches were considered within the comparison exercise for Assembly 1. The first approach, coded as "Own Choice", does not apply any scanning restrictions on any of the scanning parameters. The second one, coded as "FastScan", introduced a series of limitations, including the scanning time and the number of images per projection. 22 samples of Assembly 1 were circulated in parallel to the participants. A single sample of Assembly 2 was electronically circulated to the participants. The results of each participant are kept confidential. Participants can identify their individual results using an anonymous identification number provided by the coordinator at the beginning of the circulation. All samples were measured by the coordinator using a coordinate measuring machine before and after circulation. The samples of Assembly 1 have shown a good stability over the total comparison time of 8 months. No stability investigation was conducted on Assembly 2 due to the absence of circulation. Depending on the item and measurand, the reference expanded uncertainties (k=2) ranged from 1.1 μm to 2.6 μm. Participants stated measurement uncertainties in the range between 2 μm and 100 μm for all measurands of Assembly 1. The majority of participants stated measurement uncertainties based on MPE, whereas just a few participants used more complex uncertainty models. The metrological consistency of participants' results was investigated using the E_n value, where |E_n| < 1 indicates agreement between measurement results while |E_n| ≥ 1 shows disagreement. 71% of the measurements conducted using the Own Choice approach are in agreement with the reference values. 59% of the measurements carried out using the Fast Scan approach are in accordance with the reference values. L2, L3, and T, which are bidirectional measurands, show lower agreement than L1 and L4, which are unidirectional lengths. The majority of participants obtained similar results in both scanning approaches. A few participants achieved significantly different measurement results, most probably due to the impossibility of selecting suitable scanning parameters. Systematic errors were detected for some participants, especially in CT systems not built for metrology. Results for Assembly 2 showed that increasing the complexity of the measurand increases the range of variation among participants. A good agreement was obtained among InteraqCT_FinalReport Page 4 of 74 participants for diameters, whereas a worse agreement was registered for roundness and concentricity. It was also observed that participants obtained different results although they used similar inspection software and measuring strategies. Measuring procedures provided by the coordinator for both assemblies were followed by participants without problems. Most participants carried out measurements and sent their results to the coordinator according to the schedule.

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Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
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InteraqCT Comparison on Assemblies - Reference Measurements
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Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
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Internet of Things - Thingworks Composer 5

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Authors: Christensen, G. K. (Intern)
Number of pages: 23
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Publication: Research › Sound/Visual production (digital) – Annual report year: 2016
Introduction to Pinch Technology

The demand for effective usage of energy processes is increasing and nowadays every process engineer is facing the challenge to seek answers to the questions related to their process energy patterns. Below the questions that frequently may be asked are listed:

Is the existing process as energy efficient as it should be?
How can new projects be evaluated with respect to their energy requirements?
What changes can be made to increase the energy efficiency without incurring any cost?
What investments can be made to improve energy efficiency?
What is the most appropriate utility mix for the process?

How to put energy efficiency and other targets like reducing emissions, increasing plant capacities, improve product qualities etc, into a one coherent strategic plan for the overall site?

All these questions and more can be answered with a full understanding of Pinch Technology and an awareness of the available tools for applying it in a practical way. The aim here is to provide the basic knowledge of pinch technology concept and how it can be applied across a wide range of process industries. The pinch technology was proposed firstly for optimization of heat exchangers and therefore it is introduced / described below for such devises. Heat exchange equipments encounter in many industries for at least two reasons: a) it is often necessary as part of the process to change the thermal condition and b) it is the ambition to minimize the energy consumption of the given process. With other words the idea is to maximize the energy recovery within the process or to minimize the use of external energy sources.

Inverse design engineering of all-silicon polarization beam splitters

Utilizing the inverse design engineering method of topology optimization, we have realized high-performing all-silicon ultra-compact polarization beam splitters. We show that the device footprint of the polarization beam splitter can be as compact as similar to 2 µm² while performing experimentally with a polarization splitting loss lower than similar to 0.82 dB and an extinction ratio larger than similar to 15 dB in the C-band. We investigate the device performance as a function of the device length and find a lower length above which the performance only increases incrementally. Imposing a minimum feature size constraint in the optimization is shown to affect the performance negatively and reveals the necessity for light to scatter on a sub-wavelength scale to obtain functionalities in compact photonic devices.
Investigation of Different Piston Ring Curvatures on Lubricant Transport along Cylinder Liner in Large Two-Stroke Marine Diesel Engines

A theoretical investigation of the hydrodynamic lubrication of the top compression piston ring in a large two-stroke marine diesel engine is presented. The groove mounted piston ring is driven by the reciprocal motion of the piston. The ring shape follows a circular geometry and the effect of changes in radii is analysed. A numerical model based on the finite difference method in 1D has been developed for solving Reynold's equation in combination with the load equilibrium equation together with flow continuity between the piston ring surface and liner for analysis of the lubricant transport. The cyclic variation throughout one stroke is presented for the minimum film thicknesses at different interesting locations of the piston ring surface together with the friction and the pressure distribution history. The before mentioned parameters have been investigated numerically. The numerical results are presented and discussed.

Bibliographical note

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Investigation of digital light processing using fibre-reinforced polymers

Literature research shows multiple applications of fibre-reinforced polymers (FRP) respectively in fused deposition modelling and gypsum printing influencing the quality of the products in terms of stress and strain resistance as well as flexibility. So far, applications of fibre-reinforced polymers in digital light processing (DLP) are limited. Fibre-reinforced polymer composites were manufactured into test objects using digital light processing. Short fibres were used in an unordered manner. An anisotropic property due to fibre orientation within the material was observed. The importance of fibre length and shape compared to layer thickness has been investigated including concepts to circumvent clustering of the fibres. This research contributes to the implementation of fibre-reinforced polymers in additive manufacturing technologies. Digital light processing allows generation of miniaturized objects with relatively high surface quality compared to other additive manufacturing technologies. This paper aim to move fibre reinforced resin parts one step closer towards mechanically strong production-quality components.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Hofstätter, T. (Intern), Pedersen, D. B. (Intern), Nielsen, J. S. (Intern), Mischkot, M. (Intern), Hansen, H. N. (Intern)
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Additive Manufacturing Technologies, Digital Light Processing, Fibre-reinforced Polymers, Surface Quality
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Investigation of the in-solution relaxation of polymer optical fibre Bragg gratings

We investigate the response of PMMA microstructured polymer optical fibre Bragg gratings when immersed in methanol/water solutions. Overall we observe a permanent blue-shift in Bragg grating wavelength after solvent evaporation. The main contribution in the resonance wavelength shift probably arises from a permanent change in the size of the fibre, as already reported for high-temperature annealing of polymer optical fibres. As a consequence of the solution concentration dependence of the glass transition temperature of polymers, different methanol/water solutions lead to various degrees of frozen-in stress relaxation with an overall blue-shift of the Bragg grating wavelength.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Department of Photonics Engineering, Fiber Sensors and Supercontinuum Generation
Authors: Fasano, A. (Intern), Woyessa, G. (Intern), Janting, J. (Intern), Rasmussen, H. K. (Intern), Bang, O. (Intern)
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Electronic versions:
POF2016_conference_paper.pdf
Source: PublicationPreSubmission
Source-ID: 128125855
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Investigation of the Interaction between Mucins and β-Lactoglobulin under Tribological Stress

The interaction characteristics between mucins and beta-lactoglobulin (BLG) under tribological stress were investigated by comparing the lubricity of mixed solutions of mucineBLG with that of neat protein solutions at compliant hydrophobic interfaces. Surface adsorption properties of the proteins as characterized by bicinchoninic acid (BCA) assay revealed that
both bovine submaxillary mucin (BSM) and porcine gastric mucin (PGM) showed distinctly higher adsorbed masses compared to BLG onto polydimethylsiloxane (PDMS) or polystyrene (PS) surfaces. The adsorbed masses of the mixed protein solutions, namely BLGeBSM and BLGePGM, reduced significantly, and BLG appeared to dominate the surface adsorption event, presumably due to the reduced concentration of mucins and the Vroman effect. While pin-on-disk tribometry and mini-traction machine (MTM) were employed to provide the tribological contacts with varying contact pressure, speed range, and slide/roll ratio, the dominant lubrication mechanism of the protein solutions was boundary lubrication. BLGeBSM mixture showed the highest level of degradation in the lubricity of BSM at pH 5, although BLGesaliva interaction is known to degrade the lubricity most rapidly at more acidic pH, such as at pH 3.5. More importantly, pH dependent lubricating properties of BLGeBSM mixed solutions appeared to be determined by competitive adsorption of the two proteins onto the substrates, which suggests that they do not form as strong aggregates as BLGesaliva, especially under tribological stress.

**General information**

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Organisations: National Food Institute, Research Group for Nano-Bio Science, Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Celebioglu, H. Y. (Intern), Guðjónsdóttir, M. (Intern), Chronakis, I. S. (Intern), Lee, S. (Intern)
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- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.251 SNIP 2.564 CiteScore 5.21
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
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- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
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- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.743 SNIP 1.513
- BFI (2009): BFI-level 1
- Scopus rating (2009): SJR 1.728 SNIP 1.781
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.484 SNIP 1.654
Investigation on the micromilled surface characterization through replica technology

Micromilling is one of the most suitable technologies for the direct manufacturing of freeform micro components as well as for the generation of complex geometries typical of micro mould manufacturing. In this context, a detailed knowledge of the surface topography is fundamental to deal with quality control and tolerances to meet the parts functionality. However, in many cases, the reduced accessibility caused by the part complex features (e.g. microcavities, micro-holes, deep-cores) prevents from performing a direct measurement of the surface, using both contact and non-contact techniques. This represents an open issue that, in some cases, can be tackled by adopting the replication technology. The method consists in obtaining the replicated surface and performing its measurement using suitable measuring systems. This paper evaluates the actual performance of a commercial replication product for the indirect measurement of micromilled surfaces, characterized by submicrometer roughness levels. The study assesses the performance of the replication method by measuring the surface roughness (in terms of S\text{a}) of specifically designed micromilled flat surfaces. A 3D confocal optical microscope is employed for the measurements. Two different workpiece materials (AISI 440, annealed and hardened), two different milling conditions (roughing and finishing types) and three replications of each surface are analyzed. The replication resulted suitable for characterizing micromilled surfaces even if it gives an average overestimation in the nanometric level of the S\text{a} parameter.

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Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Politecnico di Milano
Authors: Baruffi, F. (Intern), Parenti, P. (Ekstern), Cacciatore, F. (Ekstern), Annoni, M. (Ekstern), Tosello, G. (Intern)
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Investigations on the porous resistance coefficients for fishing net structures
The porous media model has been successfully applied to numerical simulation of current and wave interaction with traditional permeable coastal structures such as breakwaters. Recently this model was employed to simulate flow through and around fishing net structures, where the unknown porous resistance coefficients were adjusted by fitting the available
experimental data. In the present paper, a new approach was proposed to calculate the porous resistance coefficients based on the transformation of Morison type load model. The transformation follows the principle that the total forces acting on a net panel from Morison type load model should be equal to the forces obtained from the porous media model. In order to account for the interaction effects in-between the twines, two coefficients were introduced, and they were calibrated by minimizing the least square error function. Extensive validation cases were carried out to examine the performance of the numerical model. This includes steady current flow through plane net panels and circular fish cages, and wave interaction with plane net panels. A variety of fishing nets with different solidity ratios were used in the validation cases, from which it was seen that the overall agreement between the numerical and experimental results is fair.

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Authors: Chen, H. (Intern), Christensen, E. D. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.277 SNIP 1.895 CiteScore 2.33
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.428 SNIP 2.738 CiteScore 2.69
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.582 SNIP 2.841 CiteScore 2.96
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.154 SNIP 2.356 CiteScore 2.14
ISI indexed (2012): ISI indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.386 SNIP 2.369 CiteScore 2.16
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.534 SNIP 2.711
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.515 SNIP 2.366
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.398 SNIP 2.688
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.385 SNIP 2.142
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.285 SNIP 2.934
Scopus rating (2005): SJR 1.205 SNIP 1.962
Scopus rating (2004): SJR 1.68 SNIP 1.703
Scopus rating (2003): SJR 0.766 SNIP 1.521
Scopus rating (2002): SJR 0.998 SNIP 1.792
In Vitro Urethra Model to Characterize The Frictional Properties of Urinary Catheters

Surface lubricity is one of the most important properties required for biomaterials or biomedical devices where tribological contacts with biological tissues are expected. While standard tribological techniques can provide sufficiently meaningful pre-clinical screening of their surface slipperiness, frictional properties of tubular devices such as catheters, endoscopes, and angioplasty balloons are particularly challenging to characterize because of non-standard shape and contact configuration. In this study, we propose that fabrication of in vitro urethra model with castable elastomers can provide conformal sliding contacts with the catheter and high relevance to clinical catherization. With the proposed urethra model assembled in texture analyzer, the lubricity of catheters lubricated in different modes was tested. In comparison with conventional pin-on-disk tribometry, the coefficients of friction of sliding contacts with the urethra model with unlubricated and lubricated catheters were determined. Impact of the improved bio-relevance of friction testing methods on the evaluation of various catheter materials and surface modification methods is discussed in detail.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Røn, T. (Intern), Lee, S. (Intern)
Pages: 188-194
Publication date: 2016

KCl-induced high temperature corrosion of selected commercial alloys. Part II: alumina and silica-formers

Laboratory testing on selected alumina and silica-forming alloys was performed to evaluate their performance against high temperature corrosion induced by potassium chloride (KCl). The alloys studied were FeCrAlY, Kanthal APM, Nimonic 80A, 214, 153MA and HR160. Exposure was conducted at 600 °C for 168 h in flowing N2(g)+5%O2(g)+15%H2O(g) (vol.%) with samples covered under KCl powder. A KCl-free exposure was also performed for comparison. Corrosion morphology and products were studied with scanning electron microscopy (SEM), energy dispersive X-ray spectroscopy (EDS) and X-ray diffractometry (XRD). It was observed that alloying with aluminum did not lead to the formation of protective alumina for the studied alloys. The silicon containing stainless steel 153MA showed an analogous performance to low silicon austenitic stainless steels of similar chromium and nickel contents. For alloy HR160, a potassium-chromium-silicon-oxygen containing layer forms as the innermost corrosion product. The layer was uniformly distributed over the surface and appears to render some protection as this alloy exhibited the best performance among the investigated alloys. To reveal further aspects of the corrosion mechanism, Nimonic 80A was exposed in static laboratory air for the same duration and temperature with either KCl or K2CO3 deposits. Comparison of results obtained with these experiments showed that both potassium and chlorine can play a role in material degradation by KCl.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Kiamehr, S. (Intern), Dahl, K. V. (Intern), Montgomery, M. (Intern), Somers, M. A. J. (Intern)
Kinematic and dynamic modeling and approximate analysis of a roller chain drive

A simple roller chain drive consisting of two sprockets connected by tight chain spans is investigated. First, a kinematic model is presented which include both spans and sprockets. An approach for calculating the chain wrapping length is presented, which also allows for the exact calculation of sprocket center positions for a given chain length. The kinematic analysis demonstrates that the total length of the chain wrapped around the sprockets generally varies during one tooth period. Analytical predictions for the wrapping length are compared to multibody simulation results and show very good agreement. It is thereby demonstrated that chain drives with tight chain spans must include compliant components to function. Second, a dynamic model is presented which includes the two spans and the driven sprocket. Assuming the presence of a stationary operating state, the presented dynamic model allows for analytical studies of the coupled motion of the chain spans and driven sprocket. Parametric excitation of the spans come from sprocket angular displacements, and the driven sprocket acts as a boundary which can be compliant in the axial direction. External transverse excitation of the spans comes from polygonal action, and is treated through kinematic forcing at the moving string boundaries. Perturbation analysis of the model is carried out using the method of multiple scales. Results show a multitude of internal and external resonance conditions, and some examples are presented of both decoupled and coupled motion. Together, the kinematic and dynamic model are aimed toward providing a framework for conducting and understanding both numerical, and experimental investigations of roller chain drive dynamics.

General information
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Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Fuglede, N. (Intern), Thomsen, J. J. (Intern)
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Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.391 SNIP 2.142 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.447 SNIP 2.38 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 2.992 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.441 SNIP 2.698 CiteScore 2.05
Kinematics of roller chain drives - Exact and approximate analysis

An exact and approximate kinematic analysis of a roller chain drive modeled as a four-bar mechanism is presented. The span connects the sprockets such that they rotate in the same direction, and the sprocket size, number of teeth, and shaft center distance can be arbitrary. The driven sprocket angular position, velocity and acceleration, as well as span length, are calculated and their (discontinuous) variation with driver angular position and main design parameters is illustrated. Kinematic predictions for the chain span motion are compared to results of multibody simulation, and there is seen to be very good agreement. All together this gives new insights into the characteristics of chain drive kinematics and the influence of main design parameters.
Fireside corrosion is a key problem when using biomass fuels in power plants. A possible solution is to apply corrosion resistant coatings. The present paper studies the corrosion and interdiffusion behaviour of a Ni-Al diffusion coating on austenitic stainless steel (TP347H). Ni-Al coatings were prepared by electrolytic deposition of nickel followed by pack aluminizing performed at 650°C. A uniform and dense Ni-Al coating with an outer layer of Ni2Al3 and an inner Ni layer was formed. Samples were exposed to 560°C for 168h in an atmosphere simulating biomass combustion. This resulted in localized corrosion attack. Interdiffusion was studied by isothermal heat treatment in static air at 650°C or 700°C for up to 3000h. The Ni2Al3 gradually transformed into NiAl and Ni3Al during the interdiffusion process. Porosity developed at the interface between the Ni-Al coating and the Ni layer and expanded with time at both temperatures.
Large scale three-dimensional topology optimisation of heat sinks cooled by natural convection

This work presents the application of density-based topology optimisation to the design of three-dimensional heat sinks cooled by natural convection. The governing equations are the steady-state incompressible Navier-Stokes equations coupled to the thermal convection-diffusion equation through the Boussinesq approximation. The fully coupled non-linear multiphysics system is solved using stabilised trilinear equal-order finite elements in a parallel framework allowing for the optimisation of large scale problems with order of 20-330 million state degrees of freedom. The flow is assumed to be laminar and several optimised designs are presented for Grashof numbers between $10^3$ and $10^6$. Interestingly, it is observed that the number of branches in the optimised design increases with increasing Grashof numbers, which is opposite to two-dimensional topology optimised designs. Furthermore, the obtained topologies verify prior conclusions regarding fin length/thickness ratios and Biot numbers, but also indicate that carefully tailored and complex geometries may improve cooling behaviour considerably compared to simple heat fin geometries. (C) 2016 Elsevier Ltd. All rights reserved.
Lateral vibration control of a flexible overcritical rotor via an active gas bearing – Theoretical and experimental comparisons

The lack of damping of radial gas bearings leads to high vibration levels of a rotor supported by this type of bearing when crossing resonant areas. This is even more relevant for flexible rotors, as studied in this work. In order to reduce these high vibration levels, an active gas bearing is proposed. The control action of this active bearing is selected based on two different strategies: a simple proportional integral derivative controller and an optimal controller. Both controllers are designed based on a theoretical model previously presented. The dynamics of the flexible rotor are modelled aided by the finite element method and the rotor–fluid interaction in the gas bearing is included using the solution of a modified version of the Reynolds equation for compressible fluids, taking into account the piezoelectrically controlled jet action. Performance and accuracy of both model-based controllers are compared against experimental results, showing good agreement. Theoretical and experimental results show a significant increase in the damping ratio of the system, enabling the flexible rotor to run safely across the critical speeds and up to 12,000rev/min, i.e. 50 percent over the second critical speed without any instability problems.
Length determination on industrial polymer parts from measurement performed under transient temperature conditions

A way to reduce the cost of metrology in manufacturing is to perform dimensional verification directly in the production environment, avoiding a long and expensive acclimatization phase. In this work the effect of a transient temperature state, typical of the production environment, was investigated on commercial polymer parts. Two points length measurements were performed before the stabilization of the temperature and length at standard conditions was estimated. The experiments consisted of synchronized measurements of length and temperature of the part over several minutes during the cooling phase, from 27 °C to 20 °C approximately. The length variation was measured by means of an inductive probe and the temperature with an RTD surface sensor. The frame of the system was composed by elements in Zerodur and Invar to minimize the thermal deformations of the structure. Uniform temperature in the part was assumed. The reference length at 20 °C (L20) was calculated with an a posteriori regression of the data from the complete cooling curve. A prediction of L20 was then performed exploiting partial segments of the curve. Several segments with different time spans and starting points were evaluated. The procedure was repeated 5 times on 5 nominally identical parts. An expanded uncertainty (k=2) below 2μm was evaluated for the predicted length at 20 °C.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Dalla Costa, G. (Intern), Madruga, D. G. (Intern), De Chiffre, L. (Intern), Hansen, H. N. (Intern)
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Dimensional measurement, Production environment, Temperature
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Length scale and manufacturability in density-based topology optimization

Since its original introduction in structural design, density-based topology optimization has been applied to a number of other fields such as microelectromechanical systems, photonics, acoustics and fluid mechanics. The methodology has been well accepted in industrial design processes where it can provide competitive designs in terms of cost, materials and functionality under a wide set of constraints. However, the optimized topologies are often considered as conceptual due to loosely defined topologies and the need of postprocessing. Subsequent amendments can affect the optimized design performance and in many cases can completely destroy the optimality of the solution. Therefore, the goal of this paper is to review recent advancements in obtaining manufacturable topology-optimized designs. The focus is on methods for imposing minimum and maximum length scales, and ensuring manufacturable, well-defined designs with robust performances. The overview discusses the limitations, the advantages and the associated computational costs. The review is completed with optimized designs for minimum compliance, mechanism design and heat transfer.

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State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Lazarov, B. S. (Intern), Wang, F. (Intern), Sigmund, O. (Intern)
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BFI (2018): BFI-level 1
LES And URANS simulations of the swirling flow in a dynamic model of a uniflow-scavenged cylinder
The turbulent swirling flow in a uniflow-scavenged two-stroke engine cylinder is investigated using computational fluid dynamics. The investigation is based on the flow in a scale model with a moving piston. Two numerical approaches are tested: a large eddy simulation (LES) approach with the wall-adaptive local eddy-viscosity (WALE) model and a Reynolds-Averaged Navier-Stokes approach using the k-ω Shear-Stress Transport model. Combustion and compression are neglected. The simulations are verified by a sensitivity study and the performance of the turbulence models are evaluated by comparison with experimental results. Both turbulence models produce results in good agreement with experimental...
data. The agreement is particularly good for the LES, immediately after the piston passes the bottom dead center. Furthermore, in the piston standstill period, the LES predicts a tangential profile in agreement with the measurements, whereas the k−ω SST model predicts a solid body rotation. Several instabilities are identified during the scavenging process. The formation of a vortex breakdown with multiple helical vortex structures are observed after the scavenge port opening, along with the shedding of vortex rings with superimposed swirl. The turbulence models predict several flow reversals in the vortex breakdown region through the scavenging process. Flow separations in the scavenge ports lead to a secondary axial flow, in the separated region. The secondary flow exits in the top of the scavenge ports, resulting in large velocity gradients near the cylinder liner above the scavenge ports.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, MAN Diesel & Turbo SE
Authors: Hemmingsen, C. S. (Intern), Ingvorsen, K. M. (Intern), Mayer, S. (Ekstern), Walther, J. H. (Intern)
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BFI (2016): BFI-level 1
Scopus rating (2016): SJR 0.991 SNIP 1.691 CiteScore 2.35
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.175 SNIP 1.788 CiteScore 2.29
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.224 SNIP 2.066 CiteScore 2.3
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.17 SNIP 2.215 CiteScore 2.37
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.375 SNIP 2.174 CiteScore 2.28
ISI indexed (2012): ISI indexed yes
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BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.328 SNIP 2.169 CiteScore 2.6
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 1.414 SNIP 2.108
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 1.36 SNIP 1.814
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.047 SNIP 1.411
Scopus rating (2007): SJR 1.523 SNIP 1.81
Scopus rating (2006): SJR 2.134 SNIP 1.855
Scopus rating (2005): SJR 1.783 SNIP 1.774
Scopus rating (2004): SJR 1.205 SNIP 1.65
Scopus rating (2003): SJR 1.486 SNIP 1.539
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.432 SNIP 1.921
Scopus rating (2001): SJR 1.563 SNIP 1.659
Longitudinal dispersion of heavy particles in an oscillating tunnel and application to wave boundary layers

The present research aims at getting an understanding of the process of dispersion of surface sediment in an oscillatory boundary layer, which may represent an idealised case of, for example, a stockpile area where excavated sediment is stockpiled temporarily (or permanently). The process is studied numerically, using a random-walk particle model with the input data for the mean and turbulence characteristics of the wave boundary layer picked up from a transitional two-equation k-ω Reynolds averaged Navier–Stokes model and plugged in the random-walk model. First, the flow model is validated against experimental data in the literature. Then, the random-walk dispersion model is run for different oscillatory flow cases and for a number of steady flow cases for comparison. The primary sediment grains of concern are fine sediments (with low fall velocity), which would stay in suspension for most of the time. Nevertheless, the dispersion of neutrally buoyant and heavier particles that spend most of their time in close vicinity to the bed are also discussed. The numerical model results are compared with the results of a series of experiments carried out in an oscillating U-tunnel facility. The results are found to be in general agreement both qualitatively and quantitatively. In the last part of the study, an example application of the present model for fine sand dispersing in a wave boundary layer under storm conditions is given.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Istanbul Technical University, Technical University of Denmark
Authors: Kirca, V. S. O. (Ekstern), Sumer, B. M. (Intern), Steffensen, M. (Ekstern), Jensen, K. L. (Intern), Fuhrman, D. R. (Intern)
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Source-ID: 2289491886
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specific, as they represent the given network and production units, but similar trends can be expected for other large networks.

**General information**

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*Organisations:* Department of Mechanical Engineering, Thermal Energy

*Authors:* Ommen, T. (Intern), Markussen, W. B. (Intern), Elmegaard, B. (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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- Web of Science (2017): Indexed yes
- BFI (2016): BFI-level 2
- Scopus rating (2016): CiteScore 5.17 SJR 1.999 SNIP 1.798
- Web of Science (2016): Indexed yes
- BFI (2015): BFI-level 2
- Scopus rating (2015): SJR 2.276 SNIP 2.046 CiteScore 5.03
- Web of Science (2015): Indexed yes
- BFI (2014): BFI-level 2
- Scopus rating (2014): SJR 2.647 SNIP 2.63 CiteScore 5.7
- Web of Science (2014): Indexed yes
- BFI (2013): BFI-level 2
- Scopus rating (2013): SJR 2.54 SNIP 2.593 CiteScore 5.02
- ISI indexed (2013): ISI indexed yes
- Web of Science (2013): Indexed yes
- BFI (2012): BFI-level 2
- Scopus rating (2012): SJR 1.998 SNIP 2.25 CiteScore 4.25
- ISI indexed (2012): ISI indexed yes
- Web of Science (2012): Indexed yes
- BFI (2011): BFI-level 2
- Scopus rating (2011): SJR 1.609 SNIP 2.043 CiteScore 4
- ISI indexed (2011): ISI indexed yes
- Web of Science (2011): Indexed yes
- BFI (2010): BFI-level 2
- Scopus rating (2010): SJR 1.814 SNIP 2.725
- Web of Science (2010): Indexed yes
- BFI (2009): BFI-level 2
- Scopus rating (2009): SJR 1.729 SNIP 2.313
- Web of Science (2009): Indexed yes
- BFI (2008): BFI-level 2
- Scopus rating (2008): SJR 1.106 SNIP 1.444
- Scopus rating (2007): SJR 0.913 SNIP 1.481
- Web of Science (2007): Indexed yes
- Scopus rating (2006): SJR 0.875 SNIP 1.306
- Web of Science (2006): Indexed yes
- Scopus rating (2005): SJR 0.965 SNIP 1.203
- Web of Science (2005): Indexed yes
- Scopus rating (2004): SJR 0.711 SNIP 1.115
Low Temperature Curing of Hydrogen Silsesquioxane Surface Coatings for Corrosion Protection of Aluminum

Hydrogen Silsesquioxane (HSQ) has shown to be a promising precursor for corrosion protective glass coatings for metallic substrates due to the excellent barrier properties of the films, especially in the application of protective coatings for aluminum in the automotive industry where high chemical stability in alkaline environments is required. The coatings have been successfully applied to stainless steel substrates. However the traditional thermal curing of HSQ involves heating to elevated temperatures, which are beyond those applicable for most industrial applications of aluminum. In this study low temperature processes are tested and evaluated as possible alternatives to the traditional high temperature cure. Thin HSQ films are deposited on silicon wafers to model the degree of curing induced by the low temperature methods in comparison to thermal curing. Furthermore, the coatings are applied on aluminum substrates to evaluate the adhesion and corrosion resistance of the films.

General information
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Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, SiOx ApS
Authors: Lampert, F. (Intern), Jensen, A. H. (Intern), Møller, P. (Intern)
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Publication: Research - peer-review › Journal article – Annual report year: 2015

Low-Temperature Nitriding of Deformed Austenitic Stainless Steels with Various Nitrogen Contents Obtained by Prior High-Temperature Solution Nitriding

In the past decades, high nitrogen steels (HNS) have been regarded as substitutes for conventional austenitic stainless steels because of their superior mechanical and corrosion properties. However, the main limitation to their wider application is their expensive production process. As an alternative, high-temperature solution nitriding has been applied to produce HNS from three commercially available stainless steel grades (AISI 304L, AISI 316, and EN 1.4369). The nitrogen content in each steel alloy is varied and its influence on the mechanical properties and the stability of the austenite investigated. Both hardness and yield stress increase and the alloys remain ductile. In addition, strain-induced transformation of austenite to martensite is suppressed, which is beneficial for subsequent low-temperature nitriding of the surface of deformed alloys. The combination of high- and low-temperature nitriding results in improved properties of both bulk and surface.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Bottoli, F. (Intern), Winther, G. (Intern), Christiansen, T. L. (Intern), Dahl, K. V. (Intern), Somers, M. A. J. (Intern)
Pages: 4146-4159
Low temperature surface hardening of stainless steel: the role of plastic deformation

Thermochemical surface engineering by nitriding of austenitic stainless steel transforms the surface zone into expanded austenite, which improves the wear resistance of the stainless steel while preserving the stainless behavior. As a consequence of the thermochemical surface engineering, huge residual stresses are introduced in the developing case, arising from the volume expansion that accompanies the dissolution of high interstitial contents in expanded austenite.

This work addresses two aspects of the role of plastic deformation on the case developing during low temperature nitriding: - plastic deformation of metastable austenitic stainless steels leads to the development of strain-induced martensite, which compromises the uniformity and the homogeneity of the expanded austenite zone. - during low temperature surface engineering composition and stress profiles develop. On numerical modelling the evolution of composition and stress profiles from the processing parameters temperature, time and gas composition it is necessary to include elastic-plastic accommodation of the composition-induced strains associated with lattice expansion.

Macromechanical Parametric Amplification

Parametric amplification is obtained by adding parametric excitation to direct (externally driven) excitation for boosting near-resonant oscillations. It is utilized for mass and force sensing, switching and signal processing, filtering, timing, signal amplification, and appears promising for energy harvesting. Using analytical, numerical, and experimental methods, the thesis focuses on superthreshold pumping (above the systems parametric instability threshold), nonlinear effects, frequency response backbones, and frequency detuning effects for parametric amplifiers.

Part one of the thesis covers superthreshold pumping and nonlinear effects. Supertheshold pumping produces some useful characteristics. For instance, strong superthreshold pumping yields a high gain even though nonlinear effects tend to reduce it. In addition, a narrower excitation phase range is realized for which attenuation occurs. It is demonstrated that stronger nonlinear effects can cause jumps and bistability in the amplitude-phase characteristics, which in turn enrich the dynamic response of the system.

Part two shows that mixed quadratic and cubic nonlinearities may generate additional amplitude-frequency solutions, as compared to a system where only cubic nonlinearities are considered. When these effects cancel out, a significantly increased response is obtained, as compared to the case with pure quadratic or pure cubic nonlinearity.

Part three investigates frequency response backbones. An undamped but parametrically excited frequency response backbone is proposed instead of the classic unforced and undamped backbone. With the modified and more general backbone, it is shown how the response of a superthreshold pumped amplifier is related to respectively the pure directly and pure parametrically excited response. Benefits of superthreshold parametric pumping, as compared to pure direct or pure parametric excitation, are given.

The last part examines frequency detuning effects. In addition to being relevant for most applications in itself, frequency detuning yields some interesting and useful features. Some of the characteristics of, respectively, a pure directly excited system and a pure parametrically excited system can simultaneously be utilized or avoided in a frequency detuned parametric amplifier. Moreover, parts of the amplitude-frequency curves can collapse, and the frequency separation between the two peaks can be altered. The first experimental bistable amplified steady-state responses are also reported.
The derived analytical models and experimental setups can readily be extended to investigate other factors. Some of the results are also applicable to the more general field of systems subjected to combined parametric and direct excitation.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Neumeyer, S. (Intern), Thomsen, J. J. (Intern)
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Macromechanical Parametric Amplification
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Makerspaces in Engineering Education: A Case Study
The recent years have witnessed a new generation of Makers working with new ways of knowledge generation for creation and sharing of digital and physical products. While this development has started within collaborative and grass roots organised networks; educational institutions have also embraced it by opening makerspaces and adopting elements of the Maker Movement in their offerings. This paper investigates how university driven makerspaces can affect engineering design and product development education through a case study. We provide our findings based on interviews and data collected from educators, students the administrative and workshop staff of the makerspace. The findings are used to outline the challenges in incorporating the offerings of makerspaces. By discussing these challenges we identify opportunities for turning university makerspaces into innovation hubs and platforms that can support engineering design education.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development, Office for Innovation & Sector Services
Authors: Jensen, L. S. (Intern), Özkil, A. G. (Intern), Mougaard, K. (Intern)
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Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Manufacturing of a LaNiO₃ composite electrode for oxygen evolution in commercial alkaline water electrolysis
The LaNiO₃ perovskite was chosen for incorporation into a nickel matrix in order to obtain a metallic composite electrode suitable for improving the oxygen evolution reaction (OER) in commercial water electrolysis at elevated temperature. The manufactured LaNiO₃ + Ni composite coatings were deposited in a Watts type nickel electrolyte in a specially designed beaker with continuous particle circulation. Activity of the composite coatings was evaluated using cyclic voltammetry
(CV), electrochemical impedance spectroscopy (EIS) and anodic potentiodynamic polarization measurements. The obtained results were compared to a non-catalysed Watts nickel reference sample and the electrochemical measurements confirmed that the coating decreased the OER overpotential by 70 mV. XRD furthermore revealed that a LaNiO$_3$ + Ni composite structure was obtained. Conventional alkaline water electrolysis was carried out at a temperature of 120 °C and a current densities of 0.2 and 0.8 A cm$^{-2}$. Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS) and X-ray Diffraction (XRD) were used for characterization of the morphology.
The austenite-to-martensite transformation at temperatures below room temperature was investigated in situ by magnetometry in Fe-N, Fe-Cr-C and Fe-Cr-Ni based alloys. After quenching to room temperature, samples were immersed in boiling nitrogen and martensite formation was followed during subsequent heating to room temperature. Different tests were performed with heating rates ranging from 0.5 K/min to 10 K/min. For comparison a sample was up-quenched in water to verify whether martensite formation can be suppressed at high heating rates. Thermally activated formation of martensite during heating was convincingly demonstrated for all investigated materials by showing heating rate dependent transformation kinetics. Moreover, magnetometry showed that the heating rate influences the fraction of martensite formed during the thermal treatment. The activation energy for thermally activated martensite formation as quantified by a Kissinger-like method lies in the range 11-18 kJ/mol and increases with the total fraction of interstitials in the alloy.
Material Removal Mechanisms Analysis in the dry Electrical Discharge Machining and Possibilities for Micro-machining Applications

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern)
Number of pages: 1
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Mathematical modelling of coupled heat and mass transport into an electronic enclosure
In contrast to high fidelity CFD codes which require higher computational effort/time, the well-known Resistor-Capacitor (RC) approach requires much lower calculation time, but also with a lower resolution of the geometrical arrangement. Therefore, for enclosures without too complex geometry in their interior, it is more efficient to use the RC method for thermal management and design of electronic compartments. Thus, the objective of this paper is to build an in-house code based on the RC approach for simulating coupled heat and mass transport into a (closed) electronic enclosure. The developed code has the capability of combining lumped components and a 1D description. Heat and mass transport is based on a FVM discretization of the heat conduction equation and Fick's second law. Simulation results are compared with corresponding experimental findings and good agreement is found. Second simulation was performed to study the response of temperature and moisture inside an enclosure exposed to the B2 STANAG climatic cyclic conditions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Staliulionis, Z. (Intern), Jabbaribehnam, M. (Intern), Hattel, J. H. (Intern)
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Main Research Area: Technical/natural sciences
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Source-ID: 2349187977
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

Maturity-based approach for the development of environmentally sustainable product/service-systems
Despite their substantial potential for enabling increased environmental performance, product/service-systems (PSS) are not intrinsically environmentally sustainable. In order to ensure increased environmental performance, PSS best practices should be integrated with ecodesign best practices, from the early stages of the development process. This paper aims to identify the best practices for PSS development, based on a systematic literature review, and to propose their integration
into an existing maturity model for ecodesign, the EcoM2, into which 30 best practices for PSS development are identified and integrated. The proposed approach has the potential to enable the development of environmentally sustainable PSS offerings.

General information
State: Published
Organisations: Department of Mechanical Engineering, Engineering Design and Product Development
Authors: Pigosso, D. C. A. (Intern), McAloone, T. C. (Intern)
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Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.953 SNIP 1.862 CiteScore 2.55
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.133 SNIP 1.777 CiteScore 2.46
Scopus rating (2013): SJR 0.95 SNIP 1.796 CiteScore 2.01
ISI indexed (2013): ISI indexed no
Scopus rating (2012): SJR 0.819 SNIP 1.822 CiteScore 1.69
ISI indexed (2012): ISI indexed no
Scopus rating (2011): SJR 0.946 SNIP 2.037 CiteScore 1.72
ISI indexed (2011): ISI indexed no
Scopus rating (2010): SJR 1.202 SNIP 2.299
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Environmental sustainability, Maturity model, Best practices, Product/service-systems , Ecodesign
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Source-ID: 2304025710
Publication: Research - peer-review › Journal article – Annual report year: 2016

Measurements of Cloaking Produced by an Array of Circular Cylinders
In the field of water waves, there has been recent interest in a process known as cloaking. According to this concept, the waves scattered by a fixed body are manipulated in the region immediately surrounding the object to eliminate scattering at large distances from the body. Cloaking of a bottom-mounted vertical monopile was first proposed by Porter (2011), who manipulated the bathymetry in the surrounding region to minimise the scattered energy to values approaching zero. Newman (2013) investigated cloaking of a surface-piercing cylinder of finite draft by introducing an array of bodies or an axisymmetric structure around the central object. In this case, a multivariate optimiser was successfully coupled with the boundary-integral equation software WAMIT to identify geometric arrangements resulting in minimal far-field wave scattering at a specified wavelength. The existence of arrays of bodies capable of cloaking has more recently been confirmed numerically by Kashiwagi et al.(2015) using the theory of Kagemoto and Yue (1986) in conjunction with a higher-order, boundary-element method. Kashiwagi et al have furthermore presented experimental results supporting the numerical findings for array-type cloaking. From a practical perspective, the elimination of the mean drift force on a surface-piercing structure associated with the cloaking process may find application in the reduction of second-order mooring loads in large offshore structures. This paper describes a further experimental investigation into the cloaking of a circular cylinder of finite draft using a circumferential array of eight surrounding cylinders. The aims of the work were: to identify a cloaking geometry suitable for investigation in the facilities available at DTU to design and build an apparatus to investigate wave scattering by this and other geometries, to confirm cloaking at one wavelength by measuring the mean drift force and far-field scattering.
Mechanisms and coherences of robust design methodology: a robust design process proposal

Although robust design (RD) methods are recognised as a way of developing mechanical products with consistent and predictable performance and quality, they do not experience widespread success in industry. One reason being the lack of a coherent RD process (RDP). In this contribution we analyse commonly used RD methods to identify their mechanisms and coherences and propose a RDP that is connected to the actual design tasks of the design engineer. The presented RDP comprises four main activities: (1) design and modification of the conceptual design solution, (2) measuring and modelling the robustness of the design, (3) processing and evaluation of the robustness data and (4) scaling of the design to optimise parameter and tolerance values. For each of the activities, the set of relevant RD methods is presented. The main objective of the RDP is to provide the design team with a better overview and understanding of the RD toolbox and to support the application of RD continuously throughout the product development by providing a sequential description of when to apply the methods and how they affect the robustness of the design.
Robust resign, Process, Product development, Variation, Implementation

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MetAMMI - Metrology for additively manufactured medical implants: Task 1.1.3 "Requirements for the design and the manufacture of medical implants and guides made of polymers"

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Authors: Stolfi, A. (Intern), De Chiffre, L. (Intern)
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Bibliographical note
The report is confidential

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Publication: Research › Report – Annual report year: 2017

Metrology of sub-micron structured polymer surfaces

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Technical University of Denmark, Lego Group
Authors: Quagliotti, D. (Intern), Tosello, G. (Intern), Salaga, J. (Ekstern), Baruffi, F. (Intern), Hansen, H. N. (Intern), Gasparin, S. (Ekstern)
Number of pages: 1
Metrology of sub-micron structured polymer surfaces

Precision moulding is an essential technology for the miniaturisation of moulded parts and it is continuously needing for specially developed solutions to face new challenges in injection moulding (IM) processes. One of the key challenges in advanced IM technology is the achievement of a full surface replication of the tool insert component when moulding the polymer melt [1]. This aspect is particularly critical when dealing with increasingly small dimensional scales in micro- and nano-structured surfaces [2, 3]. In this context, a metrological investigation of polymer replicated surfaces using metal masters with different types of finish has been carried out. Four types of surface finish were considered: a) Diamond buff polishing, b) Grit paper polishing, c) Stone polishing, d) Dry blast polishing (see Fig. 1). Both master and replicated surfaces were measured using a laser scanning confocal microscope. Hence, the replication fidelity was evaluated comparing the measurements of the polymer surfaces against the ones of the masters. The amplitude and the slope replications were considered calculating respectively Sq and Sdq areal surface texture parameters. The expanded uncertainty was also evaluated according to ISO 15530-3:2011, adapted to optical measurements, and propagated to the replication fidelity. A good amplitude replication was achieved for stone polished surfaces with a replication fidelity larger than 90%. The dry blast ones were evaluated with an amplitude replication fidelity of about 70%. The worst amplitude replication was achieved for both diamond buff and grit paper polished surfaces with a replication fidelity around 50%. The tendency is almost the same for slope replication but the replication fidelity values are lower: 70% for stone polished surfaces, 50% for dry blast and grit paper polished surfaces, 30% for diamond buff polished surfaces.

Micro-buckling of periodically layered composites in regions of stress concentration

Under longitudinal compressive loading, periodically layered composites are prone to micro-buckling, which is often the decisive mechanism determining their strength. This paper is concerned with the load carrying capacity of structures made of layered composites with respect to micro-buckling related failure in regions of stress concentrations. A series of parametric studies show the effect of non-uniform stress distributions due to bending loads and the presence of geometrical features such as notches and holes on the initiation of micro-buckling. The contribution of the bending stiffness of the reinforcing layers on the resistance against micro-buckling introduces a dependence on the layer thickness, resulting in size-scale dependent strength limits. Therefore, both the shape and dimensions of the considered geometrical features and the layering thickness of the micro-structure are varied as part of the parametric studies. Moreover, the impact of imperfections in the composite micro-structure on the strength of the considered specimens is investigated.
Composite materials, Micro-buckling, Size effects, Stress concentration

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Publication: Research - peer-review › Journal article – Annual report year: 2016
Micromechanical Analyses of Debonding and Matrix Cracking in Dual-Phase Materials

Failure in elastic dual-phase materials under transverse tension is studied numerically. Cohesive zones represent failure along the interface and the augmented finite element method (A-FEM) is used for matrix cracking. Matrix cracks are formed at an angle of 55 deg - 60 deg relative to the loading direction, which is in good agreement with experiments. Matrix cracks initiate at the tip of the debond, and for equi-biaxial loading cracks are formed at both tips. For elliptical reinforcement the matrix cracks initiate at the narrow end of the ellipse. The load carrying capacity is highest for ligaments in the loading direction greater than that of the transverse direction.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, University of Miami
Authors: Legarth, B. N. (Intern), Yang, Q. (Ekstern)
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Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.73
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): CiteScore 1.25
BFI (2014): BFI-level 1
Scopus rating (2014): CiteScore 1.16
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): CiteScore 1.27
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): CiteScore 0.9
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): CiteScore 0.95
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
BFI (2009): BFI-level 1
BFI (2008): BFI-level 1
Web of Science (2006): Indexed yes
Web of Science (2005): Indexed yes
Web of Science (2004): Indexed yes
Web of Science (2002): Indexed yes
Web of Science (2000): Indexed yes
Original language: English
DOIs:
10.1115/1.4032690
Source: FindIt
Source-ID: 2291931356
Publication: Research - peer-review › Journal article – Annual report year: 2016
Microstructural Analysis of Orientation-Dependent Recovery and Recrystallization in a Modified 9Cr-1Mo Steel Deformed by Compression at a High Strain Rate

The evolution of the microstructure and texture during annealing of a modified ferritic/martensitic 9Cr-1Mo steel compressed by dynamic plastic deformation (DPD) to a strain of 2.3 has been investigated using transmission electron microscopy and electron backscatter diffraction. It is found that the duplex 〈111〉 + 〈100〉 fiber texture formed by DPD is transformed during annealing to a dominant 〈111〉 fiber texture, and that crystallites of the 〈111〉 component have an advantage during both nucleation and growth. Detailed characterization of the microstructural morphology, and estimation of the stored energies in 〈111〉 - and 〈100〉 -oriented regions in deformed and annealed samples, as well as investigations of the growth of recrystallizing grains, are used to analyze the annealing behavior. It is concluded that recrystallization in the given material occurs by a combination of oriented nucleation and oriented growth.

General information
State: Published
Organisations: Department of Wind Energy, Materials science and characterization, Department of Mechanical Engineering, Materials and Surface Engineering, Sino-Danish Center for Education and Research, Chinese Academy of Sciences
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BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 1.91 SJR 1.179 SNIP 1.179
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.231 SNIP 1.332 CiteScore 1.78
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.671 SNIP 1.877 CiteScore 2.06
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.481 SNIP 1.63 CiteScore 1.9
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.419 SNIP 1.706 CiteScore 1.76
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.508 SNIP 1.703 CiteScore 1.78
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.688 SNIP 1.802
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Micro-Structural Evolution and Size-Effects in Plastically Deformed Single Crystals: Strain Gradient Continuum Modeling

An extensive amount of research has been devoted to the development of micro-mechanics based gradient plasticity continuum theories, which are necessary for modeling micron-scale plasticity when large spatial gradients of plastic strain appear. While many models have proven successful in capturing the macroscopic effects related to strain gradients, most predict smooth micro-structures. The evolution of dislocation micro-structures, during plastic straining of ductile crystalline materials, is highly complex and nonuniform. Published experimental measurements on deformed metal crystals show distinct pattern formation, in which dislocations, of the geometrically necessary kind, are arranged in wall and cell structures. This particular subset of signed dislocations, which have a net Burgers vector, are the main source for the observed size-effects and are directly linked to the gradients in plastic strain. It is clear that many challenges are associated with modeling dislocation structures, within a framework based on continuum fields, however, since the strain gradient effects are attributed to the dislocation micro-structure, it is a natural step, in the further development of gradient theories, to focus on their ability to capture realistic micro-structural evolution. This challenge is the main focus of the present thesis, which takes as starting point a non-work conjugate type back stress based higher order crystal plasticity theory. Within this framework, several possibilities for the back stress relation are formulated, based on a postulate of a gradient energy as well as by engaging in a phenomenological approach. Through an extensive numerical investigation, the proposed back stress formulations are shown to offer novel modeling capabilities both in terms of micro-structural predictions but also in terms of capturing complex macroscopic behavior tied to the presence of long range internal stresses. A formulation based on a near linear gradient energy reveals striking similarities to formulations based on discrete dislocation theory, and shows promising capabilities within the adopted higher order theory. Moreover, the present work offers new insight into plane strain modeling of face centered cubic crystals.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: El-Naaman, S. A. (Intern), Niordson, C. F. (Intern), Nielsen, K. L. (Intern)
Number of pages: 151
Publication date: 2016
Microstructure and corrosion performance of steam-based conversion coatings produced in the presence of TiO$_2$ particles on aluminium alloys

The steam-based conversion coatings containing TiO$_2$ particles were prepared using a two-step process comprising of spin coating of particles onto an aluminium substrate followed by a high-pressure steam treatment. Process has resulted in the formation of aluminium oxide layer (~1.3 μm thick) embedded with TiO$_2$ particles. The electrochemical measurements show the beneficial effect of TiO$_2$ particles in the oxide layer by exhibiting lowest anodic and cathodic activities, and reduced pit depth. The presence of TiO$_2$ particles shifts the corrosion potential values to positive side (noble side) when compared to the coatings without TiO$_2$ particles, while the shift in the pitting potential was a function of the steam treatment time and degree of particle incorporation into the oxide.
Model-Based Control Design for Flexible Rotors Supported by Active Gas Bearings - Theory & Experiment

Gas journal bearings have been increasingly adopted in modern turbo-machinery due to their numerous indisputable advantages. They can operate at higher speed than most bearing designs, almost without noise or heat generation and in most cases, as in this work, the gas used is air which is cheap, abundant and clean. Nevertheless, this technology has important drawbacks: the low viscosity of the lubricant results in a low load carrying capacity and gas bearings also presents low damping properties, which often lead to a reduced stability range and make dangerous running close to, or across the critical speeds. In order to overcome such limitations, a mechatronic device has been proposed as a possible solution. This device named “hybrid active radial gas bearing” or simply “active gas bearing”, combines an aerodynamic gas journal bearing with piezoelectrically controlled injectors. In the present work, the control signal design is based on a theoretical model. This approach enables easy modifications of any of the numerous physical parameters in the system if needed. The theoretical model used is based on a modified version of Reynolds equation where an extra term is added in order to include the effect of external pressurization. In order to validate the theoretical model, a test rig is used, which consists of a flexible rotor supported by a ball bearing and the active gas bearing.

This thesis has three main focuses and original contributions: Firstly, contribute to improving an existing theoretical model for active gas bearings, with special attention to the modelling of the injection system. Secondly, experimentally validate the improved mathematical model in terms of static properties (journal equilibrium position and resulting aerodynamic forces) and dynamic properties (natural frequencies and damping ratios of the rotor-bearing system) is performed and finally to design controllers that allows improvement of the dynamic properties of the rotor-active gas bearings system and lets the system to safely cross the critical speeds, using the theoretical model as a design tool. The results show a significant increase in the damping ratios of the system (10 times), which enables the flexible rotor to run safely across the critical speeds and up to 50 % over the second critical speed, without any instability problems. The theoretical and experimental results in the active cases clearly show the efficiency of having a theoretical model as a design tool for testing
different controllers and also show the advantage of applying active lubrication techniques to gas lubricated bearings.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pierart Vásquez, F. G. (Intern), Santos, I. (Intern)
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ISSN: 0903-1685
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Projects:
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Publication: Research › Ph.D. thesis – Annual report year: 2016

**Modeling and analysis of tool electrode wear during micro-electrical discharge machining of a stainless steel using a tungsten tool**

**General information**
State: Submitted
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Puthumana, G. (Intern)
Number of pages: 20
Publication date: 2016
Main Research Area: Technical/natural sciences

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**Modeling and Evaluation of Bioenergy and Agriculture System Integration**
This Ph.D thesis focuses on exploring the integration between agriculture and bioenergy, by developing and analysing biomass fuelled energy system concepts that can produce heat and power in the effort of replacing fossil fuelled production. Bioenergy technologies based on thermochemical and biochemical conversion have been developed to utilize residual resources from agricultural systems. Nevertheless, these technologies are more often used in systems that maximize energy generation while disregarding and destroying the “waste” products which often contain essential elements to agriculture. Those type of systems could then eventually lead to soil depletion and contribute to mineral resource scarcity. New energy system concepts are developed in this thesis that 1) maximize biomass utilization for heat and power generation 2) while maintaining soil quality and 3) decrease consumption of mineral fertilizers in the agricultural system.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Thermal Energy, Department of Chemical and Biochemical Engineering, CHEC Research Centre
Authors: Sigurjonsson, H. Á. (Intern), Elmegaard, B. (Intern), Ahrenfeldt, J. (Intern), Clausen, L. R. (Intern)
Modeling coupled heat and mass transfer during drying in tape casting with a simple ceramics-water system

In many industrial processes such as in tape casting for electronics or in the food industry, drying is one of the determining physical phenomena. In this study, the evaporation of water from a ceramic-water mixture is investigated with the purpose of understanding the drying rate in the drying process of thin sheets produced by the tape casting process. The rate of mass loss in the drying process is a key factor that often is of interest, as it affects the final properties of the tapes. The 1D heat conduction equation is solved numerically to obtain the temperature field in a ceramic sheet. The change in the concentration of the water content is then used as the driving force for diffusive mass transport of the water. Mass-averaged thermal properties are assumed for the ceramic-water mixture in the initial stage. As the water evaporates, the thermal properties of the solid ceramic become more dominant since the fraction of water approaches zero. The developed model is used to simulate a simple test for the drying process. The drying rate is simply calculated by examining the water content in each time step. It is found that the mass loss due to the evaporation is increasing close to linearly with the drying time corresponding to an almost constant drying rate. However, the rate starts to decrease after some time in the simulation. It is also shown that too extensive surface drying results in a slow diffusion rate from the bottom, which in turn reduces the drying rate in general and hence is not favorable from a process viewpoint.
Modeling the effect of probe force on length measurements on polymer parts

Measurement uncertainty at micrometer level is in the future going to be very common in dimensional measurements on polymer parts. Accurate dimensional measurement of polymer parts is becoming a key and common practice in the industry, especially when micrometer tolerances are required. When conducting measurements with a contact probe there is always a force applied to the part. This force (0.3N – 3.3N) leads to deformations that influence the final result. The unknown deformation of the part under the measurement conditions can produce significant errors in the measurement. In the present work, Hertzian contact theory was applied to find the deformation analyze, where the measuring force was imposed to the part. Material properties of the polymer and radius of the probe tip were known parameters. The finite element software ABAQUS was then used to model the contact problem numerically. Both analytical and numerical approaches were compared with the experimental results. The results showed that the numerical model was able to predict the deformation of the polymer part due to different probe forces. Furthermore it was shown, that the probe force should be taken into account when measurement with a few micrometer accuracy should be performed on thin walled polymer parts.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
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Main Research Area: Technical/natural sciences
Conference: euspen’s 16th International Conference & Exhibition, Nottingham, United Kingdom, 30/05/2016 - 30/05/2016
Modeling the effects of electrical and non-electrical parameters on the material removal and surface integrity in case of µEDM of a non-conductive ceramic material using a combined fuzzy-AOM approach

Micro-EDM is a non-contact process based on the thermoelectric energy between a tool electrode and a workpiece. In µEDM process, the mechanism of material removal is melting and evaporation. The thermal energy in the discharge plasma helps remove material from the workpiece, at the same time deteriorates the quality and integrity of the workpiece surface. The material removal phenomenon in µEDM of partially conductive and non-conductive materials is very complex. This paper presents a novel approach to model the effects of electrical and non-electrical parameters on the material removal phenomenon and surface integrity for a non-conductive ceramic material. The fuzzy logic modeling system is employed for predicting the µEDM process responses. The trends in the material removal rate and hardness values with the chosen electrical and non-electrical parameter for the model and obtained using AOM approach are compared. The average deviation between the model predictions and the results obtained using AOM plots is less than 10%. The material removal rate (MRR) decreases linearly with voltage, indicating a difference in material removal mechanism in the µEDM of non-conductive materials.

Modeling the elastic behavior of ductile cast iron including anisotropy in the graphite nodules

This paper presents a micro-mechanical approach to model the intrinsic elastic anisotropy of the graphite particles in ductile iron. Contrary to most of the published works in the field, the constitutive behavior is directly derived on the basis of the nodule characteristic internal structure, composed of graphite platelets arranged into conical sectors. In this way, the large uncertainty traditionally associated with local mechanical measurements of micro-hardness is eliminated. The proposed anisotropic description is validated by simulating the macroscopic ductile iron elastic response by means of a 3D periodic unit cell model. In this respect, an explicit procedure to enforce both periodic displacement and periodic traction boundary conditions in ABAQUS is presented, and the importance of fulfilling the traction continuity conditions at the unit cell boundaries is discussed. It is shown that localized inelastic deformation is likely to develop for loading conditions which can still be considered as elastic at the macroscopic scale. The presence of a weak interface between the graphite and the matrix is also investigated, and it is found to affect the results to a limited extent only.
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 2.8 SJR 1.501 SNIP 1.713
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.502 SNIP 1.917 CiteScore 2.66
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.643 SNIP 2.048 CiteScore 2.72
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.587 SNIP 2.148 CiteScore 2.6
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.584 SNIP 2.262 CiteScore 2.33
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.668 SNIP 1.911 CiteScore 2.11
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.599 SNIP 1.845
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.86 SNIP 1.774
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.823 SNIP 1.87
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.689 SNIP 1.846
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.653 SNIP 1.994
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.782 SNIP 1.704
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.879 SNIP 1.833
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 2.131 SNIP 1.727
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 2.122 SNIP 1.443
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 1.475 SNIP 1.65
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 1.75 SNIP 1.623
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 2.278 SNIP 1.819

Original language: English
Micro-mechanics, Anisotropic, Elasticity, Ductile cast iron, Graphite nodules
DOIs: 10.1016/j.ijsolstr.2016.09.023
Modelling, characterisation and uncertainties of stabilised pseudoelastic shape memory alloy helical springs

The thermo-mechanical behaviour of pseudoelastic shape memory alloy helical springs is of concern discussing stabilised and cyclic responses. Constitutive description of the shape memory alloy is based on the framework developed by Lagoudas and co-workers incorporating two modifications related to hardening and sub-loop functions designated by Bézier curves. The spring model takes into account both bending and torsion of the spring wire, thus representing geometrical non-linearities. Simplified models are explored showing that a single point in the wire cross section is enough to represent the global spring behaviour in spite of complex stress–strain distributions. The experiments are carried out considering different deflection amplitudes, frequencies and ambient temperatures, which influence the spring behaviour to different extents. The model is fitted against a calibration data set resulting in 1.3% residual standard deviation relative to the full range force. Compared to the validation data set, the errors are below 10% relative to the full range of the complex modulus. Uncertainty analysis of the model parameters using a Markov chain Monte Carlo technique shows low to high parameter correlation, and the relative uncertainties are less than ±12%. Both the heat capacity and the convection coefficient are clearly identifiable from the performed experiments.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Universidade Federal do Rio de Janeiro
Authors: Enemark, S. (Intern), Santos, I. (Intern), Savi, M. A. (Ekstern)
Pages: 2721-2743
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Intelligent Material Systems and Structures
Volume: 27
Issue number: 20
ISSN (Print): 1045-389X
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.02 SJR 0.707 SNIP 1.141
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.891 SNIP 1.584 CiteScore 2.37
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.045 SNIP 1.811 CiteScore 2.54
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.03 SNIP 1.981 CiteScore 2.84
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 1.025 SNIP 1.579 CiteScore 1.87
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.054 SNIP 1.743 CiteScore 2.06
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.864 SNIP 1.452
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.743 SNIP 1.291
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Modelling of Combustion and Pollutant Formation in a Large, Two-Stroke Marine Diesel Engine using Integrated CFD-Skeletal Chemical Mechanism

In this reported work, simulation studies of in-cylinder diesel combustion and pollutant formation processes in a two-stroke, low-speed uniflow-scavenged marine diesel engine are presented. Numerical computation is performed by integrating chemical kinetics into CFD computations. In order to minimize the computational runtime, an in-house skeletal n-heptane chemical mechanism is coupled with the CFD model. This surrogate fuel model comprises 89 reactions with 32 species essential to diesel ignition/combustion processes as well as the formation of soot precursors and nitrogen monoxide (NO). Prior to the marine engine simulation, coupling of the newly developed surrogate fuel model and a revised multi-step soot model [1] is validated on the basis of optical diagnostics measurement obtained at varying ambient pressure levels [2]. It is demonstrated that the variation of ignition delay times, liftoff lengths and averaged soot volume fraction (SVF) with respect to the change of ambient pressure captured using the model agree reasonably well with the measurement, apart from those at the low pressure condition. Numerical models are subsequently validated against experimental combustion characteristics under high load condition in a marine diesel engine. Comparisons to the measurement show that the simulated pressure rise started 1.0 crank angle degree in advance and the calculated peak pressure is 1.7 % lower. The associated flame liftoff length is negligible, yielding high local equivalence ratio and SVF values. In addition, the oxygen availability is found to affect the production of acetylene and hence soot particles. For the current test condition, the averaged NO concentration calculated when soot radiative heat loss is taken into account compared to that when only convective is considered suggests that the former is approximately 7.7 % lower. The findings here aid to gain insight of in-cylinder phenomena in this combustion system. The surrogate fuel model also allows direct couplings of sulfuric oxides formation reactions and a more comprehensive nitrogen oxides mechanisms since the surrogate fuel model includes essential radicals such as O, H and OH for these pollutant formation reactions.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy
Authors: Pang, K. M. (Intern), Karvounis, N. (Intern), Schramm, J. (Intern), Walther, J. H. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from ECCOMAS Congress 2016, Hersonissos, Greece.
Main Research Area: Technical/natural sciences
Electronic versions:
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Source-ID: 125220857
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Modelling of diesel spray flame under engine-like conditions using an accelerated eulerian stochastic fields method: A convergence study of the number of stochastic fields

The use of transported Probability Density Function(PDF) methods allows a single model to compute the autoignition, premixed mode and diffusion flame of diesel combustion under engine-like conditions [1,2]. The Lagrangian particle based transported PDF models have been validated across a wide range of conditions [2,3]. Alternatively, the transported PDF
model can also be formulated in the Eulerian framework[4]. The Eulerian PDF is commonly known as the Eulerian Stochastic Fields (ESF) model. When the same chemical mechanism and micro-mixing model were used, both ESF model and its Lagrangian counterpart generated similar results. The principal motivation for ESF compared to Lagrangian particle based PDF is the relative ease of implementation of the former into Eulerian computational fluid dynamics(CFD) codes [5]. Several works have attempted to implement the ESF model for the simulations of diesel spray combustion under engine-like conditions. The current work aims to further evaluate the performance of the ESF model in this application, with an emphasis on examining the convergence of the number of stochastic fields, n_{sf}. Five test conditions, covering both the conventional diesel combustion and low temperature combustion regimes, are used. The associated ambient conditions and injection characteristics are provided in Table 1.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy, Lund University
Authors: Pang, K. M. (Intern), Jangi, M. (Ekstern), Bai, X. (Ekstern), Schramm, J. (Intern), Walther, J. H. (Intern)
Number of pages: 2
Publication date: 2016
Event: Abstract from Joint Meeting of the Portuguese and Scandinavian-Nordic Sections of the Combustion Institute, Lisbon, Portugal.
Main Research Area: Technical/natural sciences
Electronic versions:
Final_abstract_Joint_Meeting_of_the_Portuguese_Scandinavian_Nordic_Sections_KarMunPANG.pdf
Source: PublicationPreSubmission
Source-ID: 127552584
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Modelling of fluid flow in tape casting of thin ceramics: Analytical approaches and numerical investigations
Tape casting has been used to produce thin layers of ceramics that can be used as single layers or can be stacked and laminated into multilayered structures. Many startup products such as multilayered inductors, multilayered varistors, piezoelectrics, ceramic fuel cells and lithium ion battery components are dependent upon tape casting technology. One of the growing sciences in the processing of ceramics by tape casting is the use of fluid flow analysis to control and enhance the final tapes. The fluid dynamics analysis of the ceramic slurries during tape casting is an efficient mean to elucidate the physical parameters crucial to the process. A review of the development of the tape casting process with particular focus on modelling the material flow is presented and in this context the current status is examined and future potential discussed.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Jabbaribehnam, M. (Intern), Hattel, J. H. (Intern)
Pages: 291-305
Publication date: 2016

Host publication information
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Publisher: Wiley
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ISBN (Print): 9781119211730
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Series: Ceramic Engineering and Science Proceedings
ISSN: 0196-6219
Main Research Area: Technical/natural sciences
Conference: 39th International Conference and Expo on Advanced Ceramics and Composites, Daytona Beach, FL, United States, 25/01/2015 - 25/01/2015
DOIs: 10.1002/9781119211747.ch24
Source: FindIt
Source-ID: 2302798429
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
Modelling of real area of contact between tool and workpiece in metal forming processes including the influence of subsurface deformation

New equipment for testing asperity deformation at various normal loads and subsurface elongations is presented. Resulting real contact area ratios increase heavily with increasing subsurface expansion due to lowered yield pressure on the asperities when imposing subsurface normal stress parallel to the surface. Finite element modelling supports the presentation and contributes by extrapolation of results to complete the mapping of contact area as function of normal pressure and one-directional subsurface strain parallel to the surface. Improved modelling of the real contact area is the basis for estimating friction in the numerical modelling of metal forming processes.
Modelling production system architectures in the early phases of product development

This article suggests a framework for modelling a production system architecture in the early phases of product development. The challenge in these phases is that the products to be produced are not completely defined and yet decisions need to be made early in the process on what investments are needed and appropriate to enable determination of obtainable product quality. In order to meet this challenge, it is suggested that a visual modelling framework be adopted that clarifies which product and production features are known at a specific time of the project and which features will be worked on – leading to an improved basis for prioritizing activities in the project. Requirements for the contents of the framework are presented, and literature on production and system models is reviewed. The production system architecture modelling framework is founded on methods and approaches in literature and adjusted to fit the modelling requirements of a production system architecture at an early phase of development. The production system architecture models capture and describe the structure, capabilities and expansions of the production system architecture under development. The production system architecture modelling framework is tested in a case study, and the results indicate that the modelling process facilitates identification of critical factors of the production system architecture, that the production system architecture models capture and describe the structure, capabilities and expansions of a production system architecture under development, and that the production system architecture models can facilitate dialogue on the production system architecture between heterogeneous stakeholder groups.

General information
State: Published
Organisations: Engineering Design and Product Development, Department of Mechanical Engineering, Department of Management Engineering, Management Science
Authors: Guðlaugsson, T. V. (Intern), Ravn, P. M. (Intern), Mortensen, N. H. (Intern), Hvam, L. (Intern)
Pages: 136–150
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Concurrent Engineering: Research and Applications
Volume: 25
Issue number: 2
ISSN (Print): 1063-293X
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
Modelling the deformation of nickel foil during manufacturing of nanostructures on injection moulding tool inserts

In the present work, a manufacturing process for transferring nanostructures from a glass wafer, to a double-curved insert for injection moulding is demonstrated. A nanostructure consisting of sinusoidal cross-gratings with a period of 426 nm is successfully transferred to hemispheres on an aluminium substrate with three different radii; 500 μm, 1000 μm and 2000 μm, respectively. The nanoimprint is performed using a 50 μm thick nickel foil, manufactured using electroforming. During the imprinting process, the nickel foil is stretched due to the curved surface of the aluminium substrate. Experimentally, it is possible to address this stretch by counting the periods of the cross-gratings via SEM characterization. A model for the deformation of the nickel foil during nanoimprint is developed, utilizing non-linear material and geometrical behaviour. Good agreement between measured and numerically calculated stretch ratios on the surface of the deformed nickel foil is found, and it is shown, that from the model it is also possible to predict the geometrical extent of the nanostructured area on the curved surfaces.
Modelling the deformations during the manufacturing of nanostructures on non-planar surfaces for injection moulding tool inserts: Paper

This paper presents a new manufacturing process for transferring nanostructures from a glass wafer to a curved aluminium insert for polymer injection moulding. A nanostructure consisting of sinusoidal cross-gratings with a period of 426 nm is successfully transferred to hemispheres with different radii via an embossing process. The embossing is done into a glass-like resist called HSQ, using a 50 μm thick nickel foil, manufactured with electroforming. During the imprinting process the nickel foil is stretched due to the curved surface of the aluminium substrate and it is experimentally possible to characterize this stretch by counting the periods of the cross-gratings via SEM characterization. A numerical model for simulating the deformation of the nickel foil during nanoimprint is also developed, utilizing non-linear material and geometrical behaviour. Good agreement between measured and numerically calculated stretch ratios on the surface of the deformed nickel foil is shown, and from the model it is also possible to predict the limiting boundary of the nanostructures on the curved surfaces, with decreasing radii.

General information

State: Published

Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Polymer Micro & Nano Engineering, Department of Micro- and Nanotechnology, InMold Biosystems A/S, Danmarks Nationale Metrologiinstitut, Nanyang Technological University

Authors: Sonne, M. R. (Intern), Cech, J. (Intern), Pranov, H. (Ekstern), Kofod, G. (Ekstern), Garnæs, J. (Ekstern), Lam, Y. C. (Ekstern), Hattel, J. H. (Intern), Taboryski, R. (Intern)

Number of pages: 9

Publication date: 2016

Main Research Area: Technical/natural sciences

Publication information

Journal: Journal of Micromechanics and Microengineering

Volume: 26

Issue number: 3

ISSN (Print): 0960-1317

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes

BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.74 SJR 0.595 SNIP 1.017
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.64 SNIP 1.211 CiteScore 1.96
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.725 SNIP 1.224 CiteScore 1.84
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.611 SNIP 1.055 CiteScore 1.74
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.856 SNIP 1.402 CiteScore 1.92
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.038 SNIP 1.437 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Modelling the evolution of composition-and stress-depth profiles in austenitic stainless steels during low-temperature nitriding: Paper

Nitriding of stainless steel causes a surface zone of expanded austenite, which improves the wear resistance of the stainless steel while preserving the stainless behaviour. During nitriding huge residual stresses are introduced in the treated zone, arising from the volume expansion that accompanies the dissolution of high nitrogen contents in expanded austenite. An intriguing phenomenon during low-temperature nitriding is that the residual stresses evoked by dissolution of nitrogen in the solid state, affect the thermodynamics and the diffusion kinetics of nitrogen dissolution. In the present paper solid mechanics was combined with thermodynamics and diffusion kinetics to simulate the evolution of composition-depth and stress-depth profiles resulting from nitriding. The model takes into account a composition-dependent diffusion coefficient of nitrogen in expanded austenite, short range ordering (trapping) of nitrogen atoms by chromium atoms, and the effect of composition-induced stress on surface concentration and diffusive flux. The effect of plasticity and concentration-dependence of the yield stress was also included.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Manufacturing Engineering
Authors: Jespersen, F. N. (Intern), Hattel, J. H. (Intern), Somers, M. A. J. (Intern)
Number of pages: 32
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Modelling and Simulation in Materials Science and Engineering
Volume: 24
Issue number: 2
Article number: 025003
ISSN (Print): 0965-0393
Modelling the flexible stamp deformations during NIL on curved surfaces

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Sonne, M. R. (Intern), Hattel, J. H. (Intern)
Number of pages: 1
Publication date: 2016
Event: Abstract from NILindustrial day 2016, Vienna, Austria.
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 122242798
Publication: Research - peer-review › Conference abstract for conference – Annual report year: 2016

Model Predictive Control of Offshore Power Stations With Waste Heat Recovery
The implementation of waste heat recovery units on oil and gas offshore platforms demands advances in both design methods and control systems. Model-based control algorithms can play an important role in the operation of offshore power stations. A novel regulator based on a linear model predictive control (MPC) coupled with a steady-state performance optimizer has been developed in the SIMULINK language and is documented in the paper. The test case is the regulation of a power system serving an oil and gas platform in the Norwegian Sea. One of the three gas turbines is combined with an organic Rankine cycle (ORC) turbogenerator to increase the energy conversion efficiency. Results show a potential reduction of frequency drop up to 40% for a step in the load set-point of 4 MW, compared to proportional–integral control systems. Fuel savings in the range of 2–3% are also expected by optimizing on-the-fly the thermal efficiency of the plant.

General information
State: Published
Authors: Pierobon, L. (Intern), Chan, R. (Ekstern), Li, X. (Ekstern), Lyengar, K. (Ekstern), Haglind, F. (Intern), Ydstie, E. (Ekstern)
Number of pages: 13
Pages: 071801
Publication date: 2016
Main Research Area: Technical/natural sciences
Publication information
Journal: Journal of Engineering for Gas Turbines and Power
Volume: 138
Issue number: 7
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Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.66 SJR 0.542 SNIP 1.052
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.916 SNIP 1.422 CiteScore 1.55
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.666 SNIP 1.473 CiteScore 1.45
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.679 SNIP 1.422 CiteScore 1.33
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.677 SNIP 1.53 CiteScore 0.97
Moisture diffusion coefficients determination of furan bonded sands and water based foundry coatings

Moisture content in furan bonded sand and water based coatings can be one of the main causes for gas related defects in large cast iron parts. Moisture diffusion coefficients for these materials are needed to precisely predict the possible moisture levels in foundry moulds. In this study, we first compare two different experimental methods that can be used to determine moisture diffusion coefficients. Then, we determine diffusion coefficients for water based coatings and for different types of furan binders and we investigate the effects of compaction, dust levels and temperature. Finally, we provide an example on how it is possible to apply this knowledge to estimate moisture variation in a sand mould during production.
Ratings:
BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.74 SJR 0.404 SNIP 0.851
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.334 SNIP 0.579 CiteScore 0.65
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.433 SNIP 0.913 CiteScore 0.73
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.497 SNIP 0.978 CiteScore 0.67
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.371 SNIP 0.677 CiteScore 0.52
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.578 SNIP 1.01 CiteScore 0.75
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.492 SNIP 0.849
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.263 SNIP 0.398
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.3 SNIP 0.49
Scopus rating (2007): SJR 0.525 SNIP 0.892
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.521 SNIP 0.791
Scopus rating (2005): SJR 0.393 SNIP 0.747
Scopus rating (2004): SJR 0.327 SNIP 0.587
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.275 SNIP 0.859
Scopus rating (2002): SJR 0.393 SNIP 0.701
Scopus rating (2001): SJR 0.368 SNIP 0.644
Scopus rating (2000): SJR 0.324 SNIP 0.586
Scopus rating (1999): SJR 0.842 SNIP 1.392

Original language: English
Mechanical Engineering, Mechanics of Materials, Metals and Alloys, Core drying, Furan sand, Moisture diffusion coefficients, Vapour sorption analysis, Water based foundry coating, Aromatic compounds, Cast iron, Coatings, Diffusion, Diffusion coatings, Foundries, Foundry sand, Moisture, Molds, Organic pollutants, Sand, Cast iron parts, Experimental methods, Foundry coatings, Moisture diffusion coefficient, Moisture level, Moisture variation, Water based, Water-based coating, Moisture determination, Metallurgical industries, Forming processes, Heat treatment, Surface treatment and coating techniques, Manufacturing facilities, Engineering materials, cast iron, coatings, diffusion, dust, foundries, moisture, moulding, sand, moisture diffusion coefficient determination, furan bonded sands, water based foundry coatings, moisture content, gas related defects, cast iron parts, foundry moulds, water based coatings, dust levels, moisture variation estimation, METALLURGY

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Source: FindIt
Source-ID: 2281665778
Moisture ingress into electronics enclosures under isothermal conditions
The number of electronics used in outdoor environment is constantly growing. The humidity causes about 19% of all electronics failures and, especially, moisture increases these problems due to the ongoing process of miniaturization and lower power consumption of electronic components. Moisture loads are still not understood well by design engineers, therefore this field has become one of the bottlenecks in the electronics system design. The objective of this paper is to model moisture ingress into an electronics enclosure under isothermal conditions. The moisture diffusion model is based on a 1D quasi-steady state (QSS) approximation for Fick's second law. This QSS approach is also described with an electrical analogy which gives a fast tool in modelling of the moisture response. The same QSS method is applied to ambient water vapour variations. The obtained results are compared to an analytical solution and very good agreement is found.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Staliulionis, Z. (Intern), Jabbaribehnam, M. (Intern), Hattel, J. H. (Intern)
Number of pages: 5
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Main Research Area: Technical/natural sciences

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Journal: A I P Conference Proceedings Series
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Ratings:
BFI (2018): BFI-level 1
BFI (2017): BFI-level 1
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.21 SJR 0.163 SNIP 0.236
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.179 SNIP 0.217 CiteScore 0.18
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.165 SNIP 0.191 CiteScore 0.17
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.16 SNIP 0.173 CiteScore 0.16
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.17 SNIP 0.176 CiteScore 0.14
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.153 SNIP 0.141 CiteScore 0.12
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.16 SNIP 0.144
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.157 SNIP 0.137
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.162 SNIP 0.112
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.157 SNIP 0.125
Scopus rating (2006): SJR 0.157 SNIP 0.121
Scopus rating (2005): SJR 0.157 SNIP 0.187
Scopus rating (2004): SJR 0.122 SNIP 0
Molecular Gastronomy Meets 3D Printing: Layered Construction via Reverse Spherification

The potential use of additive manufacturing (AM) techniques for processing of food can span from satisfaction of basic necessities to high-end cuisine and fine dining. The purpose of this study was to explore how AM, specifically extrusion-based layer-wise deposition, can be combined with the reverse spherification technique that is widely used in molecular gastronomy. First, by manual extrusion, we identify suitable recipes and ingredient concentrations to form freestanding features in a liquid bath. Subsequently, a desktop extrusion is adapted for the deposition of a calcium solution into an alginate bath first as a two-dimensional (2D) pathway and then as three-dimensional (3D) geometry by layer-wise deposition. The 2D geometries are measured and compared to a nominal geometry, to elucidate how tool speed and extrusion rate influence form and dimensional accuracy. We demonstrate that motorized extrusion-based AM can be combined with reverse spherification to form stable objects by gelation of fruit-based solutions. In addition, a wider set of manual experiments shows the possibility of combining different flavors and the creation of complex multilayer and multiflavor objects. Additional studies on the deposition precision are required to optimize the process of creating a full 3D geometry. This study shows that 3D printing via reverse spherification can bridge the gap between culinary art and AM technology, and enable new capabilities for creation of dining experiences. This is a step toward the digital design and manufacturing of unique edible objects with complex flavors, textures, and geometries.

General information

State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Massachusetts Institute of Technology
Authors: D'Angelo, G. (Intern), Hansen, H. N. (Intern), Hart, A. J. (Ekstern)
Pages: 153-159
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information

Journal: 3D Printing and Additive Manufacturing
Volume: 3
Issue number: 3
ISSN (Print): 2329-7662
Ratings:
Web of Science (2018): Indexed yes
Web of Science (2017): Indexed Yes
Scopus rating (2016): SJR 0.182 SNIP 0.497 CiteScore 0.8
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 0.175 SNIP 0.165
Original language: English
3d printing, Food, Molecular gastronomy, Spherification
DOIs:
10.1089/3dp.2016.0024
Source: FindIt
Source-ID: 2343400874
Publication: Research - peer-review › Journal article – Annual report year: 2016

Motions of deformable inclusions in a horizontally oscillating vessel with a compressible fluid

The paper is concerned with the analysis of rigid particle and compressible gas bubble motion in a horizontally oscillating vessel with a compressible fluid. A nonlinear differential equation describing motion of inclusions with respect to the vessel is derived and solved by the method of direct separation of motions. It is shown that rigid particles and gas bubbles can move both in nodes and antinodes of the pressure, depending on their size, density, and vibration parameters. The conditions under which different kinds of motion can incur have been determined. An expression for the critical radius of the bubbles which are affected by the negligible vibrational force is found. Also an approximate expression has been
obtained for the average velocity of bubble's motion in the fluid; relationship between this velocity and bubble radius and vibration parameters has been revealed. A simple physical explanation of the noticed effects is proposed. Series of numerical experiments has been conducted, their results confirming those obtained theoretically. These results may be of interest for development of the flotation theory and other technological processes.

**General information**
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Russian Academy of Sciences
Authors: Demidov, I. (Ekstern), Sorokin, V. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.09 SJR 1.462 SNIP 2.162
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.391 SNIP 2.142 CiteScore 2.71
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.447 SNIP 2.38 CiteScore 2.54
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.495 SNIP 2.992 CiteScore 2.3
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.441 SNIP 2.698 CiteScore 2.05
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.218 SNIP 2.069
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 1.384 SNIP 2.185
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.205 SNIP 1.96
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.173 SNIP 1.701
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 0.882 SNIP 1.632
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.087 SNIP 1.624
Moulding process characterization of paper bottles using computed tomography

The paper presents an approach for evaluating the moulding process for production of paper bottles using Computed Tomography (CT). Moulded Pulp Products (MPP) are made of a formed, dewatered and dried mixture of pulp fibers and water. Modern industrial pulp moulding is dated back to the year 1903 when a patent for MPP production was acquired by Martin L. Keyes. With an increasing demand for environmental friendly products, researchers are now focusing on investigating advanced manufacturing process for production of MPP.


For zeotropic mixtures, the temperature varies during phase change, which is opposed to the isothermal phase change of pure fluids. The use of such mixtures as working fluids in organic Rankine cycle power plants enables a minimization of the mean temperature difference of the heat exchangers, which is beneficial for cycle performance. On the other hand, larger heat transfer surface areas are typically required for evaporation and condensation when zeotropic mixtures are used as working fluids. In order to assess the feasibility of using zeotropic mixtures, it is, therefore, important to consider the additional costs of the heat exchangers. In this study, we aim at evaluating the economic feasibility of zeotropic mixtures compared to pure fluids. We carry out a multi-objective optimization of the net power output and the component costs for organic Rankine cycle power plants using low-temperature heat at 90 °C to produce electrical power at around 500 kW. The primary outcomes of the study are Pareto fronts, illustrating the power/cost relations for R32, R134a and R32/R134a (0.65/0.35 mole). The results indicate that R32/R134a is the best of these fluids, with 3.4% higher net power than R32 at the same total cost of 1200 k$.

General information
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Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Saxena, P. (Intern), Bissacco, G. (Intern)
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Publisher: Korea Technical Association of the Pulp and Paper Industry
Main Research Area: Technical/natural sciences
Source: PublicationPreSubmission
Source-ID: 126938977
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016
We present results from a new Navier-Stokes model for multiphase flow in porous media implemented in Ansys Fluent 16.2 [1]. The model includes the Darcy-Forchheimer source terms in the momentum equations and proper account for relative permeability and capillary pressure in the porous media. This approach is widely used for single phase flow, but not for multiphase flow in porous media. This might be due to the complexity of introducing relative permeability and capillary pressure in the CFD solver. The introduction of relative permeability and capillary pressure may cause numerical instabilities as the saturation of a grid cell approaches the residual saturation, i.e. the relative permeability goes towards zero. This means that the viscous resistance in the Darcy-Forchheimer equation approaches infinity. Furthermore, by coupling the Navier-Stokes equation and Darcy-Forchheimer equation it is possible to model both the non-porous and...
porous media using the same formulation.

**Multiple Crack Growth Prediction in AA2024-T3 Friction Stir Welded Joints, Including Manufacturing Effects**

A great deal of attention is currently paid by several industries toward the friction stir welding process to realize lightweight structures. Within this aim, the realistic prediction of fatigue behavior of welded assemblies is a key factor. In this work an integrated finite element method - dual boundary element method (FEM-DBEM) procedure, coupling the welding process simulation to the subsequent crack growth assessment, is proposed and applied to simulate multiple crack propagation, with allowance for manufacturing effects. The friction stir butt welding process of the precipitation hardened AA2024-T3 alloy was simulated using a thermo-mechanical FEM model to predict the process induced residual stress field and material softening. The computed stress field was transferred to a DBEM environment and superimposed to the stress field produced by a remote fatigue traction load applied on a notched specimen. The whole procedure was finally tested comparing simulation outcomes with experimental data. The good agreement obtained highlights the predictive capability of the method. The influence of the residual stress distribution on crack growth and the mutual interaction between propagating cracks were analyzed as well.
Multiple vortex structures in the wake of a rectangular winglet in ground effect

Patterns of vorticity in the wake of a single rectangular winglet (vortex generator) embedded in a turbulent boundary layer have been studied using Stereoscopic Particle Image Velocimetry (SPIV). The winglet was mounted normally to a flat surface with an angle to the oncoming flow. A parametric study varying the winglet height (constant aspect ratio) and angle has shown, contrary to the common classical single tip-vortex conception, that the wake generally consists of a complex system of multiple vortex structures. The primary vortex has previously been discovered to contain a direct coupling between the axial and the rotational flow. In the current work, even the longitudinal secondary structures detected from measured streamwise vorticity display similar behavior. A regime map depicting the observed stable far wake states of the multiple vortices as a function of winglet height and angle reveals complex patterns of the flow topologies not only with the primary tip vortex, but with the additional secondary structures as well. A bifurcation diagram shows distinct regimes of the various secondary structures as well as how the primary vortex is in some cases significantly affected by their presence. These data should serve as inspiration in the process of generating longitudinal vortices for enhancement of heat and mass transfer in industrial devices since the multiple vortex regimes can help improve the conditions for these exchanges. Further, these results point to a weakness in existing inviscid models not accounting for the possibility of multiple vortical structures in the wake. © 2015 Elsevier Inc. All rights reserved.
New strategy for testing new high nitrogen bearing steel for offshore wind turbines

This article presents some results obtained during the first stage of the European Union project titled “STEELWIND,” a part of which has been dedicated to roller–race contact dynamics. Contact has been modeled qualitatively using viscous-elastic friction, in the sliding regions, and hysteresis-modified Hertzian pressure in the whole contact zone. Slip and stick areas are detected within the contact area where the sliding velocity may have both opposite directions parallel to the entraining velocity. Considering the complexity of the hybrid rolling–sliding–sticking conditions, the developed model, although simplified, can be helpful to develop a sliding–rolling test by means of a standard reciprocator stand, where nonsymmetrical and mobile configurations of the testing race samples are introduced.
Non-Invasive Parameter Identification in Rotordynamics via Fluid Film Bearings: Linking Active Lubrication and Operational Modal Analysis

In recent years, theoretical and experimental efforts have transformed the conventional tilting pad journal bearing (TPJB) into a smart mechatronic machine element. The application of electromechanical elements into rotating systems makes feasible the generation of controllable forces over the rotor as a function of a suitable control signal. The servovalve input signal and the radial injection pressure are the two main parameters responsible for dynamically modifying the journal oil film pressure and generating active fluid film forces in controllable fluid film bearings. Such fluid film forces, resulting from a strong coupling between hydrodynamic, hydrostatic and controllable lubrication regimes, can be used either to control or to excite rotor lateral vibrations. If non-invasive forces are generated via lubricant fluid film, in situ parameter identification can be carried out, enabling evaluation of the mechanical condition of the rotating machine. Using the lubricant fluid film as a non-invasive calibrated shaker is troublesome, once several transfer functions among mechanical, hydraulic and electronic components become necessary. In this framework the main original contribution of this paper is to show experimentally that the knowledge about the several transfer functions can be bypassed by using output-only identification techniques. The manuscript links controllable (active) lubrication techniques with operational modal analysis, allowing for in-situ parameter identification in rotordynamics, i.e. estimation of damping ratio and natural frequencies. The experimental analysis is carried out on a rigid rotor level system supported by one single pair of pads. The estimation of damping and natural frequencies is performed using classical experimental modal analysis (EMA) and operational modal analysis (OMA). Very good agreements between the two experimental approaches are found. Maximum values of the main input parameters, namely servovalve voltage and radial injection pressure, are experimentally found with the objective of defining ranges of non-invasive perturbation forces.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Technical University of Denmark
Authors: Santos, I. (Intern), Svendsen, P. K. (Ekstern)
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Nonlinear Collapse of General Thin-Walled Cross-Sections Under Pure Bending

Thin-walled beams exhibit a nonlinear response to bending moments due to the progressive flattening of the crosssection, a behavior commonly referred to as the Brazier effect. Most approaches to model this effect are limited to either circular cross-sections or to cross-sections made of isotropic materials. This article proposes an efficient two-step method of predicting the nonlinear collapse of thin-walled cross-sections of arbitrary geometry with isotropic and orthotropic materials. The procedure relies on representing the cross-section by two-dimensional nonlinear corotating beam elements with imposed in-plane loads proportional to the curvature, combined with a finite strip buckling analysis based on the
deformed cross-section. By comparison with existing analytical and numerical modeling approaches, it is demonstrated that the present method can capture the cross-section flattening and critical moment for buckling of thin-walled structures commonly found in the industry.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Couturier, P. (Intern), Krenk, S. (Intern)
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Web of Science (2018): Indexed yes
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 2.58 SJR 0.884 SNIP 1.672
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BFI (2015): BFI-level 1
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.875 SNIP 1.754 CiteScore 2.28
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Scopus rating (2013): SJR 0.976 SNIP 1.837 CiteScore 2.25
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.949 SNIP 1.911 CiteScore 1.54
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 1.108 SNIP 1.725 CiteScore 1.44
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.902 SNIP 1.597
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.96 SNIP 1.519
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.014 SNIP 1.388
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.216 SNIP 1.601
Scopus rating (2006): SJR 1.057 SNIP 1.719
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.167 SNIP 1.536
Scopus rating (2004): SJR 1.064 SNIP 1.474
Scopus rating (2003): SJR 1.246 SNIP 1.263
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 1.202 SNIP 1.462
Nonlinear dynamic behaviour of a rotor-foundation system coupled through passive magnetic bearings with magnetic anisotropy - Theory and experiment

In this work, the nonlinear dynamic behaviour of a vertical rigid rotor interacting with a flexible foundation by means of two passive magnetic bearings is quantified and evaluated. The quantification is based on theoretical and experimental investigation of the non-uniformity (anisotropy) of the magnetic field and the weak nonlinearity of the magnetic forces. Through mathematical modelling the nonlinear equations of motion are established for describing the shaft and bearing housing lateral dynamics coupled via the nonlinear and non-uniform magnetic forces. The equations of motion are solved in the frequency domain by the methods of Finite Difference and pseudo-arclength continuation. The theoretical findings are validated against experiments carried out using a dedicated test-rig and a special device for characterisation of the magnetic anisotropy. The characterisation of the magnetic anisotropy shows that it can be quantified as magnetic eccentricities having an amplitude and a phase, which result in linear and parametric excitation. The magnetic eccentricities are also determined using the steady-state response of the rotor–bearing system due to forcing from the magnetic anisotropies and several levels of mass imbalance. Discrepancies in the results from the two methods in terms of magnetic eccentricity magnitude are due to additional geometric eccentricities in the shaft. The steady-state system response shows clear nonlinear phenomena, e.g. bent resonance peaks, jump phenomena and nonlinear cross-coupling between the two orthogonal directions, especially during counter-phase motion between shaft and bearings. The clear nonlinear behaviour is facilitated by the lack of damping resulting in relatively large vibrations. The overall nonlinear dynamic behaviour is well captured by the theoretical model, thereby validating the modelling approach.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Enemark, S. (Intern), Santos, I. F. (Intern)
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Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
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Web of Science (2016): Indexed yes
Scopus rating (2016): CiteScore 3.09 SJR 1.462 SNIP 2.162
Web of Science (2016): Indexed yes
Scopus rating (2015): SJR 1.391 SNIP 2.142 CiteScore 2.71
Web of Science (2015): Indexed yes
Scopus rating (2014): SJR 1.447 SNIP 2.38 CiteScore 2.54
Web of Science (2014): Indexed yes
Scopus rating (2013): SJR 1.391 SNIP 2.64 CiteScore 2.61
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
A novel crack arresting device has been implemented in foam cored composite sandwich beams panels and tested under both static and fatigue loading conditions. Fatigue crack propagation was induced in the face-core interface of the sandwich panels which met the crack arrester. The effect of the embedded crack arresters was evaluated in terms of the achieved enhancement of the damage tolerance of the tested sandwich beams and panels. Finite element (FE) modelling of the experimental setups was used for predicting propagation rates and direction of the crack growth. The FE model predicts the energy release rate and the mode mixity based on the derived crack surface displacements, utilizing algorithms for the prediction of accelerated fatigue crack growth as well as the strain field evolution in the vicinity of the crack tip on the surface of the sandwich specimens. Finally, a comparison between the experimental results and the numerical simulations has been made to validate the numerical predictions as well as the overall performance of the crack arresters. Based on a linear elastic fracture mechanics approach, the developed FE model was utilized to simulate crack propagation and arrest in foam cored sandwich beam and panel specimens subjected to fatigue loading conditions. The effect of the crack arresters on the fatigue life is analysed, and the predictive results are subsequently compared with the observations from fatigue tests. Overall it was demonstrated that the proposed crack arrester device was indeed capable of deflecting and arresting propagating face sheet/core interface cracks, and further that the use of embedded crack stoppers is capable of extending the fatigue life very significantly. It was further demonstrated that the developed
numerical analysis procedures provide predictions that are in excellent agreement with the experimental observations.

**General information**

**State:** Published

**Organisations:** Department of Mechanical Engineering, Solid Mechanics, Siemens Wind Power, University of Southampton, Aalborg University

**Authors:** Martakos, G. (Ekstern), Andreasen, J. H. (Forskerdatabase), Berggreen, C. (Intern), Thybo Thomsen, O. (Ekstern)

**Number of pages:** 2

**Publication date:** 2016

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**Main Research Area:** Technical/natural sciences

**Sandwich structures, Damage tolerance, Face-sheet/core debond, Crack stopper**

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**Numerical and experimental study of pulse-jet cleaning in fabric filters**

Pulse-jet cleaning and understanding of the complex physics are essential when designing fabric filters used for air pollution control. Today, low-pressure cleaning is of particular interest due to demand for reduced compressed air consumption. Pulse-jet cleaned fabric filters have been studied for many years by experimental investigation and to a limited extent by Computational Fluid Dynamics (CFD). The majority of the studies have focused on high-pressure cleaning systems, and the CFD models presented are so far two-dimensional (2D). In the work presented here, pulse-jet cleaning of low-pressure fabric filters (2 bar) is studied using a full three-dimensional (3D) CFD model. Experimental results obtained in a pilot-scale test filter with 28 bags, in length of 10 m and in general full-scale dimensions of the cleaning system are used to verify the reliability of the present CFD model. The validated CFD model reveals the strong compressible effects, a highly transient behaviour, the formation of compressible vortex rings and the shock cell phenomenon within the overexpanded supersonic jet. The cleaning nozzles and venturi design aid or oppose the pulse-pressure within the bags, and this plays an important role in the resulting efficiency of removing the dust layer from the bags. The CFD simulation shows that the traditional straight-bore nozzles provide substantial misalignment of the jet, and the add-on nozzle design offers only limited improvement. Further, the need for venturis in low-pressure filters and the importance of optimising the venturi design are demonstrated. The working principle of the venturi is to restrict backflow which is detrimental to the pressure rise in the bags. Reducing the venturi throat diameter is shown to reduce backflow and improve the pulse-pressure.

**General information**

**State:** Published

**Organisations:** Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, F.L. Smidth A/S

**Authors:** O. Andersen, B. (Ekstern), Nielsen, N. F. (Ekstern), Walther, J. H. (Intern)

**Pages:** 284-298

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**Main Research Area:** Technical/natural sciences

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Web of Science (2017): Indexed yes

BFI (2016): BFI-level 1

Scopus rating (2016): CiteScore 3.16 SJR 0.983 SNIP 1.482

Web of Science (2016): Indexed yes

BFI (2015): BFI-level 1

Scopus rating (2015): SJR 0.965 SNIP 1.598 CiteScore 2.99

Web of Science (2015): Indexed yes

BFI (2014): BFI-level 1

Scopus rating (2014): SJR 0.89 SNIP 1.649 CiteScore 2.67

Web of Science (2014): Indexed yes
Numerical investigation of friction joint between Basalt Fiber Reinforced Composites and aluminum

Flexible risers are used in the offshore oil industry for exporting hydrocarbons from subsea equipment to floating production and storage vessels. The latest research in unbonded flexible pipes aims to reduce weight by replacing metal components with composite materials. This would result in lighter and stiffer flexible risers, which would be well suited for ultra deep water applications. This paper develops a new finite element model used for evaluating the efficiency of anchoring flat unidirectional fiber reinforced tendons in a mechanical grip. It consists of two flat grips with the fiber reinforced tendon in between. The grips are pressed against the composite and the pullout force is ensured through friction. The novelty of the paper is represented by the detailed investigation of the influence between the coefficient of friction and the pullout force. By comparing numerical and experimentally obtained results, it is possible to show the importance of friction decay in the grip. Improper contact between the grips and composite is also taken into account and leads to good agreement between numerical and experimental results. This study shows how to avoid overestimating the efficiency of such grip by using dry friction in finite element models.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Manufacturing Engineering, National Oilwell Varco Denmark I/S
Authors: Costache, A. (Intern), Berggreen, C. (Intern), Sivebæk, I. M. (Intern), Glejbol, K. (Ekstern)
Pages: 543–551
Numerical investigation of soot formation and oxidation processes under large two-stroke marine diesel engine-like conditions using integrated CFD-chemical kinetics

In this reported work, multi-dimensional computational fluid dynamics studies of diesel combustion and soot formation processes in a constant volume combustion chamber and a marine diesel engine are carried out. The key interest here is firstly to validate the coupling of a newly developed skeletal n-heptane mechanism and a revised multi-step soot model using laser extinction measurements of diesel soot obtained at different ambient pressure levels in an optical accessible, constant volume chamber experiment. It is revealed that ignition delay times and liftoff lengths generated using the new skeletal model are close to those produced by the larger and more comprehensive chemical mechanisms, apart from those at the low pressure condition. The current study also demonstrates that the variation of averaged soot volume fraction with respect to the change of combustion chamber pressure captured using the revised soot model agrees reasonably well with the measurements in terms of peak values. The numerical model is subsequently applied to investigate the flame development, soot/nitrogen monoxide formation and heat transfer in a two-stroke, low-speed uniflow-scavenged marine diesel engine operating at full load condition, where optical measurements are not available. Comparisons to the experimental data show that the simulated pressure rise starts 1.0 crank angle degree in advance and the calculated peak pressure is 1.7% lower. The associated flame liftoff length is negligible, yielding higher local equivalence ratio and soot volume fraction values as compared to those under similar test condition in the constant volume chamber. With the use of the revised model, the total heat transfer to the walls calculated when soot radiative heat loss is taken into account is approximately 30% higher compared to that when only convective heat loss is considered. The averaged nitrogen monoxide concentration is 7.7% lower when both convective and soot radiative heat losses are accounted for but the net soot mass production is less sensitive to soot radiation. A sensitivity study reveals that neither increasing nor decreasing the soot absorption coefficient by 30% from the baseline setup is influential to nitrogen monoxide formation, soot mass production and heat transfer. The findings here aid to gain insights and provide a better understanding of the combustion and soot processes in large, uniflow-scavenged marine engines. The numerical model developed in this work can also be applied to explore different phenomena in this combustion system.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Thermal Energy
Authors: Pang, K. M. (Intern), Karvounis, N. (Intern), Walther, J. H. (Intern), Schramm, J. (Intern)
Pages: 874-887
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Main Research Area: Technical/natural sciences

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Journal: Applied Energy
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Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 7.78 SJR 3.058 SNIP 2.573
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 2.912 SNIP 2.61 CiteScore 6.4
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 3.254 SNIP 3.28 CiteScore 6.93
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 3.164 SNIP 3.377 CiteScore 6.59
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 2.854 SNIP 3.108 CiteScore 5.69
ISI indexed (2012): ISI indexed yes
Numerical Modelling of Drawbeads for Forming of Aluminium Alloys

The drawbeads in stamping tools are usually designed based on experience from the forming of steel. However, aluminium alloys display different forming behaviour to steels, which is not reflected in the drawbead design for tools used for stamping aluminium. This paper presents experimental results from different semi-circular drawbead geometries commonly encountered in automotive dies and compares them to those obtained from Stoughton’s analytical drawbead model and the 2D plane strain drawbead model set up using LS-DYNA. The study was conducted on lubricated NG5754 strips. The results presented are in terms of drawbead restraining force versus strip displacement, as a function of drawbead depth. The FE drawbead model agrees well with the experiments whereas the analytical model overpredicted the drawbead forces.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, University of Warwick
Authors: Joshi, Y. (Ekstern), Christiansen, P. (Intern), Masters, I. (Ekstern), Bay, N. O. (Intern), Dashwood, R. (Ekstern)
Number of pages: 4
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Journal of Physics: Conference Series (Online)
Volume: 734
Numerical modelling of evaporation in a ceramic layer in the tape casting process
Evaporation of water from a ceramic layer is a key phenomenon in the drying process for the manufacturing of tape cast ceramics. This process contains mass, momentum and energy exchange between the porous medium and the free-flow region. In order to analyze such interaction processes, a Representative Elementary Volume (REV)-scale model concept is presented for coupling non-isothermal multi-phase compositional porous-media flow and single-phase compositional laminar free-flow. The preliminary results show the typical expected evaporation behaviour from a porous medium initially saturated with water, and its transport to the free-flow region according to the existent results from the literature.
Numerical modelling of the flow in the resin infusion process on the REV scale: A feasibility study

The resin infusion process (RIP) has developed as a low cost method for manufacturing large fibre reinforced plastic parts. However, the process still presents some challenges to industry with regards to reliability and repeatability, resulting in expensive and inefficient trial and error development. In this paper, we show the implementation of 2D numerical models for the RIP using the open source simulator DuMuX. The idea of this study is to present a model which accounts for the interfacial forces coming from the capillary pressure on the so-called representative elementary volume (REV) scale. The model is described in detail and three different test cases - a constant and a tensorial permeability as well as a preform/Balsa domain - are investigated. The results show that the developed model is very applicable for the RIP for manufacturing of composite parts. The idea behind this study is to test the developed model for later use in a real application, in which the preform medium has numerous layers with different material properties.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering, Universitat Stuttgart, SCION DTU
Authors: Jabbaribehnam, M. (Intern), Jambhekar, V. A. (Ekstern), Gersborg, A. R. (Ekstern), Spangenberg, J. (Intern), Hattel, J. H. (Intern), Helmig, R. (Ekstern)
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BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 0.21 SJR 0.163 SNIP 0.236
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.179 SNIP 0.217 CiteScore 0.18
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.165 SNIP 0.191 CiteScore 0.17
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.16 SNIP 0.173 CiteScore 0.16
ISI indexed (2013): ISI indexed no
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.17 SNIP 0.176 CiteScore 0.14
ISI indexed (2012): ISI indexed no
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.153 SNIP 0.141 CiteScore 0.12
ISI indexed (2011): ISI indexed no
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.16 SNIP 0.144
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.157 SNIP 0.137
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.162 SNIP 0.112
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 0.157 SNIP 0.125
Scopus rating (2006): SJR 0.157 SNIP 0.121
Scopus rating (2005): SJR 0.157 SNIP 0.187
Scopus rating (2004): SJR 0.122 SNIP 0
Web of Science (2004): Indexed yes
Numerical Simulation of Condensation of Sulfuric Acid and Water in a Large Two-stroke Marine Diesel Engine

We present results from computational fluid dynamics simulations of the condensation of sulfuric acid (H$_2$SO$_4$) and water (H$_2$O) in a large two-stroke marine diesel engine. The model uses a reduced n-heptane skeletal chemical mechanism coupled with a sulfur subsetto simulate the combustion process and the formation of SOx and H$_2$SO$_4$. Condensation is modeled using a fluid film model coupled with the Eulerian in-cylinder gas phase. The fluid film condensation model is validated against both experimental and numerical results. The engine simulations reveal that the fluid film has a significant effect on the sulfuric acid gas phase. A linear correlation is found between the fuel sulfur content and the sulfuric acid condensation rate. The initial in-cylinder water content is found not to affect the sulfuric acid condensation but it has a high impact on water condensation. The scavenging pressure level shows an inverse correlation between pressure and condensation rate due to change in the flame propagation speed. Finally, increasing the cylinder liner temperature significantly decreases water condensation but has a negligible influence on the condensation of sulfuric acid.

Numerical simulation of transient moisture and temperature distribution in polycarbonate and aluminum electronic enclosures

The challenge of developing a reliable electronic product requires huge amounts of resources and knowledge. Temperature and thermal features directly affect the life of electronic products. Furthermore, moisture can be damaging for electronic components. Nowadays, computational fluid dynamics (CFD) analysis has been proven as a useful tool to exploit the detailed and visualized information about the fluid flows; and hence it can be helpful for predicting local climate inside the electronic enclosures. In this study, the temperature and moisture distributions inside an idealized electronic enclosure with some heat producing components are investigated. It is shown how the enclosure material can influence local climate inside the enclosure using transient numerical simulations. The effect of heat transfer coefficient and wall thickness of the enclosure is also investigated. The enclosure material and the heat transfer coefficient of the enclosure with the environment are found to be influential on the mean temperature and relative humidity; however, the significance of their effects are not the same at different levels. Natural convection plays a key role in RH and temperature distribution.
Numerical Simulation of Transient Moisture Transfer into an Electronic Enclosure

Electronic systems are sometimes exposed to harsh environmental conditions of temperature and humidity. Moisture transfer into electronic enclosures and condensation can cause several problems such as corrosion and alteration in thermal stresses. It is therefore essential to study the local climate inside the enclosures to be able to protect the electronic systems. In this work, moisture transfer into a typical electronic enclosure is numerically studied using CFD. In order to reduce the CPU-time and make a way for subsequent factorial design analysis, a simplifying modification is applied in which the real 3D geometry is approximated by a 2D axial symmetry one. The results for 2D and 3D models were compared in order to calibrate the 2D representation. Furthermore, simulation results were compared with experimental data and good agreement was found.
Numerical simulation of tsunami-scale wave boundary layers
This paper presents a numerical study of the boundary layer flow and properties induced by tsunami-scale waves. For this purpose, an existing one-dimensional vertical (1DV) boundary layer model, based on the horizontal component of the incompressible Reynolds-averaged Navier–Stokes (RANS) equations, is newly extended to incorporate a transitional variant of the standard two-equation k–ω turbulence closure. The developed numerical model is successfully validated against recent experimental measurements involving transient solitary wave boundary layers as well as for oscillatory flows, collectively demonstrating the ability to reproduce accurate velocity profiles, turbulence, and bed shear stresses on both smooth and rough beds. The validated model is then employed for the study of transient wave boundary layers at full tsunami scales, covering a wide and realistic geophysical range in terms of the flow duration, bottom roughness, and associated Reynolds numbers. For this purpose, three different “synthetic” (idealised) tsunami wave descriptions are considered i.e., invoking: (1) single wave (solitary-like, but with independent period and wave height), (2) sinusoidal, and (3) N-wave descriptions. The flow, boundary layer thickness, turbulence, and bed shear stresses induced are systematically monitored and parameterised, under both hydraulically smooth and roughbed conditions. The results generally support a notion that the boundary layers induced by tsunami-scale waves are both current-like, due to their long durations, as well as wave-like, in the sense that the boundary layer will not necessarily span the entirety of the water column. The results likewise suggest that there is a continuum connecting wind-wave and tsunami-wave scales, as existing expressions commonly used for characterising boundary layer properties beneath wind-waves maintain reasonable accuracy when extrapolated to full tsunami scales. Boundary layers driven by actual field-measured tsunami signals are likewise simulated, stemming from both the 2004 Indian Ocean as well as the 2011 Tohoku events. These results are reconciled with the various synthetic tsunami signals considered, generally confirming their usefulness as idealised tsunami waves.

General information
State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Utrecht University
Authors: Williams, I. A. (Ekstern), Fuhrman, D. R. (Intern)
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Main Research Area: Technical/natural sciences

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Volume: 110
ISSN (Print): 0378-3839
Ratings:
BFI (2018): BFI-level 2
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 2
Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.44 SJR 1.98 SNIP 2.252
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): SJR 1.925 SNIP 2.097 CiteScore 2.9
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): SJR 1.785 SNIP 2.123 CiteScore 2.55
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): SJR 1.727 SNIP 2.264 CiteScore 2.58
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): SJR 1.912 SNIP 2.226 CiteScore 2.21
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.616 SNIP 2.502 CiteScore 2.43
ISI indexed (2011): ISI indexed yes
BFI (2010): BFI-level 2
Scopus rating (2010): SJR 1.898 SNIP 2.332
Web of Science (2010): Indexed yes
BFI (2009): BFI-level 2
Scopus rating (2009): SJR 2.067 SNIP 2.454
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 2
Scopus rating (2008): SJR 1.189 SNIP 2.166
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.642 SNIP 2.164
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.249 SNIP 2.2
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 1.22 SNIP 1.966
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 1.143 SNIP 2.273
Web of Science (2004): Indexed yes
Scopus rating (2003): SJR 0.997 SNIP 1.873
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.729 SNIP 1.104
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.864 SNIP 1.127
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.832 SNIP 1.273
Web of Science (2000): Indexed yes
Scopus rating (1999): SJR 0.534 SNIP 1.096

Original language: English
Tsunami, Boundary layer, Turbulence, Laminar-to-turbulence transition, k–ω model
Electronic versions:
Numerical_simulation_of_tsunami_scale_wave_boundary_layers_PP.pdf. Embargo ended: 04/02/2018
Numerical simulations of concrete flow: A benchmark comparison

First, we define in this paper two benchmark flows readily usable by anyone calibrating a numerical tool for concrete flow prediction. Such benchmark flows shall allow anyone to check the validity of their computational tools no matter the numerical methods and parameters they choose. Second, we compare numerical predictions of the concrete sample final shape for these two benchmark flows obtained by various research teams around the world using various numerical techniques. Our results show that all numerical techniques compared here give very similar results suggesting that numerical simulations of concrete filling ability when neglecting any potential components segregation have reached a technology readiness level bringing them closer to industrial practice.
Scopus rating (2009): SJR 2.369 SNIP 2.596
Web of Science (2009): Indexed yes
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 1.474 SNIP 1.959
Web of Science (2008): Indexed yes
Scopus rating (2007): SJR 1.654 SNIP 1.851
Web of Science (2007): Indexed yes
Scopus rating (2006): SJR 1.168 SNIP 1.916
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.908 SNIP 1.679
Web of Science (2005): Indexed yes
Scopus rating (2004): SJR 0.976 SNIP 1.695
Scopus rating (2003): SJR 0.666 SNIP 1.69
Web of Science (2003): Indexed yes
Scopus rating (2002): SJR 0.735 SNIP 1.308
Web of Science (2002): Indexed yes
Scopus rating (2001): SJR 0.739 SNIP 1.116
Web of Science (2001): Indexed yes
Scopus rating (2000): SJR 0.623 SNIP 1.41
Scopus rating (1999): SJR 0.601 SNIP 1.471
Original language: English
Casting, Fresh Concrete (A), Modeling (E), Rheology (A), Workability (A)
Electronic versions:
marac_CEMCON_S_15_00452.pdf. Embargo ended: 28/11/2017
DOIs:
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Source: FindIt
Source-ID: 2288042926
Publication: Research - peer-review › Journal article – Annual report year: 2016

Nuovi orizzonti sulle trasformazioni di fase a bassa temperatura negli acciai
In termine “acciai” si riferisce a leghe contenenti almeno il 50% in peso di ferro assieme ad altri elementi chimici, tra cui carbonio in contenuto inferiore al 2.1% in peso. Inoltre, gli acciai sono classificati come ad alto contenuto di carbonio quando il contenuto in peso di questo elemento eccede lo 0.6%, e sono definiti martensitici quando la loro microstruttura consiste principalmente in martensite.

General information
State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering
Authors: Villa, M. (Intern)
Number of pages: 8
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Main Research Area: Technical/natural sciences
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Dispense_GdS_Trento_10_Nov_2016_Matteo_Villa.pdf

Relations
Activities:
TECNICHE INNOVATIVE DI INDURIMENTO SUPERFICIALE E TRATTAMENTO CRIOGENICO DEGLI ACCIAI
Publication: Research - peer-review › Paper – Annual report year: 2017

Objectives comparison in a confocal microscope using pseudo-random roughness artefacts
The increasing importance of optical microscopy in the geometrical and dimensional assessment of structured and freeform surfaces has easily overcome many difficulties related to the use of contact instruments. Nonetheless, some concerns related to optical instruments when measuring such surfaces are still open. The working distance (WD) of some standard (ST) lenses, e.g., can prevent from freely moving alongside features at different heights and positions of structured and freeform shapes due to the risk of collisions. In such cases, the so-called long working distance (LWD) objectives allow to operate at a longer distance from the surface under measurement, saving the same field of view (FoV)
but accepting lower numerical apertures.

General information
State: Published
Organisations: Department of Mechanical Engineering, Manufacturing Engineering
Authors: Quagliotti, D. (Intern), Tosello, G. (Intern), Hansen, H. N. (Intern)
Number of pages: 2
Publication date: 2016
Event: Abstract from Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK.
Main Research Area: Technical/natural sciences
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On Bifurcation Sensitivities and Stability Optimization Based on Local Sub-Domain Eigenvalues

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, N. L. (Intern), Pedersen, P. (Intern)
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Conference: 24th International Congress of Theoretical and Applied Mechanics, Montreal, Canada, 21/08/2016 - 21/08/2016
Source: PublicationPreSubmission
Source-ID: 126901838
Publication: Research - peer-review › Article in proceedings – Annual report year: 2016

On Coulomb and Viscosity damped single-degree-of-freedom vibrating systems
Attention on friction damping mechanisms could be of interest for vibration reduction, and appears therefore to be desirable. Presentations of textbook analyses on mechanical vibration of a viscosity damped single degree system [mass, spring and eventually damping] are numerous. Often they begin with an assumption of a sin/cos behaviour of mass-amplitude (x) versus time (t) solution to the governing equation \[M \cdot \text{acceleration} = \text{Sum of forces}\]. The solutions have all an equal sin/cos form. This may indicate that mass and spring are prime elements of the model and that damping mainly has an amplitude reducing influence.

The amount of analyses of friction damped system is comparatively more limited. The periodic square wave is a frequently occurring type of friction in this type of analyses. The periodic square wave is often named Coulomb friction. It can be resolved in an infinite series of harmonic components with frequencies 1, 3, 5, … times the basic frequency of the square wave and with respective amplitudes: \((4/\pi) \times (1, 1/3, 1/5, ... \times F_\mu(\omega t))\). \(F_\mu(\omega t)\): the square wave amplitude. The governing equation for the sequence of a free vibration with Coulomb friction damping is nonlinear, but is linear within each \(\frac{1}{2}\) period. A complete solution can therefore be made up compounding solutions from \(\frac{1}{2}\) periods by inserting end conditions from one \(\frac{1}{2}\) period as initial conditions for the following \(\frac{1}{2}\) period. – Only spring and Coulomb forces act together.
As a Coulomb force is conceivable as an infinite series of harmonic components the appearance of harmonics could be expected in the behaviour of the amplitude (x) of the mass versus the time (t) in the solution. Some authors may have considered this possibility previously. But the solutions for friction damping can be written as \([x + K1] / K2 \cos(\omega n t); K1\) and \(K2\) are constants, adjustable within each \(\frac{1}{2}\) period. \(\omega n\) is the undamped natural frequency. Apparently has friction damping alone an amplitude reducing effect. Based on these textbook presentations it appears noteworthy that displacement \(x(t)\) is described alone with the cos(\(\omega n t\)) function, that is, a completely pure cosine sequence, without triggering higher harmonics.

One conclusion could be that a free vibration with Coulomb friction damping integrates all harmonics into the constant Coulomb force: \(F_\mu(\omega n t)\). This hypothesis of an integrating mechanism may, however, not be valid when the system works, driven by the force \(F_\mu(\cos(\omega n t))\).
On fracture in finite strain gradient plasticity

In this work a general framework for damage and fracture assessment including the effect of strain gradients is provided. Both mechanism-based and phenomenological strain gradient plasticity (SGP) theories are implemented numerically using finite deformation theory and crack tip fields are investigated. Differences and similarities between the two approaches within continuum SGP modeling are highlighted and discussed. Local strain hardening promoted by geometrically necessary dislocations (GNDs) in the vicinity of the crack leads to much higher stresses, relative to classical plasticity predictions. These differences increase significantly when large strains are taken into account, as a consequence of the contribution of strain gradients to the work hardening of the material. The magnitude of stress elevation at the crack tip and the distance ahead of the crack where GNDs significantly alter the stress distributions are quantified. The SGP dominated zone extends over meaningful physical lengths that could embrace the critical distance of several damage mechanisms, being particularly relevant for hydrogen assisted cracking models. A major role of a certain length parameter is observed in the multiple parameter version of the phenomenological SGP theory. Since this also dominates the mechanics of indentation testing, results suggest that length parameters characteristic of mode I fracture should be inferred from nanoindentation.
On modeling micro-structural evolution using a higher order strain gradient continuum theory

Published experimental measurements on deformed metal crystals show distinct pattern formation, in which dislocations are arranged in wall and cell structures. The distribution of dislocations is highly non-uniform, which produces discontinuities in the lattice rotations. Modeling the experimentally observed micro-structural behavior, within a framework based on continuous field quantities, poses obvious challenges, since the evolution of dislocation structures is inherently a discrete and discontinuous process. This challenge, in particular, motivates the present study, and the aim is to improve the micro-structural response predicted using strain gradient crystal plasticity within a continuum mechanics framework.

One approach to modeling the dislocation structures observed is through a back stress formulation, which can be related directly to the strain gradient energy. The present work offers an investigation of constitutive equations for the back stress based on both considerations of the gradient energy, but also includes results obtained from a purely phenomenological starting point. The influence of model parameters is brought out in a parametric study, and it is demonstrated how a proper treatment of the back stress enables dislocation wall and cell structure type response in the adopted framework.
On nanostructured silicon success

Recent Letters by Piggott et al. 1 and Shen et al. 2 claim the smallest ever dielectric wave length and polarization splitters. The associated News & Views article by Aydin3 states that these works “are the first experimental demonstration of on-chip, silicon photonic components based on complex all-dielectric nanophotonic structures.” Here, we question the rationale behind the competition for a small device footprint as set out by the authors of the two papers 1,2 and also point out a lack of appropriate historical context in the three contributions 1–3.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, Department of Electrical Engineering, Acoustic Technology, Department of Photonics Engineering, Nanophotonic Devices
Authors: Sigmund, O. (Intern), Jensen, J. S. (Intern), Frandsen, L. H. (Intern)
Pages: 142-143
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Nature Photonics
Volume: 10
Issue number: 3
ISSN (Print): 1749-4885
Ratings:
  BFI (2018): BFI-level 2
  Web of Science (2018): Indexed yes
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  Web of Science (2017): Indexed yes
  BFI (2016): BFI-level 2
  Scopus rating (2016): CiteScore 21.32 SJR 15.831 SNIP 9.983
  Web of Science (2016): Indexed yes
  BFI (2015): BFI-level 2
  Web of Science (2015): Indexed yes
  BFI (2014): BFI-level 2
  Scopus rating (2014): SJR 14.556 SNIP 9.949 CiteScore 17.25
  Web of Science (2014): Indexed yes
  BFI (2013): BFI-level 2
  Scopus rating (2013): SJR 13.612 SNIP 9.461 CiteScore 16.32
  ISI indexed (2013): ISI indexed yes
  Web of Science (2013): Indexed yes
  BFI (2012): BFI-level 2
  Scopus rating (2012): SJR 13.418 SNIP 8.003 CiteScore 13.46
  ISI indexed (2012): ISI indexed yes
  Web of Science (2012): Indexed yes
  BFI (2011): BFI-level 2
  ISI indexed (2011): ISI indexed yes
  Web of Science (2011): Indexed yes
  BFI (2010): BFI-level 2
  Scopus rating (2010): SJR 10.754 SNIP 8.328
  Web of Science (2010): Indexed yes
  BFI (2009): BFI-level 2
  Scopus rating (2009): SJR 8.577 SNIP 11.176
  BFI (2008): BFI-level 2
  Scopus rating (2008): SJR 6.481 SNIP 6.9
  Web of Science (2007): Indexed yes
Original language: English
On nonlinear wave-structure interaction using an immersed boundary method in 2D

Introduction

We present our progress on the development and preliminary benchmarking results of a new efficient methodology for solving fully non-linear potential flow wave-structure interaction problems. The new model utilizes the efficiency of finite difference methods on structured grids. The structure geometry is introduced using an Immersed Boundary Method (IBM) and the body boundary condition (BC) is satisfied with a Weighted Least Squares (WLS) approximation [7]. This allows complex geometries to be represented with high accuracy. The stability of the scheme is ensured by adopting the Weighted Essentially Non-Oscillatory (WENO) scheme [8] together with a Lax-Friedrichs type flux applied to the free surface conditions in Hamilton-Jacobi form. This work can be viewed as a novel extension of the flexible order finite difference potential flow solver OceanWave3D [2] to include the presence of a structure. The method obtains an optimum scaling of the solution effort [2] and has been implemented on massively parallel GPU architectures using the CUDA API [3] making it suitable for high resolution flow simulations. This combination of novel and robust numerical methods aims at creating new efficient tools for non-linear wave-structure interaction problems. The scheme is validated using the forced heaving motion of a two-dimensional (2D) horizontal circular cylinder with promising results, although there are still challenges to be overcome in terms of properly capturing the behavior of the intersection between the body and the free-surface.

General information

State: Published
Organisations: Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering, Department of Applied Mathematics and Computer Science, Scientific Computing
Authors: Kontos, S. (Intern), Bingham, H. B. (Intern), Lindberg, O. (Intern), Engsig-Karup, A. P. (Intern)
Number of pages: 4
Publication date: 2016

On optimization of interference fit assembly

Assembly of shaft and hub by an interference fit is a classical connection with known advantages and disadvantages. The advantage being the level of possible torque transfer while the disadvantage is a possible fretting fatigue failure at the points of stress concentration. To improve the assembly the present paper discusses different optimized designs that improve the contact pressure distribution. The pressure distribution in the contact is the source responsible for the fatigue failure. The distribution can be improved by design modification done directly on the contacting surfaces which however requires a very high production precision. Alternatively it is shown, how hub side shape optimization can improve the pressure distribution significantly. The latter design change has no influence on the remaining shaft-hub design i.e. the attachment of other parts. The analysis is performed either by a traditional contact analysis, or by a super element contact analysis where no iterations are needed for the contact evaluation.

General information

State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics
Authors: Pedersen, N. L. (Intern)
Pages: 349-359
Publication date: 2016
Main Research Area: Technical/natural sciences
On the Carbon Solubility in Expanded Austenite and Formation of Hägg Carbide in AISI 316 Stainless Steel

The carbon solubility in expanded austenite is investigated by controlled low temperature gaseous through-carburizing of AISI 316 stainless steel thin foils with thermogravimetry and synchrotron powder diffraction analysis. Carburizing is carried out in C2H2–H2–N2 and CO–H2–N2 atmospheres at 380–420 °C and 465–470 °C, respectively. Hägg carbide (\(x\) \(M_5C_2\)) develops when the carbon content in the expanded austenite exceeds the metastable solubility limit; the transformation of
carbon expanded austenite into Hägg carbide occurs irrespective of carburizing temperature in the investigated
temperature range (380–470 °C). The maximum solubility of carbon in expanded austenite (380 °C) is found to correspond
to an occupancy (\(y_C\)) of 0.220 of the interstitial octahedral sites of the austenite lattice (i.e., 4.74wt%C). Decomposition of
Hägg carbide into \(\text{M}_7\text{C}_3\) occurs upon prolonged carburizing treatment or thermal exposure in inert atmosphere (in situ
synchrotron experiments).

**General information**

State: Published
Organisations: Department of Mechanical Engineering, Materials and Surface Engineering, Department of Chemistry, X-
ray Crystallography
Authors: Christiansen, T. L. (Intern), Ståhl, K. (Intern), Brink, B. (Intern), Somers, M. A. J. (Intern)
Number of pages: 11
Pages: 1395–1405
Publication date: 2016
Main Research Area: Technical/natural sciences

**Publication information**

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BFI (2018): BFI-level 1
Web of Science (2018): Indexed yes
BFI (2017): BFI-level 1
Web of Science (2017): Indexed Yes
BFI (2016): BFI-level 1
Scopus rating (2016): CiteScore 1.24 SJR 0.665 SNIP 1.013
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 1
Scopus rating (2015): SJR 0.479 SNIP 0.713 CiteScore 0.74
BFI (2014): BFI-level 1
Scopus rating (2014): SJR 0.65 SNIP 1.003 CiteScore 0.71
BFI (2013): BFI-level 1
Scopus rating (2013): SJR 0.516 SNIP 0.75 CiteScore 0.61
ISI indexed (2013): ISI indexed yes
BFI (2012): BFI-level 1
Scopus rating (2012): SJR 0.624 SNIP 1.369 CiteScore 0.87
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
BFI (2011): BFI-level 1
Scopus rating (2011): SJR 0.474 SNIP 0.899 CiteScore 0.71
ISI indexed (2011): ISI indexed yes
Web of Science (2011): Indexed yes
BFI (2010): BFI-level 1
Scopus rating (2010): SJR 0.636 SNIP 0.89
BFI (2009): BFI-level 1
Scopus rating (2009): SJR 0.397 SNIP 0.545
BFI (2008): BFI-level 1
Scopus rating (2008): SJR 0.385 SNIP 0.798
Scopus rating (2007): SJR 0.459 SNIP 0.597
Scopus rating (2006): SJR 0.429 SNIP 1.044
Web of Science (2006): Indexed yes
Scopus rating (2005): SJR 0.492 SNIP 0.894
Scopus rating (2004): SJR 0.413 SNIP 0.809
Scopus rating (2003): SJR 0.615 SNIP 0.964
Scopus rating (2002): SJR 0.612 SNIP 0.972
On the implementation and effectiveness of morphological close-open and open-close filters for topology optimization

This note reconsiders the morphological close-open and open-close filters for topology optimization introduced in an earlier paper (Sigmund Struct Multidiscip Optim 33(4–5):401–424 (2007)). Close-open and open-close filters are defined as the sequential application of four dilation or erosion filters. In the original paper, these filters were proposed in order to provide length scale control in both the solid and the void phase. However, it was concluded that the filters were not useful in practice due to the computational cost of the sensitivity analysis. In this note, it is shown that the computational cost is much lower if the sensitivity analysis for each erosion or dilation step is performed sequentially. Unfortunately, it is also found that the close-open and open-close filters do not have the expected effect in terms of length scale control: each close or open operation ruins the effect of the preceding filters, resulting in a design with a minimum length scale in either the solid phase or the void phase, but not both.

General information
State: Published
Organisations: Department of Mechanical Engineering, Solid Mechanics, KU Leuven
Authors: Schevenels, M. (Ekstern), Sigmund, O. (Intern)
Pages: 15–21
Publication date: 2016
Main Research Area: Technical/natural sciences

Publication information
Journal: Structural and Multidisciplinary Optimization
Volume: 54
Issue number: 1
ISSN (Print): 1615-147X
Ratings:
BFI (2018): BFI-level 2
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Web of Science (2017): Indexed yes
BFI (2016): BFI-level 2
Scopus rating (2016): CiteScore 3.14
Web of Science (2016): Indexed yes
BFI (2015): BFI-level 2
Scopus rating (2015): CiteScore 2.42
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 2
Scopus rating (2014): CiteScore 2.77
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
Scopus rating (2013): CiteScore 2.86
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 2
Scopus rating (2012): CiteScore 2.08
ISI indexed (2012): ISI indexed yes
Web of Science (2012): Indexed yes
On the isotropic elastic constants of graphite nodules in ductile cast iron: Analytical and numerical micromechanical investigations

A comprehensive description of the mechanical behavior of nodules in ductile iron is still missing in the published literature. Nevertheless, experimental evidence exists for the importance of such graphite particles during macroscopic material deformation, especially under compressive loading. In the present paper, the nodules’ elastic properties are thoroughly investigated by means of both analytical and numerical techniques. The analysis takes into account the influence of several non-linear phenomena, as local residual stresses arising during solid-state cooling, interface debonding and limited particle strength. It is shown that if the nodule internal structure is considered, the traditional isotropy assumption leads to the definition of a domain of admissible values for the effective elastic constants. However, micromechanical calculations indicate that values within the domain do not provide mesoscopic moduli in agreement with Young’s modulus and Poisson’s ratio recorded for common ferritic ductile iron grades. This suggests that graphite nodules may not be considered isotropic at the microscopic scale, at least from a mechanical viewpoint.
Projects:

**Multiscale topology optimization strategies including local and global stability**

Department of Mechanical Engineering  
Period: 01/04/2018 → 31/03/2021  
Number of participants: 4  
Phd Student:  
Andersen, Morten Nørgaard (Intern)  
Supervisor:  
Aage, Niels (Intern)  
Wang, Fengwen (Intern)
Main Supervisor:
Sigmund, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme:  Samfinansieret - Andet
Project: PhD

Developing high performance and climatically reliable Hearing Aids
Department of Mechanical Engineering
Period: 01/03/2018 → 28/02/2021
Number of participants: 4
Phd Student:
Yadav, Abhijeet (Intern)
Supervisor:
Espersen, Christian (Ekstern)
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Developing robust concepts for highly integrated products
Department of Mechanical Engineering
Period: 01/03/2018 → 28/02/2021
Number of participants: 4
Phd Student:
Sigurdarson, Nökkvi Steinn (Intern)
Supervisor:
Christensen, Martin Ebro (Intern)
Eifler, Tobias (Intern)
Main Supervisor:
Howard, Thomas J. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Microchannel two-phase flow cooling of power modules
Department of Mechanical Engineering
Period: 15/02/2018 → 14/02/2021
Number of participants: 4
Phd Student:
Criscuolo, Gennaro (Intern)
Supervisor:
Kærn, Martin Ryhl (Intern)
Palm, Björm (Ekstern)
Main Supervisor:
Markussen, Wiebke Brix (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD
Additive Manufacturing for marine propulsion systems

Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
Phd Student:
Dahmen, Thomas (Intern)
Supervisor:
Lund, Claus Rarup (Ekstern)
Pedersen, David Bue (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Advanced Damage Models with Intrinsic Size Effects

Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
Phd Student:
Holte, Ingrid (Ekstern)
Supervisor:
Nielsen, Kim Lau (Intern)
Winther, Grethe (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Advanced Damage Models with Intrinsic Size Effects

Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
Phd Student:
Holte, Ingrid (Intern)
Supervisor:
Nielsen, Kim Lau (Intern)
Winther, Grethe (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

PhD scholarship in CFD Analysis of the Impact of the Scale Build-Up on the Liquid Flow in the Wells used for Oil & Gas Production

Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 3
PhD Student:
Bentzon, Jakob Roar (Intern)
Supervisor:
Feilberg, Karen Louise (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Fonde
Project: PhD

Quantitative Modular Maintenance Principles
Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 3
PhD Student:
Sigsgaard, Kristoffer Vandrup (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Fonde
Project: PhD

Structure Optimization of 3D printed metal through heat and surface treatment
Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 4
PhD Student:
Valente, Emilie Hørdum (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Pedersen, David Bue (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Thermodynamics and kinetics of mixed interstitial phases in the titanium systems; modelling and synthesis
Department of Mechanical Engineering
Period: 01/02/2018 → 31/01/2021
Number of participants: 3
PhD Student:
Kværndrup, Frederik Bojesen (Intern)
Supervisor:
Dahl, Kristian Vinter (Intern)
Main Supervisor:
Christiansen, Thomas Lundin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
**Thermochemical treatment of titanium and titanium alloys;**

Department of Mechanical Engineering  
Period: 15/01/2018 → 14/01/2021  
Number of participants: 4  
Phd Student:  
Meng, Yichen (Intern)  
Supervisor:  
Dahl, Kristian Vinter (Intern)  
Villa, Matteo (Intern)  
Main Supervisor:  
Christiansen, Thomas Lundin (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Grundforskningsfonden  
Project: PhD

**Biomimetic artificial anterior chamber model for corneal transplantations**

Department of Mechanical Engineering  
Period: 01/01/2018 → 31/12/2020  
Number of participants: 3  
Phd Student:  
Svendsen, Nicklas Werge (Intern)  
Supervisor:  
Nunez, Jevier Francisco Cabrerizo (Ekstern)  
Main Supervisor:  
Lenau, Torben Anker (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**Data Driven Analysis of Plant Operation**

Department of Mechanical Engineering  
Period: 01/01/2018 → 31/12/2020  
Number of participants: 3  
Phd Student:  
Bertram, Christian Alexander (Intern)  
Supervisor:  
Hvam, Lars (Intern)  
Main Supervisor:  
Mortensen, Niels Henrik (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Grundforskningsfonden  
Project: PhD

**Data Driven Plant Reconfiguration**

Department of Mechanical Engineering  
Period: 01/01/2018 → 31/12/2020  
Number of participants: 3  
Phd Student:  
Lundgaard, Rasmus (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Developing Product Architectures in Collaboration with Key-Customers
Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 3
Phd Student:
Askhøj, Christoffer (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Development of Process Integration Methodologies for Systematic Implementation in non-Energy Intensive Industries
Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 3
Phd Student:
Bergamini, Riccardo (Intern)
Supervisor:
Nguyen, Tuong-Van (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Implementation of electrochemical impedance spectroscopy (EIS) for validation of humidity robustness of PCBA design elements
Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 4
Phd Student:
Lauser, Simone (Intern)
Supervisor:
Eckold, Pierre (Ekstern)
Verdingovas, Vadimas (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt m/virksomhed
Project: PhD
Photopolymerization based Additive Manufacturing Process Chains

Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 3
Phd Student:
Mendez Ribo, Macarena (Intern)
Supervisor:
Islam, Aminul (Intern)
Main Supervisor:
Pedersen, David Bue (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Solder flux chemistry and climatic reliability of electronics: optimization of flux chemistry for robust performance

Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 3
Phd Student:
Li, Feng (Intern)
Supervisor:
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Surface engineering of aluminium alloys for prosthetics

Department of Mechanical Engineering
Period: 01/01/2018 → 31/12/2020
Number of participants: 6
Phd Student:
Andersen, Asger Gade (Intern)
Supervisor:
Hansen, Jesper (Ekstern)
Jørgensen, René Schow (Ekstern)
Nielsen, Lars Pleth (Ekstern)
Olafsson, Sigurdur (Ekstern)
Main Supervisor:
Meller, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Ship propulsion in waves

Department of Mechanical Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 3
Phd Student:
Saettone, Simone (Intern)
Supervisor: 
Steen, Sverre (Ekstern)
Main Supervisor: 
Andersen, Poul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Sustainability Impact Assessment for Circular Economy
Department of Mechanical Engineering
Period: 01/12/2017 → 30/11/2020
Number of participants: 5
Phd Student: 
Kravchenko, Mariia (Intern)
Supervisor: 
Pigosso, Daniela Cristina Antelmi (Intern)
Hauschild, Michael Zwicky (Intern)
Hildenbrand, Jutta (Ekstern)
Main Supervisor: 
McAlonee, Tim C. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Shape and Topology Optimization of Aeroelastic Systems
Department of Mechanical Engineering
Period: 15/11/2017 → 14/11/2020
Number of participants: 4
Phd Student: 
Conlan-Smith, Cian James (Intern)
Supervisor: 
Ramos Garcia, Néstor (Intern)
Sigmund, Ole (Intern)
Main Supervisor: 
Andreasen, Casper Schousboe (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Villum Center for Advanced Structural and Material Testing
Department of Civil Engineering
Department of Wind Energy
Composites and Materials Mechanics
Section for Structural Engineering
Department of Mechanical Engineering
Solid Mechanics
Wind Turbine Structures and Component Design
Period: 07/11/2017 → …
Number of participants: 17
Acronym: CASMaT
Project participant:
Kleis, Camilla (Intern)
Mikkelsen, Lars Pilgaard (Intern)
Sørensen, Bent F. (Intern)
Toftegaard, Helmut Langmaack (Intern)
Berggreen, Christian (Intern)
Branner, Kim (Intern)
Michel, Alexander (Intern)
Andreasen, Michael Joachim (Intern)
Luczak, Marcin (Intern)
Chen, Xiao (Intern)
Bjørnbak-Hansen, Jørgen (Intern)
Legarth, Brian Nyvang (Intern)
Waldbjørn, Jacob Paamand (Intern)
Project Manager, organisational:
Stang, Henrik (Intern)
PhD Student:
Bangaru, Ashish Kumar (Intern)
Moncy, Aakash (Intern)
Quinlan, Alex (Intern)

Relations
Related projects:
Fatigue behaviour of polymer matrix at the microstructural scale
Multi-axial fatigue damage laws for composite materials at the macro-scale
Fatigue behaviour of polymer composite materials at the sub-structural and structural scale
Publications:
Uncovering the fatigue damage initiation and progression in uni-directional non-crimp fabric reinforced polyester composite
Statistical validation of individual fibre segmentation from tomograms and microscopy
Fatigue Damage Evolution in Fibre Composites for Wind Turbine Blades
Micromechanical Investigation of Fatigue Damage in Uni-Directional Fibre Composites
Three dimensional fatigue damage evolution in non-crimp glass fibre fabric based composites used for wind turbine blades
Individual fibre segmentation from 3D X-ray computed tomography for characterising the fibre orientation in unidirectional composite materials
Micromechanical Time-Lapse X-ray CT Study of Fatigue Damage in Uni-Directional Fibre Composites
Fatigue damage observed non-destructively in fibre composite coupon test specimens by X-ray CT
Ex-situ X-ray computed tomography data for a non-crimp fabric based glass fibre composite under fatigue loading

Project

Multi-axial fatigue damage laws for composite materials at the macro-scale

Department of Mechanical Engineering
Period: 01/11/2017 → 31/10/2020
Number of participants: 5
PhD Student:
Moncy, Aakash (Intern)
Supervisor:
Branner, Kim (Intern)
Stang, Henrik (Intern)
Sørensen, Bent F. (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Gaseous surface hardening and heat treatment of martensitic stainless steel

Department of Mechanical Engineering
Period: 01/10/2017 → 30/09/2020
Number of participants: 5
Phd Student: Tibollo, Chiara (Intern)
Supervisor: Barrallier, Laurent (Ekstern)
Christiansen, Thomas Lundin (Intern)
Michel, Grégory (Ekstern)
Main Supervisor: Somers, Marcel A. J. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Modelling the thermo-metallurgical-mechanical conditions in precision additive metal manufacturing

Department of Mechanical Engineering
Period: 01/10/2017 → 30/09/2020
Number of participants: 5
Phd Student: Bayat, Mohamad (Intern)
Supervisor: Mohanty, Sankhya (Intern)
Thorborg, Jesper (Intern)
Tiedje, Niels Skat (Intern)
Main Supervisor: Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Modelling the thermo-metallurgical-mechanical conditions in precision additive metal manufacturing

Department of Mechanical Engineering
Period: 01/10/2017 → 30/09/2020
Number of participants: 5
Phd Student: Bayat, Mohamad (Intern)
Supervisor: Mohanty, Sankhya (Intern)
Thorborg, Jesper (Intern)
Tiedje, Niels Skat (Intern)
Main Supervisor: Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD
Developing Modular Product and Process Architectures in Engineer to Order (ETO) Companies

Department of Mechanical Engineering
Period: 15/09/2017 → 14/09/2020
Number of participants: 3
Phd Student: Christensen, Carsten Keinicke Fjord (Intern)
Supervisor: Hvam, Lars (Intern)
Main Supervisor: Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Extension of a Fast Potential Flow Solver to Fully-Nonlinear Wave Loading on Offshore Structures

Department of Mechanical Engineering
Period: 15/09/2017 → 14/09/2020
Number of participants: 5
Phd Student: Hicks, Jacob Bjarke Hansen (Intern)
Supervisor: Engsig-Karup, Allan Peter (Intern)
Lindberg, Ole (Intern)
Read, Robert (Intern)
Main Supervisor: Bingham, Harry B. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Integrating Micro and Nano structures on Steel Surfaces - Process Chain Implementation and Validation

Department of Mechanical Engineering
Period: 15/09/2017 → 14/09/2020
Number of participants: 4
Phd Student: Loaldi, Dario (Intern)
Supervisor: Calaon, Matteo (Intern)
Zhang, Yang (Intern)
Main Supervisor: Tosello, Guido (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD

Topology optimization for transient problems

Department of Mechanical Engineering
Period: 15/09/2017 → 14/09/2020
Number of participants: 4
Phd Student:
Viscoelastic Simulation and Optimization of Filament based 3D Printing

Department of Mechanical Engineering
Period: 15/09/2017 → 14/09/2020
Number of participants: 3
Phd Student:
Serdeczny, Marcin Piotr (Intern)
Supervisor:
Pedersen, David Bue (Intern)
Main Supervisor:
Spangenberg, Jon (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Experimental and numerical investigation of friction, power loss and lubricant transport between a piston ring and cylinder liner in a heavy duty diesel engine.

Department of Mechanical Engineering
Solid Mechanics
Period: 11/09/2017 → ...
Number of participants: 3
Project participant:
Overgaard, Hannibal Toxværd (Intern)
Klit, Peder (Intern)
Vølund, Anders (Intern)

Biofuel production based on Integrated Systems combining Biomass Gasification and Solid Oxide Cells

Department of Mechanical Engineering
Period: 01/09/2017 → 31/08/2020
Number of participants: 4
Phd Student:
Butera, Giacomo (Intern)
Supervisor:
Ahrenfeldt, Jesper (Intern)
Jensen, Søren Højgaard (Intern)
Main Supervisor:
Clausen, Lasse Røngaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
How to improve the utilization of a Configuration Lifecycle Management (CLM) system

The aim of the post-doc project is to add to the theory on scoping and setting up Configuration Lifecycle Management (CLM) systems and to study the potential benefits of applying them. A CLM-system supports the management of multi model configurations, as it covers the application of product configuration in all the different life cycle phases of a complex and highly engineered product.
Designing Sustainable Circular Business Models on Product/Service-Systems

Department of Mechanical Engineering
Period: 15/06/2017 → 14/06/2020
Number of participants: 4
Phd Student:
  de Pádua Pieroni, Marina (Intern)
  Hildenbrand, Jutta (Ekstern)
  McAloone, Tim C. (Intern)
Main Supervisor:
Pigosso, Daniela Cristina Antelmi (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Design of innovative low-cost expanders for organic Rankine cycle power systems

Department of Mechanical Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 5
Phd Student:
  Geiselhart, Matthias (Intern)
  Almdal, Kristoffer (Intern)
  Lenau, Torben Anker (Intern)
  Schiffmann, Jürg Alexander (Ekstern)
Main Supervisor:
  Haglind, Fredrik (Intern)

Financial sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Powder Technologies for Additive Manufacturing

Department of Mechanical Engineering
Period: 01/06/2017 → 31/05/2020
Number of participants: 3
Phd Student:
  Andersen, Sebastian Aagaard (Intern)
Supervisor:
Pedersen, David Bue (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Industry 4.0 Digital Technologies For High Added Value Zero Defect Manufacturing**
Department of Mechanical Engineering
Period: 01/05/2017 → 14/12/2017
Number of participants: 5
Phd Student:
Charalambis, Alessandro (Intern)
Supervisor: Calaon, Matteo (Intern)
Hansen, Hans Nørgaard (Intern)
Pedersen, David Bue (Intern)
Main Supervisor: Tosello, Guido (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Fracture of Fiber Composites under Transient Loading**
Department of Mechanical Engineering
Period: 15/04/2017 → 14/04/2020
Number of participants: 6
Phd Student:
Pérez, Ignacio Vidal (Intern)
Supervisor: Eriksen, Rasmus Normann Wilken (Intern)
Kepler, Jørgen Asbøll (Ekstern)
Riisgaard, Benjamin (Intern)
Toftegaard, Helmuth Langmaack (Intern)
Main Supervisor: Berggreen, Christian (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

**Integrated processes chains based on additive manufacturing precision processes and technologies for production of high accuracy mould components**
Department of Mechanical Engineering
Period: 01/04/2017 → 31/03/2020
Number of participants: 5
Phd Student:
Moshiri, Mandaná (Intern)
Supervisor: Hansen, Hans Nørgaard (Intern)
Hardar, Ronen (Ekstern)
Høvsgaard, Per (Ekstern)
Main Supervisor:
Tosello, Guido (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Numerical Modelling and Experimental Characterization of the Resin Injection Pultrusion Process
Department of Mechanical Engineering
Period: 01/04/2017 → 05/05/2020
Number of participants: 4
PhD Student:
Rasmussen, Filip Salling (Intern)
Supervisor:
Sonne, Mads Rostgaard (Intern)
Spangenberg, Jon (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Vibrations for Estimating Bolted Joint Integrity (VEBJI)
Department of Mechanical Engineering
Period: 01/04/2017 → 31/03/2020
Number of participants: 4
PhD Student:
Brøns, Marie (Intern)
Supervisor:
Fidlin, Alexander (Ekstern)
Tcherniak, Dmitri (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Nanofluids as working fluids for organic Rankine cycles
The project is funded by the European Union’s Horizon 2020 research and innovation programme with a with a Marie Skłodowska-Curie Fellowship.
Department of Mechanical Engineering
Thermal Energy
Period: 01/03/2017 → 01/03/2019
Number of participants: 2
Acronym: NanoORC
Project ID: 704201
Project participant:
Montagud, Maria E. Mondejar (Intern)
Haglind, Fredrik (Intern)
Measurement of lubricant film thicknesses by laser induced fluorescence

Department of Mechanical Engineering
Solid Mechanics
Period: 01/03/2017 → …
Number of participants: 3
Project participant:
Overgaard, Hannibal Toxværd (Intern)
Supervisor:
Vølund, Anders (Intern)
Main Supervisor:
Klit, Peder (Intern)

Damage Tolerance of Sandwich Structures in Naval Operating in Arctic Regions Vessels

Department of Mechanical Engineering
Period: 01/03/2017 → 29/02/2020
Number of participants: 4
Phd Student:
Sabbadin, Pietro (Intern)
Supervisor:
Hayman, Brian (Intern)
Legarth, Brian Nyvang (Intern)
Main Supervisor:
Berggreen, Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Rheology of matrix and concrete with crushed aggregates

Department of Mechanical Engineering
Period: 01/03/2017 → 29/02/2020
Number of participants: 4
Phd Student:
Skare, Elisabeth Leite (Intern)
Supervisor:
Jacobsen, Stefan (Ekstern)
Mørtsell, Ernst (Ekstern)
Main Supervisor:
Spangenberg, Jon (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Joint degree
Project: PhD

Surface Engineering of Bulk Metallic Glasses

Department of Mechanical Engineering
Period: 01/03/2017 → 29/02/2020
Number of participants: 3
Phd Student:
Haratian, Saber (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Waste heat recovery on liquefied natural gas-fuelled ships

Department of Mechanical Engineering
Period: 01/03/2017 → 29/02/2020
Number of participants: 4
Phd Student:
Baldasso, Enrico (Intern)
Supervisor:
Larsen, Ulrik (Intern)
Montagud, Maria E. Mondejar (Intern)
Main Supervisor:
Haglind, Fredrik (Intern)

Developing High Performance Aluminium Tube Alloys for heat exchange Applications

Department of Mechanical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 5
Phd Student:
Zaffaroni, Giorgio Giovanni Battista (Intern)
Supervisor:
Gudla, Visweswara Chakravarthy (Intern)
Nordlien, Jan Halvor (Ekstern)
Sørensen, Jens Sandahl (Ekstern)
Main Supervisor:
Ambat, Rajan (Intern)

Investigation of oil production well corrosion issues and prevention

Department of Mechanical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 4
Phd Student:
Rizzo, Riccardo (Intern)
Supervisor:
Fosbøl, Philip Loldrup (Intern)
Thomsen, Kaj (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Transients Optimization of Acoustic-Mechanical Interaction Problems
Department of Mechanical Engineering
Period: 01/02/2017 → 31/01/2020
Number of participants: 3
Phd Student:
Dilgen, Cetin Batur (Intern)
Supervisor:
Jensen, Jakob Søndergaard (Intern)
Main Supervisor:
Aage, Niels (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Advancing Numerical Analysis of Large Scale Crack Propagation in Plate Structures
Department of Mechanical Engineering
Period: 01/01/2017 → 31/12/2019
Number of participants: 3
Phd Student:
Andersen, Rasmus Grau (Intern)
Supervisor:
Niordson, Christian Frithiof (Intern)
Main Supervisor:
Nielsen, Kim Lau (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Applying modular architecture and LEAN thinking to well head platforms
Department of Mechanical Engineering
Period: 01/01/2017 → 10/01/2017
Number of participants: 3
Phd Student:
Hilstøm, Kristine Wille (Intern)
Supervisor:
Bek-Pedersen, Erik (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

From Passive to Controllable Gas Foil Bearings - Modelling & Control Design
Department of Mechanical Engineering
Period: 01/01/2017 → 31/12/2019
Number of participants: 3
Phd Student:
von Osmanski, Alexander Sebastian (Intern)
Supervisor:
Larsen, Jon Steffen (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Surface engineering of Fe-C coatings
Department of Mechanical Engineering
Period: 01/01/2017 → 31/12/2019
Number of participants: 3
Phd Student:
Nielsen, Jacob Obitsø (Intern)
Supervisor:
Møller, Per (Intern)
Main Supervisor:
Pantleon, Karen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Stability of Tungsten Plates during High Temperatures
Department of Mechanical Engineering
Period: 01/12/2016 → 30/11/2019
Number of participants: 3
Phd Student:
Ciucani, Umberto Maria (Intern)
Supervisor:
Luo, Guangnan (Ekstern)
Main Supervisor:
Pantleon, Wolfgang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Modelling of Hydraulic Fracturing
Department of Mechanical Engineering
Period: 15/10/2016 → 14/10/2019
Number of participants: 4
Phd Student:
Lynggaard, Julie (Intern)
Supervisor:
Andreasen, Casper Schousboe (Intern)
Jørgensen, Ole (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Modeling of Large-Scale Electricity Storage Systems based on Pressurized Reversible Solid Oxide Cells
Master of Science Thesis
Department of Mechanical Engineering
Thermal Energy
Risø National Laboratory for Sustainable Energy
Department of Energy Conversion and Storage
Applied Electrochemistry
Period: 01/10/2016 → 28/02/2017
Number of participants: 4
Natural Gas, Electricity Storage, Natural gas grid, Pressurized Solid Oxide Cells, Highly Efficient Storage, Bio-Syngas Upgrade
Project participant:
Butera, Giacomo (Intern)
Supervisor:
Jensen, Søren Højgaard (Intern)
Campanari, Stefano (Ekstern)
Main Supervisor:
Clausen, Lasse Røngaard (Intern)
Documents:
Giacomo_Butera_Master_Thesis_2015_2016
Development and Validation of Mechanical Micro Polishing of 3D and Free Form Geometries for Application to Micro Forging Dies
Department of Mechanical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 3
Phd Student:
Ben Achour, Soufian (Intern)
Supervisor:
De Chiffre, Leonardo (Intern)
Main Supervisor:
Bissacco, Giuliano (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD
End-to-end configuration
Department of Mechanical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 3
Phd Student:
Rasmussen, Jeppe Bredahl (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Heat Pump Integration in the Greater Copenhagen District Heating System
Department of Mechanical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 4
Phd Student:
Jørgensen, Pernille Hartmund (Intern)
Supervisor:
Markussen, Wiebke Brix (Intern)
Ommen, Torben Schmidt (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Heat pump solutions for integration with district heating in a renewable energy system
Department of Mechanical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 4
Phd Student:
Meesenburg, Wiebke (Intern)
Supervisor:
Markussen, Wiebke Brix (Intern)
Ommen, Torben Schmidt (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Resonant Piezoelectric Shunt Damping of Structures
Department of Mechanical Engineering
Period: 01/10/2016 → 30/09/2019
Number of participants: 4
Phd Student:
Toftekær, Johan Frederik (Intern)
Supervisor:
Benjeddou, Ayech (Ekstern)
Krenk, Steen (Intern)
Main Supervisor:
Høgsberg, Jan Becker (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Electrocatalytic Materials
Department of Mechanical Engineering
Period: 15/09/2016 → 14/09/2019
Number of participants: 3
Phd Student:
Villadsen, Sebastian Nis Bay (Intern)
Supervisor:
Nielsen, Lars Pleth (Ekstern)
Main Supervisor:
Møller, Per (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Damping of Torsional Beam Vibrations
Department of Mechanical Engineering
Period: 01/09/2016 → 31/08/2019
Number of participants: 3
Phd Student: Hoffmeyer, David (Intern)
Supervisor: Krenk, Steen (Intern)
Main Supervisor: Høgsberg, Jan Becker (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Process chains to manufacture micro structures on 3D surfaces by replication
Department of Mechanical Engineering
Period: 01/09/2016 → 31/08/2019
Number of participants: 5
Phd Student: Li, Dongya (Intern)
Supervisor: Bissacco, Giuliano (Intern)
Tang, Peter Torben (Intern)
Tosello, Guido (Intern)
Main Supervisor: Zhang, Yang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Production of Synthetic Fuels
Department of Mechanical Engineering
Period: 01/09/2016 → 31/07/2017
Number of participants: 3
Phd Student: Warm, Christian (Intern)
Supervisor: Nielsen, Lars Pleth (Ekstern)
Main Supervisor: Møller, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Experimental and Numerical studies of water flow in choanocytes and choanoflagellates
Department of Mechanical Engineering
Period: 01/08/2016 → 31/07/2019
Number of participants: 3
Phd Student:
Asadzadeh, Seyed Saeed (Ekstern)
Supervisor:
Meyer, Knud Erik (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Experimental and Numerical studies of water flow in choanocytes and choanoflagellates

Department of Mechanical Engineering
Period: 01/08/2016 → 31/07/2019
Number of participants: 3
Phd Student:
Asadzadeh, Seyed Saeed (Intern)
Supervisor:
Meyer, Knud Erik (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Process technologies for functional anisotropic surfaces generation in Quick Response Code applications

Department of Mechanical Engineering
Period: 01/08/2016 → 31/07/2019
Number of participants: 3
Phd Student:
Regi, Francesco (Intern)
Supervisor:
Tosello, Guido (Intern)
Main Supervisor:
Zhang, Yang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Micro scale metal plasticity: fundamentals and applications

H.C. Ørsted Postdoctoral Fellowships. People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement nº 609405 (COFUNDPost-docDTU)

Department of Mechanical Engineering
Solid Mechanics
Period: 01/07/2016 → 30/06/2018
Number of participants: 1
Acronym: MICROMETAL
Project ID: 76931
Project participant:
Martínez Pañeda, Emilio (Intern)
Project
Characterizing Porous Tool Materials for Impulse Drying Technology

Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/06/2016 → 01/07/2017
Number of participants: 1
Project participant: Stolfi, Alessandro (Intern)

**Metrology for Additively Manufactured Medical Implants**

Additive manufacturing, a technology used to manufacture parts layer-by-layer from a 3D digital model, offers an effective solution. Indeed, the key advantage of this technology, in the medical sector, is to produce on demand (without the need of a large inventory of different sizes or sterile storage) customised medical devices for specialities such as orthopaedic, spinal, cranial, maxillo-facial, and dental surgery, and to provide grafts that promote bone growth which match the patient’s anatomy. The overall objective of this project is to provide a comprehensive basis to enable the safe and cost efficient use of additive manufacturing (AM) products within the medical sector. Therefore, within this project AM off-the-shelf medical devices as well as patient specific guides (PSG) and patient specific implants (PSI) manufactured from patient X-ray Computed Tomography (XCT) image data sets or computer aided design (CAD) will be qualified. This will guarantee their reliability to notified bodies and facilitate acceptance of this technology, which has proven clinical advantages in the medical sector.

Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/06/2016 → 31/05/2019
Number of participants: 2
Acronym: MetAMMI
Project participant: Stolfi, Alessandro (Intern)
Project Manager, academic: De Chiffre, Leonardo (Intern)

**Relations**

Publications:
MetAMMI - Metrology for additively manufactured medical implants

**Aerodynamic Stability of Long Span Bridges**

Department of Mechanical Engineering
Period: 01/06/2016 → 31/05/2019
Number of participants: 4
Phd Student: Møller, Randi Nøhr (Ekstern)
Supervisor: Pedersen, Claus (Ekstern)
Svendsen, Martin Nymann (Intern)
Main Supervisor: Krenk, Steen (Intern)
**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Industrial PhD  
Project: PhD

**Cutting Force Modelling and Error Compensation in Large Structure Machining**  
Department of Mechanical Engineering  
Period: 01/06/2016 → 31/05/2019  
Number of participants: 3  
Phd Student:  
Checchi, Alessandro (Intern)  
Supervisor:  
Hansen, Hans Nørgaard (Intern)  
Main Supervisor:  
Bissacco, Giuliano (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**Improving endurance of wind-turbine coatings for use in offshore environments**  
Department of Mechanical Engineering  
Period: 01/06/2016 → 31/05/2019  
Number of participants: 3  
Phd Student:  
Johansen, Nicolai Frost-Jensen (Intern)  
Supervisor:  
Bech, Jakob Ilsted (Intern)  
Main Supervisor:  
Møller, Per (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**CoolPower**  
An evaluation of scroll expanders for use in refrigeration cycles  
Department of Mechanical Engineering  
Thermal Energy  
Innogie ApS  
DELTA  
Carrier  
Period: 05/05/2016 → 04/05/2017  
Number of participants: 2  
Project participant:  
Baldasso, Enrico (Intern)  
Project Manager, academic:  
Haglind, Fredrik (Intern)  
Project

**Lubricant Transport across the Piston Ring with Flat and Triangular Lubrication Injection Profiles on the Liner in Large Two-Stroke Marine Diesel Engines.**  
Department of Mechanical Engineering
Solid Mechanics  
Period: 02/05/2016 → 07/06/2017  
Number of participants: 3  
Project participant: 
Overgaard, Hannibal Toxværd (Intern)  
Supervisor: 
Valund, Anders (Intern)  
Main Supervisor: 
Klit, Peder (Intern)  

**High precision tooling for heat assisted micro forging**  
Department of Mechanical Engineering  
Period: 01/05/2016 → 30/04/2019  
Number of participants: 4  
Phd Student: 
Cannella, Emanuele (Intern)  
Supervisor: 
Bay, Niels Oluf (Intern)  
Rasmussen, Anette Alsted (Intern)  
Main Supervisor: 
Nielsen, Chris Valentin (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Ansat eksternt  
Project: PhD  

Integrated micro product/process quality assurance in micro injection moulding production  
Department of Mechanical Engineering  
Period: 01/05/2016 → 30/04/2019  
Number of participants: 3  
Phd Student: 
Baruffi, Federico (Intern)  
Supervisor: 
Calaon, Matteo (Intern)  
Main Supervisor: 
Tosello, Guido (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Marie Curie (EU-stipendium)  
Project: PhD  

Optimal integration of district heating, district cooling, heat sources and heat sinks  
Department of Mechanical Engineering  
Period: 01/05/2016 → 04/06/2019  
Number of participants: 4  
Phd Student: 
Pieper, Henrik (Intern)  
Supervisor: 
Elmegaard, Brian (Intern)  
Ommen, Torben Schmidt (Intern)  
Main Supervisor: 
Markussen, Wiebke Brix (Intern)  

**Financing sources**  
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

**Relations**

**Activities:**
- Performance analysis of heat pumps utilizing different low temperature heat sources to supply district heating
  - Project: PhD

**Biomass Corrosion Management**

- Department of Mechanical Engineering
- Period: 01/03/2016 → 28/02/2019
- Number of participants: 4
- PhD Student:
  - Malede, Yohanes Chekol (Intern)
- Supervisor:
  - Dahl, Kristian Vinter (Intern)
  - Montgomery, Melanie (Intern)
- Main Supervisor:
  - Hald, John (Intern)

**Financing sources**
- Source: Internal funding (public)

Name of research programme: Samfinansieret - Andet
- Project: PhD

**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)

**Understanding and Implementing Design for Biodegradability**

- Bachelor thesis project about designing for biodegradability
- Department of Mechanical Engineering
- Engineering Design and Product Development
- Period: 01/02/2016 → 17/06/2016
- Number of participants: 2
- Supervisor:
  - Meijer, Ellen Brilhuis (Intern)
Application of Architectures in SME's

Department of Mechanical Engineering  
Period: 01/02/2016 → 01/08/2019  
Number of participants: 4  
Phd Student:  
Rask, Lars Christian (Ekstern)  
Supervisor:  
Hvam, Lars (Intern)  
Vestergaard, Jørn (Ekstern)  
Main Supervisor:  
Mortensen, Niels Henrik (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Industrial PhD  
Project: PhD

Limits of lubrication in severe stamping operations

Department of Mechanical Engineering  
Period: 01/02/2016 → 03/04/2019  
Number of participants: 5  
Phd Student:  
Moghadam, Marcel (Intern)  
Supervisor:  
Bay, Niels Oluf (Intern)  
Christiansen, Peter (Intern)  
Møller, Per (Ekstern)  
Main Supervisor:  
Nielsen, Chris Valentin (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

Microproportioning with crushed sand: experiment and simulations of fine particles effect on rheology

Department of Mechanical Engineering  
Period: 01/02/2016 → 17/11/2016  
Number of participants: 4  
Phd Student:  
Ramenskiy, Evgeny (Ekstern)  
Supervisor:  
Hattel, Jesper Henri (Intern)  
Spangenberg, Jon (Intern)  
Main Supervisor:  
Jacobsen, Stefan (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Stipendie fra udlandet  
Project: PhD

Experimental analysis of heat transfer and pressure drop using zeotropic mixtures in plate heat exchangers for low-grade heat to power conversion
Department of Mechanical Engineering

Thermal Energy
Alfa Laval

University of Bayreuth
Period: 01/01/2016 → 31/12/2018
Number of participants: 2
Project participant:
Zhang, Ji (Intern)
Project Manager, organisational:
Haglind, Fredrik (Intern)

**Additive Manufacturing of Fibre-Reinforced Polymers**

Department of Mechanical Engineering
Period: 01/01/2016 → 27/05/2019
Number of participants: 4
Phd Student:
Hofstätter, Thomas (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Tosello, Guido (Intern)
Main Supervisor:
Tosello, Guido (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Developing High Frequency Pulse Anodizing Methods for Decorative Aluminium**

Department of Mechanical Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Jensen, Flemming (Ekstern)
Supervisor:
Gudla, Visweswara Chakravarthy (Intern)
Kongstad, Ib (Ekstern)
Main Supervisor:
Ambat, Rajan (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

**Investigation of Different Piston Ring Curvatures on Lubricant Transport along Cylinder Liner in Large Two-Stroke Marine Diesel Engines**

Department of Mechanical Engineering
Solid Mechanics
Period: 01/01/2016 → 30/09/2016
Number of participants: 3
Project participant:
Overgaard, Hannibal Toxvaerd (Intern)
Supervisor:
Vølund, Anders (Intern)
Investigation of material combinations for gold free electrical contact systems

Department of Mechanical Engineering
Period: 01/01/2016 → 28/02/2018
Number of participants: 4
Phd Student:
Jensen, Peter Jonatan Bernhardt (Intern)

Supervisor:
Gudla, Visweswara Chakravarthy (Intern)
Jellesen, Morten Stendahl (Intern)

Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Multiscale design methods for Topology Optimization

Department of Mechanical Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Groen, Jeroen Peter (Intern)

Supervisor:
Aage, Niels (Intern)
Lazarov, Boyan Stefanov (Intern)

Main Supervisor:
Sigmund, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Precision Injection Moulding of Micro Features using Integrated Process/Product Quality Assurance

Department of Mechanical Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Giannekas, Nikolaos (Intern)

Supervisor:
Hansen, Hans Nørgaard (Intern)
Zhang, Yang (Intern)

Main Supervisor:
Tosello, Guido (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Sulphuric Acid Corrosion in Large 2-Stroke Diesel Engines

Department of Mechanical Engineering
Period: 01/01/2016 → 31/12/2018
Number of participants: 4
Phd Student:
Kjemtrup, Lars (Intern)
Supervisor:
Cordtz, Rasmus Faurskov (Intern)
Ivarsson, Anders (Intern)
Main Supervisor:
Schramm, Jesper (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Early application of tolerance design
Department of Mechanical Engineering
Period: 15/12/2015 → 14/12/2018
Number of participants: 3
Phd Student:
Bjarklev, Kristian (Intern)
Supervisor:
Eifler, Tobias (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Heat transfer equipment for utilization of low temperature heat sources
Department of Mechanical Engineering
Period: 01/12/2015 → 30/11/2018
Number of participants: 4
Phd Student:
Mancini, Roberta (Intern)
Supervisor:
Haglind, Fredrik (Intern)
Markussen, Wiebke Brix (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Design and modelling of concentrated solar power plants focusing on dynamic performances
Department of Mechanical Engineering
Thermal Energy
KTH - Royal Institute of Technology
Aalborg CSP
Period: 01/11/2015 → 31/10/2018
Number of participants: 2
Project participant:
Ferruzza, Davide (Intern)
Alloy development for martensitic High Cr steels

Department of Mechanical Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 2
Phd Student: Fedorova, Irina (Intern)
Main Supervisor: Hald, John (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Design and modelling of boilers for concentrated solar power plants

Department of Mechanical Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 4
Phd Student: Ferruzza, Davide (Intern)
Supervisor: Kærn, Martin Ryhl (Intern)
Laumert, Björn (Ekstern)
Main Supervisor: Haglind, Fredrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Experimental and Numerical Characterization of Nano-filled Polymers for Thin-Walled Micro Component

Department of Mechanical Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 3
Phd Student: Doagou Rad, Saeed (Intern)
Supervisor: Jensen, Jakob Søndergaard (Intern)
Main Supervisor: Islam, Aminul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

High-performance heat pump cycles for low temperature heat sources

Department of Mechanical Engineering
Period: 01/11/2015 → 31/10/2018
Number of participants: 4
Phd Student: Zühlsdorf, Benjamin (Intern)
Supervisor:
Haglind, Fredrik (Intern)
Markussen, Wiebke Brix (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Topology Optimization of Transient Heat Transfer Problems
Department of Mechanical Engineering
Period: 01/11/2015 → 30/04/2017
Number of participants: 4
PhD Student:
Zeidan, Said (Intern)
Supervisor:
Engelbrecht, Kurt (Intern)
Lazarov, Boyan Stefanov (Intern)
Main Supervisor:
Sigmund, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

MICROMAN, Process Fingerprint for Zero-defect NET-shape
Department of Mechanical Engineering
Manufacturing Engineering
University of Nottingham
University of Bremen
University of Strathclyde
Technische Universität Chemnitz
Politecnico di Milano
University of Leuven
University of Bradford
Institute for Product Development
Period: 01/10/2015 → 30/09/2019
Number of participants: 8
Acronym: MICROMAN
Project ID: 76816
Number of related Ph.D. students: 3
Project participant:
Calaon, Matteo (Intern)
Bissacco, Giuliano (Intern)
Bay, Niels Oluf (Intern)
Nielsen, Chris Valentin (Intern)
Baruffi, Federico (Intern)
Enggrob, Hans G. (Intern)
Project Manager, organisational:
Carlberg, Lena Kristina (Intern)
Heat transfer in swirling flow

Department of Mechanical Engineering
Period: 01/10/2015 → 30/09/2019
Number of participants: 2
Phd Student:
Binti Haminudin, Nor Faizah (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Interaction of stress and phase transformations during thermochemical surface engineering

Department of Mechanical Engineering
Period: 01/10/2015 → 30/09/2018
Number of participants: 4
Phd Student:
Küçükylidiz, Ömer Can (Intern)
Supervisor:
Somers, Marcel A. J. (Intern)
Thorborg, Jesper (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Organic Rankine cycle unit for waste heat recovery on ships

PilotORC is aimed at evaluating the technical and economic feasibility of using an organic Rankine cycle (ORC) unit for recovering low-temperature waste heat on container vessels. The project includes numerical analyses and a demonstration of a 110 kW ORC unit utilizing the waste heat of the main engine cooling system on-board one of Maersk’s container vessels. The retro-fitting potential and the maturity of using ORC units for maritime applications will be evaluated. The project is funded by the Danish Maritime Fund and A.P. Moeller - Maersk.

Department of Mechanical Engineering
Thermal Energy

A. P. Møller-Mærsk
Period: 01/09/2015 → 28/02/2017
Number of participants: 3
Acronym: PilotORC
Project participant:
Montagud, Maria E. Mondejar (Intern)
Andreasen, Jesper Graa (Intern)
Project Manager, organisational:
Haglind, Fredrik (Intern)

Relations
Publications:
Organic Rankine cycle unit for waste heat recovery on ships (PilotORC)
Documents:
Final_Report_PilotORC
Numerical and experimental work of a small-scale organic Rankine cycle unit

Department of Mechanical Engineering
Thermal Energy
Innogie ApS
Period: 01/09/2015 → 28/02/2017
Number of participants: 2
Project participant:
Baldasso, Enrico (Intern)
Project Manager, organisational:
Haglind, Fredrik (Intern)

Bonding processes for large wind turbine blades - numerical modelling and experimental verification

Department of Mechanical Engineering
Period: 01/09/2015 → 31/03/2017
Number of participants: 7
Phd Student:
Uzal, Anil (Intern)
Supervisor:
Jabbaribehnam, Mirmasoud (Intern)
Nielsen, Michael Wenani (Intern)
Sonne, Mads Rostgaard (Intern)
Spangenberg, Jon (Intern)
Østergaard, Rasmus Christian (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Diesel Engine Tribology

Department of Mechanical Engineering
Period: 01/09/2015 → 15/09/2018
Number of participants: 3
Phd Student:
Overgaard, Hannibal Toxværd (Intern)
Supervisor:
Vølund, Anders (Intern)
Main Supervisor:
Klit, Peder (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Extreme wave interaction and wave loads on offshore wind turbine structures

Department of Mechanical Engineering
Period: 01/09/2015 → 21/06/2019
Number of participants: 4
Phd Student:
Vested, Malene Hovgaard (Intern)
Flow in SCR systems
Department of Mechanical Engineering
Period: 01/09/2015 → 31/08/2018
Number of participants: 2
PhD Student:
Gotfredsen, Erik (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

New production paradigms for wind turbines
Department of Mechanical Engineering
Period: 01/09/2015 → 31/08/2018
Number of participants: 5
PhD Student:
Jensen, Mathias Laustsen (Ekstern)
Supervisor:
Haahr, Arne (Ekstern)
Pedersen, David Bue (Intern)
Skjølstrup, Carl Erik (Ekstern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Steady-State Modeling of Engineering Processes
Department of Mechanical Engineering
Period: 01/09/2015 → 31/08/2018
Number of participants: 3
PhD Student:
Juul, Kristian Jørgensen (Intern)
Supervisor:
Niordson, Christian Frithiof (Intern)
Main Supervisor:
Nielsen, Kim Lau (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Grundforskningsfonden
Project: PhD
Moulding Process Development with Impulse Drying

Department of Mechanical Engineering
Period: 01/08/2015 → 31/01/2019
Number of participants: 3
Phd Student: Didone, Mattia (Intern)
Supervisor: Howard, Thomas J. (Intern)
Main Supervisor: Tosello, Guido (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Tooling for green fibre moulding

Department of Mechanical Engineering
Period: 01/08/2015 → 31/07/2018
Number of participants: 3
Phd Student: Saxena, Prateek (Intern)
Supervisor: Howard, Thomas J. (Intern)
Main Supervisor: Bissacco, Giuliano (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Using Integrated Sustainable Product Development for the development of a Green Fibre Bottle for Carlsberg

Department of Mechanical Engineering
Period: 01/08/2015 → 31/07/2018
Number of participants: 5
Phd Student: Meijer, Ellen Brilhuis (Intern)
Supervisor: Pigosso, Daniela Cristina Antelmi (Intern)
Howard, Thomas J. (Intern)
Olsen, Stig Irving (Intern)
Main Supervisor: McAloone, Tim C. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Activities:
Integrating Product and Technology Development: A Proposed Reference Model for Dual Innovation
Project: PhD

Disbond Damages in Aircraft Honeycomb Sandwich Structures

Department of Mechanical Engineering
Period: 15/07/2015 → 14/07/2018
Number of participants: 4
Phd Student:
Farshidi, Arash (Intern)
Supervisor:
Carlsson, Leif A. (Intern)
Hilgers, Ralf (Ekstern)
Main Supervisor:
Berggreen, Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Investigating New Design Paradigms in Agile Product Development and Rapid Prototyping
Department of Mechanical Engineering
Period: 15/07/2015 → 14/07/2018
Number of participants: 3
Phd Student:
Jensen, Lasse Skovgaard (Intern)
Supervisor:
Mortensen, Niels Henrik (Intern)
Main Supervisor:
Özkil, Ali Gürçan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Reduction of methane emissions from LNG fuelled diesel engines
Department of Mechanical Engineering
Period: 01/07/2015 → 30/09/2018
Number of participants: 3
Phd Student:
Jespersen, Mads Carsten (Intern)
Supervisor:
Schramm, Jesper (Intern)
Main Supervisor:
Ivarsson, Anders (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Improving the wear- and corrosion resistance of high-performance stainless steel by interstitial alloying
Department of Mechanical Engineering
Period: 15/06/2015 → 30/09/2016
Number of participants: 4
Phd Student:
Elmegaard-Fessel, Nils (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
State-of-the-art laser Doppler systems development for turbulence measurements

Department of Mechanical Engineering
Period: 15/06/2015 → 14/06/2018
Number of participants: 4
Phd Student:
Yaacob, Mohd Rusdy (Ekstern)
Supervisor:
Buchhave, Preben (Intern)
Meyer, Knud Erik (Intern)
Main Supervisor:
Velte, Clara Marika (Intern)

Project: PhD

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

State-of-the-art laser Doppler systems development for turbulence measurements

Testing and development of improved laser Doppler anemometry methods

Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering
Period: 01/06/2015 → 31/05/2018
Number of participants: 4
Project participant:
Yaacob, Mohd Rusdy (Ekstern)
Velte, Clara Marika (Intern)
Meyer, Knud Erik (Intern)
Buchhave, Preben (Intern)

Phd Student:
Karvounis, Nikolas (Intern)
Supervisor:
Vølund, Anders (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Project: PhD

Numerical Simulation of the Hydrodynamic Behaviour of the Lubricant Oil Film in Large Two-stoke Marine Diesel Engines

Department of Mechanical Engineering
Period: 01/06/2015 → 31/05/2018
Number of participants: 3
Phd Student:
Nießen, Frank (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Phase transformations in supermartensitic stainless steels

Department of Mechanical Engineering
Period: 01/06/2015 → 31/05/2018
Number of participants: 3
Phd Student:
Nießen, Frank (Intern)
Structural reorganization during cyclic deformation

Department of Mechanical Engineering
Period: 01/06/2015 → 31/05/2018
Number of participants: 3
PhD Student:
Diederichs, Annika Martina (Intern)
Supervisor:
Poulsen, Henning Friis (Intern)
Main Supervisor:
Pantleon, Wolfgang (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Experimental and theoretical investigations of turbulent axi-symmetric jets

Fundamental turbulence study for studying the development of the jet for creating an analytical model. The results will be useful for studying the dependence upon initial/upstream condition and the development of turbulence.

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

Imperial College London
Period: 15/04/2015 → 14/04/2018
Number of participants: 4
Number of related Ph.D. students: 1
Project participant:
Hodzic, Azur (Intern)
Velte, Clara Marika (Intern)
Meyer, Knud Erik (Intern)
George, William K (Intern)
**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)

**EnergyLab Nordhavn - New Urban Energy Infrastructures**
Department of Electrical Engineering
Center for Electric Power and Energy
Energy resources, services and control
Energy Analytics and Markets
Energy system operation and 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)  
Elmegaard, Brian (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:
Optimal usage of low temperature heat sources to supply district heating by heat pumps
Cost-Benefit Analysis of a Novel DC Fast-Charging Station with a Local Battery Storage for EVs
DC Fast-Charging Stations for EVs Controlled by a Local Battery Storage in Low Voltage Grids
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
Methods and Strategies for Overvoltage Prevention in Low Voltage Distribution Systems with PV
Efficient Control of Energy Storage for Increasing the PV Hosting Capacity of LV Grids
Efficient Control of Active Transformers for Increasing the PV Hosting Capacity of LV Grids

Experimental and theoretical investigations of turbulent axi-symmetric jets
Department of Mechanical Engineering
Period: 01/04/2015 → 31/07/2018
Number of participants: 4
Phd Student:
Hodzic, Azur (Intern)
Supervisor:
George, William K (Intern)
Meyer, Knud Erik (Intern)
Main Supervisor:
Velte, Clara Marika (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Topology Optimization of Thermoelectric Generators
Department of Mechanical Engineering
Period: 01/04/2015 → 31/05/2018
Number of participants: 4
Phd Student:
Lundgaard, Christian (Intern)
Two and Three Dimensional Modelling of Bridge Aerodynamics

Department of Mechanical Engineering
Period: 01/04/2015 → 30/06/2018
Number of participants: 2
Phd Student:
Spietz, Henrik Juul (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

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 Kjaer (Intern)
Kulahci, Murat (Intern)
Thyregod, Camilla (Intern)
Hovad, Emil (Intern)
Project Manager, academic: Juul Jensen, Dorte (Intern)

Financing sources
Source: Public research council
Name of research programme: Innovationsfonden
Web address: http://innovationsfonden.dk/da
Amount: 12,700,000.00 Danish Kroner
Year of approval: 2014

Development of Improved Cavitation and Noise Radiation Prediction Methods for Marine Propellers

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Period: 01/03/2015 → 31/03/2018
Number of participants: 4
Phd Student:
Mirsadraee, Yasaman (Intern)
Supervisor:
Schöön, Johannes (Ekstern)
Walther, Jens Honore (Intern)
Main Supervisor:
Andersen, Poul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

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 Kjaer (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

Limits of lubrication in deep drawing production
Department of Mechanical Engineering
Period: 01/03/2015 → 30/09/2018
Number of participants: 5
Phd Student:
Üstünyagız, Esmeray (Intern)
Supervisor:
Bay, Niels Oluf (Intern)
Martins, Paulo Antonio Firme (Ekstern)
Martins, Paulo Antonio Firme (Ekstern)
Main Supervisor:
Nielsen, Chris Valentin (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Limits of lubrication in severe stamping operations
Department of Mechanical Engineering
Period: 15/02/2015 → 30/09/2015
Number of participants: 2
Phd Student:
Zahrani, Esmaeil Ghadiri (Ekstern)
Main Supervisor:
Bay, Niels Oluf (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Building a business case for ecodesign implementation based on a system dynamics simulation model
Department of Mechanical Engineering
Period: 01/02/2015 → 31/07/2018
Number of participants: 3
Phd Student:
Rodrigues, Vinicius Picanco (Intern)
Supervisor:
Pigosso, Daniela Cristina Antelmi (Intern)
Main Supervisor:
McAloone, Tim C. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Science Without Borders, Brasi
Project: PhD
Development of new decorative nickel and chromium like coating systems with better chemical and physical properties

Department of Mechanical Engineering
Period: 01/02/2015 → 30/04/2018
Number of participants: 2
Phd Student:
Reveko, Valeriia (Intern)
Main Supervisor:
Møller, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Damping of overhead transmission line systems

Department of Mechanical Engineering
Period: 15/01/2015 → 31/03/2018
Number of participants: 3
Phd Student:
Kliem, Mathias (Intern)
Supervisor:
Berggreen, Christian (Intern)
Main Supervisor:
Høgsberg, Jan Becker (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Humidity control inside electronic enclosures: Developing design principles based on empirical understanding

Department of Mechanical Engineering
Period: 15/01/2015 → 14/07/2018
Number of participants: 3
Phd Student:
Joshy, Salil (Intern)
Supervisor:
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Quantified Robust Design: Measurement of sensitivity, variance and impact

Department of Mechanical Engineering
Period: 15/01/2015 → 14/01/2018
Number of participants: 6
Phd Student:
Boorla, Srinivasa Murthy (Intern)
Supervisor:
Eifler, Tobias (Intern)
Main Supervisor:
Howard, Thomas J. (Intern)
Examiner:
De Chiffre, Leonardo (Intern)
Söderberg, Rikard (Ekstern)
Thornton, Anna (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed
Project: PhD

Exhaust Gas Valve for High Temperatures
Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/01/2015 → 31/12/2017
Number of participants: 2
Project participant:
Hattel, Jesper Henri (Intern)
Sonne, Mads Rostgaard (Intern)

Advanced Thermodynamic Methods for Utilization of Industrial Energy Saving Potentials
Department of Mechanical Engineering
Thermal Energy
Period: 15/12/2014 → 08/03/2018
Number of participants: 3
Phd Student:
Bühler, Fabian (Intern)
Supervisor:
Nguyen, Tuong-Van (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Coatings for Biomass firing
Department of Mechanical Engineering
Period: 15/12/2014 → 29/03/2018
Number of participants: 7
Phd Student:
Wu, Duoli (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Dahl, Kristian Vinter (Intern)
Main Supervisor:
Hald, John (Intern)
Examiner:
Jappe Frandsen, Flemming (Intern)
Hansson, Anette Nørgaard (Intern)
Tuurna, Satu Marita (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Cyclic Yielding of Tubular Structures
Department of Mechanical Engineering
Period: 15/12/2014 → 14/01/2018
Number of participants: 7
Phd Student:
Tidemann, Lasse (Ekstern)
Supervisor:
Tychsen, Jesper (Ekstern)
Wægter, John (Ekstern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Høgsberg, Jan Becker (Intern)
D'Aniello, Mario (Ekstern)
Ristinmaa, Matti (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

AC-Corrosion of Cathodically Protected Pipelines
Department of Mechanical Engineering
Period: 01/12/2014 → 24/10/2018
Number of participants: 3
Phd Student:
Junker-Holst, Andreas (Intern)
Supervisor:
Nielsen, Lars Vendelbo (Intern)
Main Supervisor:
Møller, Per (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Design and modelling of expander and compression machines for thermodynamic cycles utilizing low-temperature heat sources
Department of Mechanical Engineering
Period: 01/12/2014 → 01/06/2018
Number of participants: 5
Phd Student:
Meroni, Andrea (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Persico, Giacomo (Ekstern)
Pierobon, Leonardo (Intern)
Main Supervisor:
Haglind, Fredrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Topology optimization of thermal heat sinks
PhD Project
Department of Energy Conversion and Storage
Electrofunctional materials
Department of Mechanical Engineering
Solid Mechanics
Period: 01/11/2014 → 31/10/2017
Number of participants: 4
Acronym: TOPTEN
Project participant:
Engelbrecht, Kurt (Intern)
Sigmund, Ole (Intern)
Lazarov, Boyan Stefanov (Intern)
Phd Student:
Haertel, Jan Hendrik Klaas (Intern)

Relations
Publications:
Topology Optimization of Thermal Heat Sinks
Project

Measuring Surf-Zone Wave Conditions and other Coastal Processes
Department of Mechanical Engineering
Period: 01/11/2014 → 22/05/2018
Number of participants: 4
Phd Student:
Hansen, Asger Bendix (Intern)
Supervisor:
Drønen, Nils Kjetil (Intern)
Main Supervisor:
Carstensen, Stefan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Modelling Climatic Reliability of Electronic Devices
Department of Mechanical Engineering
Period: 01/11/2014 → 31/10/2017
Number of participants: 6
Phd Student:
Shojaee Nasirabadi, Parizad (Intern)
Supervisor:
Mohanty, Sankhya (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Spangenberg, Jon (Intern)
Punch, Jeff (Ekstern)
Wilcoxon, Ross (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Optimization of Industrial Energy Efficient Heat Pumps
Department of Mechanical Engineering
Period: 01/11/2014 → 31/10/2017
Number of participants: 3
Phd Student: Christensen, Stefan Wuust (Intern)
Supervisor: Markussen, Wiebke Brix (Intern)
Main Supervisor: Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Process chains for advanced tooling based on additive manufacturing
Department of Mechanical Engineering
Period: 01/11/2014 → 06/03/2018
Number of participants: 6
Phd Student: Biondani, Francesco Giuseppe (Intern)
Supervisor: Hansen, Hans Nørgaard (Intern)
Main Supervisor: Bissacco, Giuliano (Intern)
Examiner: De Chiffre, Leonardo (Intern)
Beaucamp, Anthony (Ekstern)
Lauwers, Bert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Tsunami-Seabed Interaction
Department of Mechanical Engineering
Period: 01/11/2014 → 20/04/2018
Number of participants: 5
Phd Student: Eltard-Larsen, Bjarke (Intern)
Supervisor: Christensen, Erik Damgaard (Intern)
Hjelmager Jensen, Jacob (Intern)
Sumer, B. Mutlu (Intern)
Main Supervisor: Fuhrman, David R. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Development and testing of tailored surfaces for sheet metal forming
Department of Mechanical Engineering
Period: 15/10/2014 → 07/12/2017
Number of participants: 7
Phd Student:
Sulaiman, Mohd Hafis Bin (Intern)
Supervisor:
Bay, Niels Oluf (Intern)
Christiansen, Peter (Intern)
Main Supervisor:
Nielsen, Chris Valentin (Intern)
Examiner:
De Chiffre, Leonardo (Intern)
Ceron, Ermanno (Intern)
Dubar, Laurent (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

Relations
Activities:
Influence of tool texture on friction and lubrication in strip reduction

Publications:
Development and Testing of Tailored Tool Surfaces for Sheet Metal Forming
Project: PhD

Climatic Reliability of Electronic Devices
Department of Mechanical Engineering
Materials and Surface Engineering
Period: 01/10/2014 → 30/09/2017
Number of participants: 3
Project participant:
Piotrowska, Kamila (Intern)
Supervisor:
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Project

CFD analyses of flow and scour around a mono-pile with and without scour protection
Department of Mechanical Engineering
Period: 01/10/2014 → 01/07/2018
Number of participants: 3
Phd Student:
Mandviwalla, Xerxes (Intern)
Supervisor:
Carstensen, Stefan (Intern)
Main Supervisor:
Christensen, Erik Damgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Fracture Characterization and Analysis in Curved Sandwich Structures
Department of Mechanical Engineering
Modeling for Dynamic Length Metrology in Accurate Manufacture

Department of Mechanical Engineering
Period: 01/10/2014 → 31/12/2017
Number of participants: 6
Phd Student:
Mohammadi, Ali (Intern)
Supervisor:
Sonne, Mads Rostgaard (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thorborg, Jesper (Intern)
Andreasen, Jan Lasson (Intern)
Savio, Enrico (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Quartz Coated Metals for Hygienic applications in Food, Pharma and Medical Industry

Department of Mechanical Engineering
Period: 01/10/2014 → 11/01/2018
Number of participants: 6
Phd Student:
Lampert, Felix (Intern)
Supervisor:
Rasmussen, Jan Boye (Ekstern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Minzari, Daniel (Intern)
Nielsen, Lars Pleth (Ekstern)
Taylor, Shelton Ray (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Relations
Publications:
Thin Glass Coatings for the Corrosion Protection of Metals
Project: PhD

**Water film formation on PCBA surface under humidity: Investigation of electrochemical and electrical aspects leading to corrosion failures**

Department of Mechanical Engineering  
Period: 01/10/2014 → 02/06/2018  
Number of participants: 3  
Phd Student:  
Piotrowska, Kamila (Intern)  
Supervisor:  
Jellesen, Morten Stendahl (Intern)  
Main Supervisor:  
Ambat, Rajan (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**FMAT**

Department of Mechanical Engineering  
Manufacturing Engineering  
Period: 15/09/2014 → …  
Number of participants: 2  
Project participant:  
Mahshid, Rasoul (Intern)  
Project Coordinator:  
Hansen, Hans Nørgaard (Intern)  
Project

**Improvement of heat transfer processes in power cycles utilizing low grade heat**

Department of Mechanical Engineering  
Period: 01/09/2014 → 13/11/2018  
Number of participants: 4  
Phd Student:  
Andreasen, Jesper Graa (Intern)  
Supervisor:  
Elmegaard, Brian (Intern)  
Kærn, Martin Ryhl (Intern)  
Main Supervisor:  
Haglind, Fredrik (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**Optimizing Oil Production by Novel Technology Integration - Well flow modeling**

Department of Mechanical Engineering  
Period: 01/09/2014 → 14/07/2018  
Number of participants: 3  
Phd Student:  
Hemmingsen, Casper Schytte (Intern)  
Supervisor:  
Nielsen, Kenny Krogh (Ekstern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Sensing for dynamic length metrology in accurate manufacture

Department of Mechanical Engineering
Period: 01/09/2014 → 11/01/2018
Number of participants: 6
Phd Student:
Dalla Costa, Giuseppe (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
Islam, Aminul (Intern)
Carli, Lorenzo (Intern)
Savio, Enrico (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Accurate dimensional measurements in production environment using Dynamic Length Metrology
Project: PhD

Topology Optimization and Lattice Boltzmann Methods

Department of Mechanical Engineering
Period: 01/09/2014 → 01/02/2018
Number of participants: 7
Phd Student:
Nørgaard, Sebastian Arlund (Intern)
Supervisor:
Engelbrecht, Kurt (Intern)
Lazarov, Boyan Stefanov (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Fuhrman, David R. (Intern)
Evgrafov, Anton (Intern)
Stingl, Michael Walter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Topology optimization and lattice Boltzmann methods
Project: PhD

Development of a decision support system for ships based on continuous measurements
Department of Mechanical Engineering
Period: 01/08/2014 → 30/07/2018
Number of participants: 4
Phd Student:
Choi, Ju Hyuck (Intern)
Supervisor:
Andersen, Ingrid Marie Vincent (Intern)
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Nielsen, Ulrik Dam (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Micro Assembly Injection Moulding of Multi-Material Micro Mechanical Systems
Department of Mechanical Engineering
Period: 01/08/2014 → 31/05/2015
Number of participants: 4
Phd Student:
Hasnæs, Frederik Boris (Ekstern)
Supervisor:
Elsborg, René (Ekstern)
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
Tosello, Guido (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Nonlinear Dynamics of Controllable Backup Bearings - Theory & Experiment
Department of Mechanical Engineering
Period: 01/08/2014 → 01/02/2018
Number of participants: 6
Phd Student:
Lampe Linhares da Fonseca, Cesar Augusto (Intern)
Supervisor:
Weber, Hans Ingo (Ekstern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Thomsen, Jon Juel (Intern)
Liebich, Robert (Ekstern)
Wiercigroch, Marian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Science Without Borders, Brasi

Relations
Publications:
A theoretical-experimental study of backup bearings
Project: PhD
Reducing time-to-market by means of modular platforms
Department of Mechanical Engineering
Period: 01/08/2014 → 06/03/2018
Number of participants: 6
Phd Student:
Løkkegaard, Martin (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Hildre, Hans Petter (Ekstern)
Bysted, Tommy (Ekstern)
Malmqvist, Johan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Design and Optimization of Active Feedback Control for Flexible Rotor-Blade Systems
Department of Mechanical Engineering
Period: 15/07/2014 → 30/06/2018
Number of participants: 5
Phd Student:
de Souza Reboucas, Geraldo Francisco (Intern)
Supervisor:
Schilder, Frank (Intern)
Starke, Jens (Intern)
Thomsen, Jon Juel (Intern)
Main Supervisor:
Santos, Ilmar (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Science Without Borders, Brasi
Project: PhD

SteelWind
Department of Mechanical Engineering
Materials and Surface Engineering
Centro Sviluppo Materiali S.p.A. (CSM)
ECOR Research
Gerdau Investigacion y Desarrollo Europa SA
Schaeffler Technologies GMBH&Co.kg
Energietechnik Essen GmbH
Period: 01/07/2014 → 31/12/2017
Number of participants: 2
Acronym: SteelWind
Project participant:
Winther, Grethe (Intern)
Grumsen, Flemming Bjerg (Intern)
Project
Development of natural seabed forms and their interaction with OWF

Department of Mechanical Engineering
Period: 01/07/2014 → 31/12/2017
Number of participants: 5
Phd Student:
Margalit, Jonatan (Intern)
Main Supervisor:
Fuhrman, David R. (Intern)
Examiner:
Christensen, Erik Damgaard (Intern)
Holmedal, Lars Erik (Ekstern)
Roulund, Andreas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Martensitic Transformation in Metastable Austenitic Stainless Steel

Department of Mechanical Engineering
Materials and Surface Engineering
DTU Danchip
Center for Electron Nanoscopy
Period: 01/06/2014 → 31/05/2016
Number of participants: 4
Martensite, Steel, Transformation kinetics, Magnetometry, Dilatometry, X-Ray Diffraction
Acronym: MaT-MASS
Project participant:
Villa, Matteo (Intern)
Somers, Marcel A. J. (Intern)
Alimadadi, Hossein (Intern)
Jensen, Louise Helene Søgaard (Intern)

Financing sources
Source: Public research council
Name of research programme: The Danish Council for Independent Research, Technology and Production Sciences
Amount: 2,326,209.00 Danish Kroner
Year of approval: 2014

Composite mast structures for electrical transmission lines

Department of Mechanical Engineering
Period: 01/06/2014 → 01/04/2018
Number of participants: 3
Phd Student:
Manouchehr, Mehrtash (Intern)
Supervisor:
Holbøll, Joachim (Intern)
Main Supervisor:
Berggreen, Christian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD
Characterisation and modelling of crystallographic orientation changes at the grain scale during plastic deformation

Department of Mechanical Engineering
Materials and Surface Engineering
Department of Physics
Neutrons and X-rays for Materials Physics
Period: 01/04/2014 → 31/03/2017
Number of participants: 3
Project participant:
Juul, Nicolai Ytterdal (Intern)
Winther, Grethe (Intern)
Oddershede, Jette (Intern)

Relations
Parent project:
Multi-scale material models for smart metal forming
Related projects:
Mechanical and microstructural transients after strain path changes in metal forming
Project

Characterisation and modelling of crystallographic orientation changes at the grain scale during plastic deformation

Department of Mechanical Engineering
Period: 01/04/2014 → 07/09/2017
Number of participants: 6
Phd Student:
Juul, Nicolai Ytterdal (Intern)
Supervisor:
Oddershede, Jette (Intern)
Main Supervisor:
Winther, Grethe (Intern)
Examiner:
Nielsen, Kim Lau (Intern)
Lienert, Ulrich (Ekstern)
Quey, Romain (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Advanced thermodynamic cycles utilising low-temperature heat sources
Energy sources at a low temperature level are available from a variety of sources ranging from waste heat from ships, industry and refrigeration plants, to renewable energy in the form of biomass, geothermal and solar.

There is significant potential for improving the use of these sources in developing new cycles based on new multi-component fluid mixtures. These improvements will not only increase the efficiency of today's technology, but they will also make it possible to use low-temperature sources which, due to lack of technical feasibility or economy is not used today. This ambitious, interdisciplinary project will lead the way to innovative thermal system for electricity generation, heat pumping and cooling by utilization of low value sources, at efficiencies that surpass today's level significantly. The project will develop advances in the design of both processes and media so that energy savings of 15% can be achieved. The analysis will include numerical simulation and advanced thermodynamic methods based on energy and exergy analysis and experimental verification of component performance. The development of a systematic approach to the optimization of cycle and the working medium in the given application. The results will provide a scientific basis for choosing the future use of low-temperature resources in Denmark. This may contribute significantly to the development of the future society using no fossil resources, but large amounts of fluctuating renewable energy.

Department of Mechanical Engineering
Thermal Energy
Department of Chemical and Biochemical Engineering

CAPEC-PROCESS

Danish Technological Institute

Danfoss A/S

Viegand Maagøe

Alfa Laval

MAN Diesel & Turbo SE

A. P. Møller-Mærsk

Arla Foods

Technical University of Munich

Delft University of Technology

Aalborg University

Alfa Laval

Period: 01/03/2014 → 28/02/2019

Number of participants: 17

Acronym: THERMCYC

Project ID: 76567

Number of related Ph.D. students: 7

Project participant:

Haglind, Fredrik (Intern)

Clausen, Lasse Røngaard (Intern)

Kærn, Martin Ryhl (Intern)

Markussen, Wiebke Brix (Intern)

Sin, Gürkan (Intern)

Gani, Rafiqul (Intern)

Babi, Deenesh Kavi (Intern)

Pierobon, Leonardo (Intern)

Zhang, Lei (Intern)

Zühlsdorf, Benjamin (Intern)

Mancini, Roberta (Intern)

Phd Student:

Meroni, Andrea (Intern)

Andreasen, Jesper Graa (Intern)

Cignitti, Stefano (Intern)

Frutiger, Jerome (Intern)

Project Manager, academic:

Elmegaard, Brian (Intern)

Project Coordinator:

Sørensen, Iben (Intern)

Relations

Activities:

International Workshop on High Temperature Heat Pumps

Publications:

Book of presentations of the International Workshop on High Temperature Heat Pumps

Mapping of low temperature heat sources in Denmark

Improving efficiency of heat pumps by use of zeotropic mixtures for different temperature glides

High Temperature Heat Pump Integration using Zeotropic Working Fluids for Spray Drying Facilities

Derivation of guidelines for the design of plate evaporators in heat pumps using zeotropic mixtures

Forbedring af industrielle processers energieffektivitet

Project report: Experimental planning and verification of working fluids (WP 5)
Spatially periodic structures are used in many fields of science and technology. Examples of such structures are vibration and acoustic isolators made of functionally graded composite materials, trusses of bridges, railway tracks, and similar. Tailoring and optimizing parameters of these structures, which control their dynamic behavior, is a relevant technological challenge. The purpose of the project is to investigate to which extent dynamic characteristics of periodic structures and structures made of the composite materials may be changed and tailored by modulating parameters of the structural composition, and how this could be used in synthesizing new types of structures. Particularly the possibilities to employ the coupled spatial-temporal modulations will be studied.

Department of Mechanical Engineering
Solid Mechanics
Period: 01/02/2014 → 31/01/2016
Number of participants: 1
Periodic structures, Tailoring, Optimization, Dynamics, Spatial-temporal modulations
Project participant:
Sorokin, Vladislav (Intern)

Relations
Publications:
Vibration suppression for strings with distributed loading using spatial cross-section modulation
Suppression of vibration in bounded structures subjected to action of a distributed load by continuous spatial modulations of their parameters
On the response of a nonlinear parametric amplifier driven beyond resonance
On the unlimited gain of a nonlinear parametric amplifier
Analysis of motion of inverted pendulum with vibrating suspension axis at low-frequency excitation as an illustration of a new approach for solving equations without explicit small parameter

**Project**

**Multi-scale material models for smart metal forming**

Analysis of deformation-induced intragranular orientation spread in IF-steel by a combination of 3DXRD and crystal plasticity

Department of Mechanical Engineering
Materials and Surface Engineering
Department of Physics
Neutrons and X-rays for Materials Physics
Manufacturing Engineering

**DTU Admission Course**

University of Illinois
Period: 01/02/2014 → 31/07/2017
Number of participants: 5
Acronym: MulMatMod
Number of related Ph.D. students: 2
Project participant:
Winther, Grethe (Intern)
Oddershede, Jette (Intern)
Bay, Niels Oluf (Intern)
Juul, Nicolai Ytterdal (Intern)
Jensen, Mikkel Ravn Boye (Intern)

**Relations**

Related projects:
Characterisation and modelling of crystallographic orientation changes at the grain scale during plastic deformation
Mechanical and microstructural transients after strain path changes in metal forming

Activities:
Hierarchical microstructures in metals due to dislocation-mediated plasticity
Grain-scale investigations of deformation and surface treatment of stainless steel
Intragranular orientation spread induced by grain interaction
Parallel evolution of deformation textures and dislocation boundaries
Combining crystal plasticity and dislocation theory to model dislocation boundary characteristics
Intragranular orientation spread induced by grain interaction
Deformation-induced intragranular orientation spread in ferrite investigated by 3DXRD and forward modeling
Measured Resolved Shear Stresses on Slip Systems in Austenitic Steel Grains
Analysis of grain-scale experimental data in a crystal plasticity framework
Analysis of deformation-induced intragranular orientation spread in IF-steel by a combination of 3DXRD and crystal plasticity

Publications:
Deformation-induced orientation spread in individual bulk grains of an interstitial-free steel
Analysis of deformation-induced intragranular orientation spread in IF-steel by a combination of 3DXRD and crystal plasticity

**Project**

**Multi Scale Micro and Nano Metrology for Advanced Precision Moulding Technologies**

Department of Mechanical Engineering
Period: 01/02/2014 → 20/04/2017
Number of participants: 6
Phd Student:
Quagliotti, Danilo (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
Tosello, Guido (Intern)
Examiner:
De Chiffre, Leonardo (Intern)
Balsamo, Alessandro (Ekstern)
Bosse, Harald (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Relations
Publications:
Multi Scale Micro and Nano Metrology for Advanced Precision Moulding Technologies
Project: PhD

Product/Service-System Design from a Life Cycle Costing Perspective
Department of Mechanical Engineering
Period: 01/02/2014 → 21/09/2017
Number of participants: 6
Phd Student:
Pagoropoulos, Aris (Intern)
Supervisor:
Maier, Anja (Intern)
Main Supervisor:
McAloone, Tim C. (Intern)
Examiner:
Laurent, Alexis (Intern)
Andersen, Ingrid Marie Vincent (Intern)
Isaksson, Karl Ola (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet

Enhanced evaluation of structural damping using Operational Modal Analysis
Department of Mechanical Engineering
Period: 15/01/2014 → 11/01/2018
Number of participants: 5
Phd Student:
Bajric, Anela (Intern)
Main Supervisor:
Høgsberg, Jan Becker (Intern)
Examiner:
Thomsen, Jon Juel (Intern)
Chatzi, Eleni (Ekstern)
Peeters, Bart (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)

Relations
Publications:
Identification of Damping from Structural Vibrations
Project: PhD

**Metric-driven Robust Design & Robustness Quantification of Complex Engineering Systems**

Department of Mechanical Engineering
Period: 15/01/2014 → 29/05/2017
Number of participants: 6
PhD Student:
Göhler, Simon Moritz (Intern)
Supervisor:
Eifler, Tobias (Intern)
Main Supervisor:
Howard, Thomas J. (Intern)
Examiner:
McMahon, Christopher Alan (Intern)
Dantan, Jean-Yves (Ekstern)
Söderberg, Rikard (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

**Relations**
Publications:
Metric-driven Robust Design – Robustness Quantification of Complex Engineering Systems
Project: PhD

**Structural Design of FRP Composite Flexible Riser Systems**

Department of Mechanical Engineering
Period: 15/12/2013 → 16/06/2018
Number of participants: 5
PhD Student:
Lukassen, Troels Vestergaard (Intern)
Supervisor:
Anyfantis, Konstantinos (Intern)
Glejbøl, Kristian (Ekstern)
Lukassen, Troels Vestergaard (Intern)
Main Supervisor:
Berggreen, Christian (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

**The process chain in microstructured polymer optical fibres production**

Department of Mechanical Engineering
Period: 15/12/2013 → 23/03/2017
Number of participants: 5
PhD Student:
Fasano, Andrea (Intern)
Main Supervisor:
Rasmussen, Henrik K. (Intern)
Examiner:
Szabo, Peter (Intern)
Cristiansen, Jesper de Claville (Ekstern)
Sendergaard, Thomas (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)
Project: PhD

DTU-Novo Nordisk Robust Design Programme
This project is a research and educational programme focusing on the development and application of Robust Design, Tools, Methods and Processes. Robust Design is essential to a country’s competitiveness in production. When a design is robust it means that it is insensitive to small variations in production and therefore over large production volumes over long lifetime, will continually give a consistent performance to the customer.

Department of Mechanical Engineering
Novo Nordisk A/S
Period: 01/12/2013 → 01/12/2017
Number of participants: 5
Robust Design, Reliability Engineering, Quality Engineering, Process Capability Assessment, Product development, Design Engineering, Tolerance Analysis, Dimensional Engineering
Acronym: RDP
Phd Student:
Pedersen, Søren Nygaard (Intern)
Christensen, Martin Ebro (Intern)
Göhler, Simon Moritz (Intern)
Supervisor:
Eifler, Tobias (Intern)
Project Manager, academic:
Howard, Thomas J. (Intern)

Multiphysics approach applied to the design of AMB for high speed turbomachinery

Department of Mechanical Engineering
Period: 01/12/2013 → 30/09/2017
Number of participants: 6
Phd Student:
Lauridsen, Jonas Skjødt (Intern)
Supervisor:
Schlee, Mathias (Ekstern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Blanke, Mogens (Intern)
Keogh, Patrick Sean (Ekstern)
Maslen, Eric Harvey (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
Control Design of Active Magnetic Bearings for Rotors Subjected to Destabilising Seal Forces - Theory & Experiment
Project: PhD

Product/Service-System Design from a Life Cycle Environmental Perspective

Department of Mechanical Engineering
Period: 01/12/2013 → 03/01/2018
Number of participants: 6
Phd Student:
Kjær, Louise Laumann (Intern)
Supervisor:
Pigosso, Daniela Cristina Antelmi (Intern)
Main Supervisor:
McAloone, Tim C. (Intern)
Examiner:
Olsen, Stig Irving (Intern)
Evans, Stephen (Ekstern)
Goedkoop, Mark (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Quantifying Functional Requirements as Robust Design Target Values
Department of Mechanical Engineering
Period: 01/12/2013 → 29/05/2017
Number of participants: 6
Phd Student:
Pedersen, Søren Nygaard (Intern)
Supervisor:
Eifler, Tobias (Intern)
Main Supervisor:
Howard, Thomas J. (Intern)
Examiner:
McMahon, Christopher Alan (Ekstern)
Dantan, Jean-Yves (Ekstern)
Söderberg, Rikard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansierede - Virksomhed

Relations
Publications:
Perceptual Robust Design
Project: PhD

Integrated Quality Control of Precision Assemblies using Computed Tomography
Department of Mechanical Engineering
Period: 15/11/2013 → 16/02/2017
Number of participants: 6
Phd Student:
Stolfi, Alessandro (Intern)
Supervisor:
Carli, Lorenzo (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
Tosello, Guido (Intern)
Andreasen, Jan Lasson (Intern)
Dewulf, Wim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Marie Curie (EU-stipendium)

Relations
Publications:
Integrated Quality Control of Precision Assemblies using Computed Tomography
Project: PhD

Quantitative Architecture Synthesis
Department of Mechanical Engineering
Period: 15/11/2013 → 01/04/2018
Number of participants: 3
Phd Student:
Jensen, Troels Victor (Intern)
Supervisor:
Hansen, Claus Thorp (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Quality control and tolerance verification of complex castings by means of optical methods
To remain competitive the foundries find it imperative that they can offer the most modern and precise documentation of the products they make.
For the foundries this project is essential to be able to reduce production costs and to remain competitive. Disa Industries wishes to strengthen its position as one of the world’s leading suppliers of foundry equipment. Zebicon will through the project strengthen its position as supplier of advanced optical measurement equipment to the Danish industry.
The results from the project will be used to reduce production costs at Vestas’ and Vald. Birn’s foundries by reducing the number of defective castings and by reducing the machining requirements of the finished castings.
When tolerances are improved it will allow engineers and designers to create structurally optimised, light constructions for the energy and transport sectors.

Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/11/2013 → 01/11/2016
Number of participants: 1
Acronym: Q-CAST
Project Manager, organisational:
Mohaghegh, Kamran (Intern)

Assessment, STrategy And Risk Reduction for Tsunamis in Europe
ASTARTE is organized to foster tsunami resilience in Europe, through innovative research on scientific problems critical to enhance forecast skills in terms of sources, propagation and impact. ASTARTE will employ lessons on coastal resilience learned from disaster surveys following tsunamis and hurricane surges. Within ASTARTE, we will acquire new information to complete the existing European knowledge base, and we will benefit from a stronger integration than ever attempted previously in the field. This will involve close cooperation with coastal populations, civil protection, emergency management and other local organizations.

ASTARTE is a collaborative project within the FP7-ENV2013 6.4-3

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Period: 01/11/2013 → 01/11/2016
Number of participants: 3
tsunamis, risk reduction
Acronym: ASTARTE
Project ID: 603839
Number of related Ph.D. students: 1
Project participant:
Fuhrman, David R. (Intern)
Sumer, B. Mutlu (Intern)
Eltard-Larsen, Bjarke (Intern)

**Relations**

Publications:
D5.10 - Interaction of the tsunami with the seabed. Implications for wind farms, aquaculture, coastal ecosystems and marine protected areas.

**Advanced Process Chains for Prototyping and Pilot Production based on Additive Manufacturing**

Department of Mechanical Engineering  
Period: 01/11/2013 → 31/10/2017  
Number of participants: 7  
Phd Student:  
Mischkot, Michael (Intern)  
Supervisor:  
Hansen, Hans Nørgaard (Intern)  
Pedersen, David Bue (Intern)  
Main Supervisor:  
Tosello, Guido (Intern)  
Examiner:  
Islam, Aminul (Intern)  
Hardar, Ronen (Ekstern)  
Qian, Jun (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Institut stipendie (DTU)  
Project: PhD

**Climatic Reliability of Electronic Devices**

Department of Mechanical Engineering  
Period: 01/11/2013 → 06/03/2018  
Number of participants: 7  
Phd Student:  
Gudla, Helene Virginie Conseil (Intern)  
Supervisor:  
Hattel, Jesper Henri (Intern)  
Jellesen, Morten Stendahl (Intern)  
Main Supervisor:  
Ambat, Rajan (Intern)  
Examiner:  
Holm, Allan Hjarbæk (Ekstern)  
König, Daniel (Ekstern)  
Pan, Jinshan (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Samfinansieret - Andet  
Project: PhD

**State-of-the-art laser Doppler system for turbulence measurements**

Department of Mechanical Engineering  
Fluid Mechanics, Coastal and Maritime Engineering  
Intarsia Optics  
Period: 23/10/2013 → 31/12/2015  
Number of participants: 2
Developing semi-empirical models for predicting climate inside electronic device enclosures

Department of Mechanical Engineering
Period: 15/10/2013 → 22/07/2017
Number of participants: 8
PhD Student:
Staliulionis, Zygimantas (Intern)
Supervisor:
Ambat, Rajan (Intern)
Jellesen, Morten Stendahl (Intern)
Mohanty, Sankhya (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Rode, Carsten (Intern)
Park, Seungbae (Ekstern)
Tamulevicius, Sigitas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Major retrofitting technologies for containerships- propellers

Department of Mechanical Engineering
Period: 01/10/2013 → 20/04/2017
Number of participants: 5
PhD Student:
Regener, Pelle Bo (Intern)
Main Supervisor:
Andersen, Poul (Intern)
Examiner:
Bingham, Harry B. (Intern)
Bensow, Rickard E. (Ekstern)
Steen, Sverre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samfinansieret - Andet
Project: PhD

Numerical modeling of the hot wire and hot blade cutting processes

Department of Mechanical Engineering
Period: 15/09/2013 → 16/02/2017
Number of participants: 5
PhD Student:
Petkov, Kiril (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thorborg, Jesper (Intern)
Ahn, Dong-Gyu (Ekstern)
Aitchison, David Robert (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

**Automation and Robotics for EUropean Sustainable Manufacturing**
Department of Management Engineering
Quantitative Sustainability Assessment
Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/09/2013 → 31/08/2016
Number of participants: 6
Acronym: AREUS
Project ID: 81375
Number of related Ph.D. students: 1
Project participant:
Bey, Niki (Intern)
Rödger, Jan-Markus (Intern)
Dijkman, Teunis Johannes (Intern)
Hauschild, Michael Zwicky (Intern)
Molin, Christine (Intern)
Alting, Leo (Intern)

**Analyses of fish-cage interaction with waves and currents**
Department of Mechanical Engineering
Period: 01/09/2013 → 22/06/2017
Number of participants: 5
Phd Student: Chen, Hao (Intern)
Main Supervisor: Christensen, Erik Damgaard (Intern)
Examiner: Bingham, Harry B. (Intern)
Kristiansen, Trygve (Ekstern)
Zang, Jun (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

**Fast Methods for Predicting the Added Resistance on Ships**
Department of Mechanical Engineering
Period: 01/09/2013 → 09/12/2016
Number of participants: 7
Phd Student: Kontos, Stavros (Intern)
Supervisor: Engsig-Karup, Allan Peter (Intern)
Lindberg, Ole (Intern)
Main Supervisor: Bingham, Harry B. (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Robust Numerical Methods for Nonlinear Wave-Structure Interaction in a Moving Frame of Reference
Project: PhD

Modelling the Effects of Process Induced Defects on Subsequent Mechanical Behaviour of Cast Components
Department of Mechanical Engineering
Period: 01/09/2013 → 16/02/2017
Number of participants: 7
Phd Student:
Andriollo, Tito (Intern)
Supervisor:
Thorborg, Jesper (Intern)
Tiedje, Niels Skat (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Niordson, Christian Frithiof (Intern)
Bellet, Michel (Ekstern)
Kouznetsova, Varvara (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Thermomechanical modelling of casting large wind turbine parts
Department of Mechanical Engineering
Period: 01/09/2013 → 07/12/2017
Number of participants: 7
Phd Student:
Bjerre, Mathias Karsten (Intern)
Supervisor:
Thorborg, Jesper (Intern)
Tiedje, Niels Skat (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Juul Jensen, Dorte (Intern)
Lacaze, Jacques (Ekstern)
Sándor Diószegi, Attila (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
In situ observations of graphite formation during solidification of cast iron
Numerical Simulation of Flow and Compression of Green Sand
Department of Mechanical Engineering
Period: 15/08/2013 → 07/09/2017
Number of participants: 7
PhD Student:
Hovad, Emil (Intern)
Supervisor:
Larsen, Per Leif (Intern)
Thorborg, Jesper (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Szabo, Peter (Intern)
Rasmussen, Niels Winther (Intern)
Schumacher, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Industrial PhD
Project: PhD

Relations
Publications:
Numerical simulation of flow and compression of green sand
Documents:
Numerical simulation of flow and compression of green sand
Project: PhD

Topology optimization for medium- to high-frequency applications
Department of Mechanical Engineering
Period: 15/06/2013 → 30/09/2016
Number of participants: 7
PhD Student:
Christiansen, Rasmus Ellebæk (Intern)
Supervisor:
Jensen, Jakob Søndergaard (Intern)
Lazarov, Boyan Stefanov (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Agerkvist, Finn T. (Intern)
Berggren, Martin (Ekstern)
Schevenels, Mattias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Topology Optimization for Wave Propagation Problems with Experimental Validation
Project: PhD

High-temperature corrosion on biodust firing
Department of Mechanical Engineering
Period: 15/03/2013 → 19/01/2017
Number of participants: 6
Phd Student:
Okoro, Sunday Chukwudi (Intern)
Supervisor:
Jappe Frandsen, Flemming (Intern)
Main Supervisor:
Pantleon, Karen (Intern)
Examiner:
Hald, John (Intern)
Lundberg, Mats Olov (Ekstern)
Yrjas, Patrik Klaus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
High Temperature Corrosion on Biodust Firing
Project: PhD

Operation of Ultra Large Container Ships
Department of Mechanical Engineering
Period: 15/03/2013 → 04/07/2016
Number of participants: 6
Phd Student:
Montazeri, Najmeh (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Nielsen, Ulrik Dam (Intern)
Examiner:
Bingham, Harry B. (Intern)
Dietz, Jesper Skjoldager (Intern)
Iseki, Toshio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

**Relations**

**Publications:**

Estimation of waves and ship responses using onboard measurements  
*Project: PhD*

**Optimization of materials for nonlinear dynamic performance**

Department of Mechanical Engineering  
Period: 15/03/2013 → 01/09/2016  
Number of participants: 6  
PhD Student:  
Frandsen, Niels Morten Marslev (Intern)  
Supervisor:  
Thomsen, Jon Juel (Intern)  
Main Supervisor:  
Jensen, Jakob Søndergaard (Intern)  
Examiner:  
Høgsberg, Jan Becker (Intern)  
Kerschen, Gaëtan (Ekstern)  
Phani, A. Srikantha (Ekstern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: Anden EU-finansiering

**Relations**

**Publications:**

Design of advanced materials for linear and nonlinear dynamics  
*Project: PhD*

**Topology Optimisation for Multiscale Problems**

Department of Mechanical Engineering  
Period: 15/03/2013 → 09/12/2016  
Number of participants: 7  
PhD Student:  
Alexandersen, Joe (Intern)  
Supervisor:  
Aage, Niels (Intern)  
Lazarov, Boyan Stefanov (Intern)  
Main Supervisor:  
Sigmund, Ole (Intern)  
Examiner:  
Jensen, Jakob Søndergaard (Intern)  
Guedes, José Arnaldo Pereira Leite Miranda (Ekstern)  
Maute, Kurt (Ekstern)

**Financing sources**

Source: Internal funding (public)  
Name of research programme: Institut, samfinansiering

**Relations**

**Publications:**

Efficient topology optimisation of multiscale and multiphysics problems  
*Project: PhD*

**BLADERUNNER - Large scale cost-effective robotic production of advanced formwork**

Department of Mechanical Engineering
Effects and characterization of metal release from metal implants

Department of Mechanical Engineering
Period: 01/03/2013 → 09/12/2016
Number of participants: 7
PhD Student:
Christiansen, Rune Juul (Intern)
Supervisor:
Bonefeld, Charlotte Menné (Ekstern)
Jakobsen, Stig Storgaard (Ekstern)
Main Supervisor:
Jellesen, Morten Stendahl (Intern)
Examiner:
Hilbert, Lisbeth Rischel (Intern)
Summer, Burkhard (Ekstern)
Tengvall, Pentti (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Topology optimization for additive manufacturing

Department of Mechanical Engineering
Period: 01/03/2013 → 09/12/2016
Number of participants: 7
PhD Student:
Clausen, Anders (Intern)
Supervisor:
Aage, Niels (Intern)
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Guedes, José Arnaldo Pereira Leite Miranda (Ekstern)
Maute, Kurt (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Topology Optimization for Additive Manufacturing
Project: PhD

Combining Gas Bearing and Smart Material Technologies for Improving Machine Performance - Theory and Experiment
Department of Mechanical Engineering
Period: 01/02/2013 → 18/05/2017
Number of participants: 5
Phd Student:
Nielsen, Bo Bjerregaard (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Andreasen, Casper Schousboe (Intern)
Bonello, Philip (Ekstern)
Savi, Marcelo Amorim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Combining Gas Bearing and Smart Material Technologies for Improved Machine Performance Theory and Experiment
Project: PhD

Design and Manufacture of micro Products Using Concurrent Engineering
Department of Mechanical Engineering
Period: 01/02/2013 → 28/04/2016
Number of participants: 7
Phd Student:
Marhöfer, David Maximilian (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Islam, Aminul (Intern)
Main Supervisor:
Tosello, Guido (Intern)
Examiner:
Bissacco, Giuliano (Intern)
Griffiths, Christian Andrew (Ekstern)
Qian, Jun (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Surface engineering of metallic implants
Department of Mechanical Engineering
Period: 01/02/2013 → 30/06/2016
Number of participants: 3
Phd Student:
Barington, Alexander Elmkvist (Intern)
Supervisor:
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Christiansen, Thomas Lundin (Intern)

Financing sources
**Micro punching of micro containers for oral drug delivery**

Department of Mechanical Engineering

Manufacturing Engineering

Department of Micro- and Nanotechnology

Nanoprobes

Period: 21/01/2013 → 13/11/2014

Number of participants: 3

Project participant:

- Petersen, Ritika Singh (Intern)
- Mahshid, Rasoul (Intern)
- Hansen, Hans Nærgaard (Intern)

**Håndtering af interfaces i højkomplekse og multidisciplinære produkter**

Department of Mechanical Engineering

Period: 01/01/2013 → 04/07/2016

Number of participants: 6

Phd Student:

- Parslov, Jakob Filipsson (Intern)

Supervisor:

- Hvam, Lars (Intern)

Main Supervisor:

- Mortensen, Niels Henrik (Intern)

Examiner:

- Malmqvist, Johan (Ekstern)
- Weber, Christian (Ekstern)
- Wörösch, Michael (Intern)

**Financing sources**

Source: Internal funding (public)

Name of research programme: ErhvervsPhD-ordningen VTU

**Relations**

Publications:

- Defining Interactions and Interfaces in Engineering Design

Project: PhD

**Radiation in Combustion Engines**

Department of Mechanical Engineering

Period: 01/01/2013 → 23/03/2017

Number of participants: 6

Phd Student:

- Westlye, Fredrik Ree (Intern)

Supervisor:

- Schramm, Jesper (Intern)

Main Supervisor:

- Ivarsson, Anders (Intern)

Examiner:

- Erlandsson, Anders Christiansen (Ekstern)
- Bardi, Michele (Ekstern)
- Hult, Johan Fredrik (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Experimental Study of Liquid Fuel Spray Combustion
Project: PhD

Micro Injection Moulding for Micro Fuel cells Production
Department of Mechanical Engineering
Period: 15/12/2012 → 25/11/2016
Number of participants: 7
Phd Student:
Wöhner, Timo (Intern)
Supervisor:
Islam, Aminul (Intern)
Tosello, Guido (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Zhang, Yang (Intern)
Savio, Enrico (Ekstern)
Tang, Peter Torben (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Detailed analyses of breaking wave dynamics interaction with nearshore and offshore structures
Department of Mechanical Engineering
Period: 01/12/2012 → 19/01/2017
Number of participants: 5
Phd Student:
Tomaselli, Pietro (Intern)
Main Supervisor:
Christensen, Erik Damgaard (Intern)
Examiner:
Fuhrman, David R. (Intern)
Bihs, Hans (Ekstern)
Troch, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Ionic Liquid Hydrogen Compressor
Department of Mechanical Engineering
Period: 01/12/2012 → 07/12/2017
Number of participants: 6
Phd Student:
Arjomand Kermani, Nasrin (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Main Supervisor:
Rokni, Masoud (Intern)
Examiner:
Li, Qingfeng (Intern)
Bellosta von Colbe, José M. (Ekstern)
Yartys, Volodymyr A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Design and prototyping of an ionic liquid piston compressor as a new generation of compressors for hydrogen refueling stations
Project: PhD

Prediction of Stainless Steel Performance After Forming and Finishing
Department of Mechanical Engineering
Period: 15/11/2012 → 07/04/2016
Number of participants: 7
Phd Student:
Bottoli, Federico (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Somers, Marcel A. J. (Intern)
Main Supervisor:
Winther, Grethe (Intern)
Examiner:
Hald, John (Intern)
Drouet, Michel (Ekstern)
Hanshan, Dong (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Influence of steel composition and plastic deformation on the surface properties induced by low temperature thermochemical processing
Project: PhD

Integrated Systems for Bioenergy and Agriculture in a future without Fossil Resources
Department of Mechanical Engineering
Period: 01/11/2012 → 22/06/2017
Number of participants: 7
Phd Student:
Sigurjonsson, Hafthor ÁEgir (Intern)
Supervisor:
Ahrenfeldt, Jesper (Intern)
Clausen, Lasse Rængaard (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Birkved, Morten (Intern)
Holm, Jens Kai (Intern)
Marechal, François (Ekstern)

Financing sources
Relations
Publications:
Modeling and Evaluation of Bioenergy and Agriculture System Integration
Project: PhD

Modeling and Analysis of Coupled wind Turbine Blades
Department of Mechanical Engineering
Period: 01/11/2012 → 07/04/2016
Number of participants: 7
Phd Student:
Couturier, Philippe (Intern)
Supervisor:
Høgsberg, Jan Becker (Intern)
Winther Stærdahl, Jesper (Ekstern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Legarth, Brian Nyvang (Intern)
Lund, Erik (Ekstern)
Saravanos, Dimitris (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Multi material additive manufacturing
Department of Mechanical Engineering
Period: 01/11/2012 → 07/04/2016
Number of participants: 5
Phd Student:
D'Angelo, Greta (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Lenau, Torben Anker (Intern)
Andreasen, Jan Lasson (Intern)
Fantoni, Gualtiero (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Smart Materials Applied to Control Rotor Dynamics - Theory and Experiment
Department of Mechanical Engineering
Period: 01/11/2012 → 07/04/2016
Number of participants: 5
Phd Student:
Enemark, Søren (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Thomsen, Jon Juel (Intern)
Meraghni, Fodil (Ekstern)
Wiercigroch, Marian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

**Tank Design for Combined High Pressure Gas and Solid State Hydrogen Storage**
Department of Mechanical Engineering
Period: 01/11/2012 → 26/05/2016
Number of participants: 6
Phd Student:
Mazzucco, Andrea (Intern)
Supervisor: Elmegaard, Brian (Intern)
Main Supervisor: Rokni, Masoud (Intern)
Examiner:
Li, Qingfeng (Intern)
Bellosta von Colbe, José M. (Ekstern)
Yartys, Volodymyr A. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

**Relations**
Publications:
Tank designs for combined high pressure gas and solid state hydrogen storage
Project: PhD

**Turbulence Modeling in Multiresolution Vortex Methods with Application to Bluff Body Aerodynamics**
Department of Mechanical Engineering
Period: 01/11/2012 → 01/09/2016
Number of participants: 5
Phd Student:
Hejlesen, Mads Mølholm (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Adams, Nikolaus Andreas (Ekstern)
Winckelmans, Grégoire (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

**Relations**
Publications:
A high order regularisation method for solving the Poisson equation and selected applications using vortex methods
Project: PhD

**High Precision Micro Production Technologies**
HiMicro is a collaborative research project funded by EU. The Hi-Micro project proposes an innovative process chain for precision μM and μPIM, using Additive Manufacturing (AM) to produce monolithic tool inserts with integrated complex internal channels for efficient thermal management and process control. At the same time, enabling precision manufacturing technologies will be developed to post-process the tool insert features. Special metrology techniques based on computer-tomography (CT) will be applied to control the quality of the integrated complex internal channels. Handling
System and high-speed in-line quality control system for non-statistic quality control will be developed and integrated into an industrial production platform.

Department of Mechanical Engineering

Manufacturing Engineering
Period: 30/10/2012 → 30/11/2015
Number of participants: 4
Micro injection moulding precision manufacturing X-ray CT metrology micro-EDM micro-milling micro-ECM digital holography
Acronym: HiMicro
Project ID: 314055
Project participant:
Tosello, Guido (Intern)
Islam, Aminul (Intern)
Giannekas, Nikolaos (Intern)
Phd Student:
Marhöfer, David Maximilian (Intern)

Relations
Publications:
D5.3 Production and Validation of Hi-Micro Demonstrators
D 1.3 Standardized micro moulding simulation procedure and tolerance guidelines
D4.3 System integration technologies for Hi-Micro production platform with in-line quality control
D1.1 Product/Tool/Process Simulation Report for PoT Components
D1.3 Standardized micro moulding simulation procedure and tolerance guidelines
High Precision Micro Production Technologies - MS12 Handling concepts for all micro part demonstrators are available
Calibration and Metrology for Micro/Nano Dimensional Quality Control. D3.5.

Autonomous optimization of flow, solidification and thermomechanical conditions in the high pressure die casting process
Department of Mechanical Engineering
Period: 15/09/2012 → 15/10/2016
Number of participants: 4
Phd Student:
Li, Shizhao (Intern)
Supervisor:
Spangenberg, Jon (Intern)
Tutum, Cem Celal (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Topology Optimisation for Coupled Convection Problems
Master Thesis by Joe Alexandersen, titled "Topology Optimisation for Coupled Convection Problems".
Department of Mechanical Engineering

Solid Mechanics
Period: 03/09/2012 → 22/02/2013
Number of participants: 4
Topology optimisation, Convective cooling, Natural convection, Heat sink
Project participant:
Alexandersen, Joe (Intern)
Supervisor:
Sigmund, Ole (Intern)
Andreasen, Casper Schousboe (Intern)
Aage, Niels (Intern)

**Relations**
Activities:
10th World Congress on Structural and Multidisciplinary Optimization
Publications:
Topology Optimisation for Coupled Convection Problems
Documents:
JAlexandersen_MSc_Thesis_2013

**Analysis of power cycles using multi-component working fluids**
Department of Mechanical Engineering
Period: 01/09/2012 → 30/04/2014
Number of participants: 3
Phd Student:
Knudsen, Thomas (Intern)
Supervisor:
Clausen, Lasse Røngaard (Intern)
Main Supervisor:
Haglind, Fredrik (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Dimensionally stable reflow polishing of molding tools**
In spite of the technological development most of molding tool polishing is still performed by hand with uneven quality as a result. A new glazing method achieves a better and more uniform surface finish.

The concept is inspired by nanotechnological processes used in the semiconductor industry

The project will ensure a significantly shorter turnaround time for polishing as well as a much bigger polishing capacity – both will be of great value for the end users.

The manufacturing of larger product series typically also requires a large number of molding tools – many of these series of tools require months or years of total polishing time. The aim of the project is to establish a European service center, which offers polishing of all types of molding tools within 24 hours.

Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/09/2012 → 31/10/2013
Number of participants: 1
Acronym: RePol
Project participant:
Mohaghegh, Kamran (Intern)

**Heat driven air conditioning system based on Desiccant Dewpoint Cooler DDC 2012**
Department of Mechanical Engineering
Period: 01/09/2012 → 16/02/2017
Number of participants: 8
Phd Student:
Bellemo, Lorenzo (Intern)
Supervisor:
Kærn, Martin Ryhl (Intern)
Markussen, Wiebke Brix (Intern)
Reinholdt, Lars Ove (Ekstern)
Higher order continuum modeling of micro-structural evolution in plastically deformed metals

Department of Mechanical Engineering
Period: 01/09/2012 → 07/12/2017
Number of participants: 6
PhD Student:
Nellemann, Christopher (Intern)
Supervisor:
Nielsen, Kim Lau (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)
Examiner:
Legarth, Brian Nyvang (Intern)
Forest, Samuel (Ekstern)
Jensen, Henrik Myhre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Relations
Publications:
Micro-structural evolution in plastically deformed crystalline materials
Project: PhD

Micro-structural evolution and size-effects in single crystals

Department of Mechanical Engineering
Period: 01/09/2012 → 25/11/2016
Number of participants: 6
PhD Student:
El-Naaman, Salim Abdallah (Intern)
Supervisor:
Nielsen, Kim Lau (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)
Examiner:
Winther, Grethe (Intern)
Bargmann, Swantje (Ekstern)
Jensen, Henrik Myhre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Relations
Publications:
Micro-Structural Evolution and Size-Effects in Plastically Deformed Single Crystals: Strain Gradient Continuum Modeling
Project: PhD

Modelling and optimisation of novel polygeneration plants
Department of Mechanical Engineering
Period: 01/09/2012 → 19/01/2017
Number of participants: 7
Phd Student:
Lythcke-Jørgensen, Christoffer Ernst (Intern)
Supervisor:
Clausen, Lasse Røngaard (Intern)
Münster, Marie (Intern)
Main Supervisor:
Haglind, Fredrik (Intern)
Examiner:
Morthorst, Poul Erik (Intern)
Ahlgren, Erik (Intern)
Pistikopoulos, Efstratios N. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Design and optimization of flexible multi-generation systems
Project: PhD

Modelling of concentrated solar power systems using multi-component working fluids
Department of Mechanical Engineering
Period: 01/09/2012 → 28/01/2016
Number of participants: 7
Phd Student:
Modi, Anish (Intern)
Supervisor:
Clausen, Lasse Røngaard (Intern)
Wieland, Christoph (Ekstern)
Main Supervisor:
Haglind, Fredrik (Intern)
Examiner:
Elmegaard, Brian (Intern)
Gonzalez-Aguilar, José (Ekstern)
Karellas, Sotirios (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Udvikling af ultra-høj-temperatur hybridvarmepumpe for industrielle procesapplikationer
Department of Mechanical Engineering
Period: 01/09/2012 → 28/04/2016
Number of participants: 7
Phd Student:
Jensen, Jonas Kjær (Intern)
Supervisor:
Markussen, Wiebke Brix (Intern)
Reinholdt, Lars Ove (Ekstern)

Main Supervisor:
Elmegaard, Brian (Intern)

Examiner:
Rokni, Masoud (Intern)
Eikevik, Trygve Magne (Ekstern)
Elefsen, Frank (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

Relations
Publications:
Industrial heat pumps for high temperature process applications.
Project: PhD

Makromekanisk parametrisk forstærkning
Department of Mechanical Engineering
Period: 15/08/2012 → 30/09/2016
Number of participants: 5
Phd Student:
Neumeyer, Stefan (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Jensen, Jakob Søndergaard (Intern)
Gallacher, Barry John (Ekstern)
Sorokin, Sergey V. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Macromechanical Parametric Amplification
Project: PhD

FRP Composite Flexible Riser Systems
Department of Mechanical Engineering
Period: 15/07/2012 → 25/02/2016
Number of participants: 7
Phd Student:
Costache, Andrei (Intern)
Supervisor:
Glejbøl, Kristian (Ekstern)
Sivebæk, Ion Marius (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Echtermeyer, Andreas (Ekstern)
Prakash, Braham (Ekstern)

Financing sources
Source: Internal funding (public)
Modeling of displacements of flexible pavements under moving load

Department of Mechanical Engineering
Period: 01/07/2012 → 30/09/2016
Number of participants: 5
Phd Student:
Madsen, Stine Skov (Intern)
Main Supervisor:
Pedersen, Niels Leergaard (Intern)
Examiner:
Høgsberg, Jan Becker (Intern)
Kallivokas, Loukas F. (Ekstern)
Vabbersgaard Andersen, Lars (Ekstern)

Financing sources
Source: Internal funding (public)

Synthesis and characterisation of interstitial solutions

Department of Mechanical Engineering
Period: 01/07/2012 → 30/09/2015
Number of participants: 7
Phd Student:
Brink, Bastian (Intern)
Supervisor:
Christiansen, Thomas Lundin (Intern)
Ståhl, Kenny (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Examiner:
Pantleon, Wolfgang (Intern)
Hansen, Staffan Samuel (Ekstern)
Malinov, Savko (Ekstern)

Financing sources
Source: Internal funding (public)

Systemintegration i teknologiudviklingsprojekter

Department of Mechanical Engineering
Period: 01/07/2012 → 04/07/2016
Number of participants: 6
Phd Student:
Ravn, Poul Martin (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Hildre, Hans Petter (Ekstern)
Jensen, Lars Jepsen (Ekstern)
Krause, Dieter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering

**Relations**
Publications:
Coherent Architecture Development as a Basis for Technology Development
Project: PhD

**Design for micro manufacturing**
Department of Mechanical Engineering
Period: 15/06/2012 → 30/10/2015
Number of participants: 7
Phd Student:
Omidvarnia, Farzaneh (Intern)
Supervisor:
Lenau, Torben Anker (Intern)
Mortensen, Niels Henrik (Intern)
Main Supervisor:
Hansen, Hans Nørregaard (Intern)
Examiner:
Tosello, Guido (Intern)
Bilberg, Arne (Intern)
Shu, Li (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

**IFaCOM– Intelligent Fault Correction and selfOptimizing Manufacturing systems**
Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/05/2012 → 31/08/2012
Number of participants: 1
Acronym: IFaCOM
Project participant:
Mohaghegh, Kamran (Intern)

**Computational thermodynamics of interstitial alloys**
Department of Mechanical Engineering
Period: 01/05/2012 → 30/11/2015
Number of participants: 6
Phd Student:
Bakkedal, Morten Bjørn (Intern)
Supervisor:
Shang, ShunLi (Ekstern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Examiner:
Pantleon, Wolfgang (Intern)
Böttger, Amarante Johanna (Ekstern)
Liu, Zi-Kui (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Diesel Engine Tribology
Department of Mechanical Engineering
Period: 01/05/2012 → 28/04/2016
Number of participants: 6
Phd Student:
Christiansen, Christian Kim (Intern)
Supervisor:
Walther, Jens Honore (Intern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Santos, Ilmar (Intern)
Arghir, Mihai (Ekstern)
Lethovaara, Arto (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Mechatronics applied to Lubrication Systems of Internal Combustion Engines - Theory and Experiment
Department of Mechanical Engineering
Period: 01/05/2012 → 26/05/2016
Number of participants: 5
Phd Student:
Pierart Vásquez, Fabián Gonzalo (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Achiche, Sofiane (Intern)
Aidanpää, Jan-Olov (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

Relations
Publications:
Model-Based Control Design for Flexible Rotors Supported by Active Gas Bearings - Theory & Experiment
Project: PhD

Modelling selective Laser Melting
Department of Mechanical Engineering
Period: 01/05/2012 → 11/12/2015
Number of participants: 6
Phd Student:
Mohanty, Sankhya (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thorborg, Jesper (Intern)
Schulz, Wolfgang (Ekstern)
Yadroitsev, Igor (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Optimization in nonlinear dynamic using reduced-order models
Department of Mechanical Engineering
Period: 01/05/2012 → 30/11/2015
Number of participants: 5
Phd Student:
Dou, Suguang (Intern)
Main Supervisor:
Jensen, Jakob Søndergaard (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Kerschen, Gaëtan (Ekstern)
Sorokin, Sergey V. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Udvikling af Produkt/Service-systemer i nye forretningsområdet og virksomheder
Department of Mechanical Engineering
Period: 01/05/2012 → 11/12/2015
Number of participants: 5
Phd Student:
Andersen, Jakob Axel Bejbro (Intern)
Main Supervisor:
McAloone, Tim C. (Intern)
Examiner:
Broeng, Jes (Intern)
Larsson, Tobias Christoffer (Ekstern)
Thoben, Klaus-Dieter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
PSS Support for Maritime Technology Ventures: From Exploration to Methodology and Theory
Project: PhD

Development of low cost electrocatalysts for oxygen evolution in advanced alkaline electrolyzers
Department of Mechanical Engineering
Period: 01/04/2012 → 24/09/2015
Number of participants: 7
Phd Student:
Egelund, Sune Daaskov (Intern)
Supervisor:
Jensen, Jens Arne Dahl (Intern)
Nielsen, Carsten Vandel (Intern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Tang, Peter Torben (Intern)
Johnsen, Roy (Ekstern)
Leisner, Peter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

**High efficiency, low-cost cathode electrodes durable in advanced alkaline electrolysers**
Department of Mechanical Engineering
Period: 01/04/2012 → 24/09/2015
Number of participants: 7
PhD Student:
Caspersen, Michael (Intern)
Supervisor:
Jensen, Jens Arne Dahl (Intern)
Nielsen, Carsten Vandel (Intern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Tang, Peter Torben (Intern)
Johnsen, Roy (Ekstern)
Leisner, Peter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

**Model-Based Control Design for Flexible Rotors Supported by Active Tilting Pad Bearings**
Department of Mechanical Engineering
Period: 01/04/2012 → 19/01/2017
Number of participants: 5
PhD Student:
Salazar, Jorge Andrés González (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Galeazzi, Roberto (Intern)
Glavatskikh, Sergei (Ekstern)
Sahinkaya, Mehmet Necip (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Stipendie fra udlandet

**Relations**
Publications:
Towards Model-Based Control Design for Flexible Rotors Supported by Active Tilting Pad Bearings - Theory & Experiment
Project: PhD

**Modelling induction heating in the surface of injection moulding tools**
Department of Mechanical Engineering
Period: 01/04/2012 → 24/09/2015  
Number of participants: 8  
Phd Student:  
Guerrier, Patrick (Intern)  
Supervisor:  
Hansen, Hans Nørgaard (Intern)  
Nielsen, Kaspar Kirstein (Intern)  
Tosello, Guido (Intern)  
Main Supervisor:  
Hattel, Jesper Henri (Intern)  
Examiner:  
Thorborg, Jesper (Intern)  
Costa, Franco (Ekstern)  
Lindgren, Lars-Erik (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet  
Project: PhD

Optical designing of anodized aluminium surfaces  
Department of Mechanical Engineering  
Period: 01/04/2012 → 30/11/2015  
Number of participants: 5  
Phd Student:  
Gudla, Visweswara Chakravarthy (Intern)  
Main Supervisor:  
Ambat, Rajan (Intern)  
Examiner:  
Juhl, Anne Deacon (Intern)  
Deconinck, Johan (Ekstern)  
Takahashi, Hideaki (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations  
Publications:  
Optically Designed Anodised Aluminium Surfaces: Microstructural and Electrochemical Aspects  
Project: PhD

Træfssikkerhed i produktudvikling gennem brugercentreret design: En undersøgelse af teori og praksis  
Department of Mechanical Engineering  
Period: 01/04/2012 → 25/02/2016  
Number of participants: 6  
Phd Student:  
Christensen, Martin Ebro (Intern)  
Supervisor:  
McAloone, Tim C. (Intern)  
Main Supervisor:  
Howard, Thomas J. (Intern)  
Examiner:  
Mortensen, Niels Henrik (Intern)  
Söderberg, Rikard (Ekstern)  
Thornton, Anna (Ekstern)  

Financing sources  
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Applying Robust Design in an Industrial Context
Project: PhD

Damping of Wind Turbine Tower Vibrations
Department of Mechanical Engineering
Period: 15/03/2012 → 19/01/2017
Number of participants: 7
Phd Student:
Brodersen, Mark Laier (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Pedersen, Mikkel Melters (Ekstern)
Main Supervisor:
Høgsberg, Jan Becker (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Basu, Biswajit (Ekstern)
Neild, Simon Andrew (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Relations
Publications:
Damping of wind turbine tower vibrations
Project: PhD

Steam initiated surface modification process for metallic surfaces
Department of Mechanical Engineering
Period: 15/03/2012 → 22/06/2015
Number of participants: 5
Phd Student:
Din, Rameez Ud (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Nielsen, Lars Pleth (Ekstern)
Leygraf, Christofer (Ekstern)
Nisancioglu, Kemal (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Steam Initiated Surface Modification of Aluminium Alloys
Project: PhD

Sustainable processes in foundry industry, theory and practical implementation
Department of Mechanical Engineering
Period: 01/03/2012 → 22/06/2015
Number of participants: 6
Phd Student: 
di Muoio, Giovanni Luca (Intern)
Supervisor: 
Johansen, Bjørn Budolph (Ekstern)
Main Supervisor: 
Tiedje, Niels Skat (Intern)
Examiner: 
Thorborg, Jesper (Intern)
Hansen, Torben (Ekstern)
Schumacher, Peter (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Yaw Drive Unit**
Surface characterisation of brakes for wind turbines

Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/02/2012 → 31/05/2012
Number of participants: 1
Acronym: YDU
Project participant:
Mohaghegh, Kamran (Intern)

**Innovative Multi-purpose offshore platforms: planning, design and operation**

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Administration
Period: 01/01/2012 → 31/12/2015
Number of participants: 8
Acronym: MERMAID
Project ID: FP7 OCEAN.2011-1 Grant Agreement no.: 288710
Project participant:
Sumer, B. Mutlu (Intern)
Hjelmager Jensen, Jacob (Intern)
Jensen, Bjarne (Intern)
Saremi, Sina (Intern)
Chen, Hao (Intern)
Tomaselli, Pietro (Intern)
Project Manager, organisational:
Carlberg, Lena Kristina (Intern)
Project Coordinator:
Christensen, Erik Damgaard (Intern)

**Seals in Multiphase Flow: Identification of Rotor Dynamic Properties using Active Magnetic Bearings - Modeling and Validation**

Department of Mechanical Engineering
Period: 01/01/2012 → 25/11/2016
Number of participants: 6
Phd Student:
Voigt, Andreas Jauernik (Intern)
Supervisor:
Nielsen, Kenny Krogh (Ekstern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Arghir, Mihai (Ekstern)
Keogh, Patrick Sean (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Project: PhD

Thermal Stability of Tungsten
Department of Mechanical Engineering
Period: 15/12/2011 → 24/09/2015
Number of participants: 7
PhD Student:
Alfonso Lopez, Angel (Intern)
Supervisor:
Juul Jensen, Dorte (Intern)
Luo, Guangnan (Ekstern)
Main Supervisor:
Pantleon, Wolfgang (Intern)
Examiner:
Huang, Xiaoxu (Intern)
Godfrey, Andrew William (Intern)
Zöllner, Dana (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Design and Modelling of Small Scale Low Temperature Power Cycles
Department of Mechanical Engineering
Period: 01/12/2011 → 28/01/2016
Number of participants: 7
PhD Student:
Wronski, Jorrit (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Skovrup, Morten Juel (Intern)
Main Supervisor:
Haglind, Fredrik (Intern)
Examiner:
Ivarsson, Anders (Intern)
Shaffer, Bryce R. (Ekstern)
van den Broek, Martijn (Ekstern)

Financing sources
Source: Internal funding (public)
Hybrid Testing of Wind Turbine Blades

Department of Mechanical Engineering
Period: 01/12/2011 → 04/07/2016
Number of participants: 8
Phd Student:
Høgh, Jacob Herold (Intern)
Supervisor:
Branner, Kim (Intern)
Schmidt, Jacob Wittrup (Intern)
Stang, Henrik (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Examiner:
Høgsberg, Jan Becker (Intern)
Barton, Janice (Ekstern)
Lund, Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Hybrid Simulation of Composite Structures
Project: PhD

Interaction of stress and phase transformations during thermochemical surface engineering

Department of Mechanical Engineering
Period: 01/12/2011 → 28/01/2016
Number of participants: 6
Phd Student:
Sjøgreen, Freja Naima (Intern)
Supervisor:
Tvergaard, Viggo (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Examiner:
Winther, Grethe (Intern)
Galdikas, Arvaidas (Ekstern)
Ågren, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret
Project: PhD

Modelling and design of Anodised Aluminium Surfaces

Department of Mechanical Engineering
Period: 01/12/2011 → 19/03/2015
Number of participants: 7
Phd Student:
Johansen, Villads Egede (Intern)
Supervisor:
Aage, Niels (Intern)
Breinbjerg, Olav (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Mortensen, N. Asger (Intern)
Berggren, Martin (Ekstern)
Shin, Jung H. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Requirement management with multiple product platforms
Department of Mechanical Engineering
Period: 01/12/2011 → 24/09/2015
Number of participants: 7
Phd Student:
Hauksdóttir, Dagný (Intern)
Supervisor:
Hvam, Lars (Intern)
Nielsen, Poul Erik (Ekstern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Malmqvist, Johan (Ekstern)
Hildre, Hans Petter (Ekstern)
Krause, Dieter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut/centerfinansieret
Project: PhD

Tooling process chains for micro injection moulding
Department of Mechanical Engineering
Period: 01/12/2011 → 19/03/2015
Number of participants: 7
Phd Student:
Menotti, Stefano (Intern)
Supervisor:
Bissacco, Giuliano (Intern)
Tang, Peter Torben (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Tosello, Guido (Intern)
Kin Kong, Steven Tong (Ekstern)
Savio, Enrico (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Early prediction and control of climatic reliability of electronic devices
Department of Mechanical Engineering
Period: 01/11/2011 → 24/08/2015
Number of participants: 6
Phd Student:
Verdingovas, Vadimas (Intern)
Supervisor:
Jellesen, Morten Stendahl (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Krog, Jens Peter (Ekstern)
Leisner, Peter (Ekstern)
Nowottnick, Mathias (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.

Relations
Publications:
Climatic Reliability of Electronics: Early Prediction and Control of Contamination and humidity effects
Project: PhD

Modelling and Optimization of Energy Systems for Off-Shore Platforms
Department of Mechanical Engineering
Period: 01/11/2011 → 26/01/2015
Number of participants: 6
Phd Student:
Nguyen, Tuong-Van (Intern)
Supervisor:
Haglind, Fredrik (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Sin, Gürkan (Intern)
Angelo, Per (Ekstern)
de Oliveira Júnior, Silvio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Modelling of innovative gas turbine and waste heat recovery systems for off-shore platforms
Department of Mechanical Engineering
Period: 01/11/2011 → 19/03/2015
Number of participants: 7
Phd Student:
Pierobon, Leonardo (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Main Supervisor:
Kandepu, Rambabu (Ekstern)
Examiner:
Santos, Ilmar (Intern)
Buijtenen, Jos Van (Ekstern)
Nord, Lars Olof (Ekstern)

Financing sources
Intelligent Fault Correction and self Optimizing Manufacturing Systems

Department of Mechanical Engineering
Period: 15/10/2011 → 22/06/2015
Number of participants: 6
Phd Student:
Pilny, Lukas (Intern)
Supervisor:
Bissacco, Giuliano (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
Tosello, Guido (Intern)
Archenti, Andreas (Ekstern)
Axinte, Dragos Aurelian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Multi-Functional Surfaces
Characterisation of Multifunctional surfaces

Department of Mechanical Engineering
Manufacturing Engineering
Period: 01/10/2011 → 31/01/2012
Number of participants: 1
Acronym: MUFU
Project participant:
Mohaghegh, Kamran (Intern)

High-efficiency energy system utilising combined heat and power and heat pumps

Department of Mechanical Engineering
Period: 01/10/2011 → 24/08/2015
Number of participants: 6
Phd Student:
Ommen, Torben Schmidt (Intern)
Supervisor:
Markussen, Wiebke Brix (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Rokni, Masoud (Intern)
Meibom, Peter (Intern)
Palm, Björn (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Udvikling af teknologisk produktarkitektur fra specification til produktion
Predicting the added resistance of slow ships in waves

Department of Mechanical Engineering
Period: 15/09/2011 → 19/03/2015
Number of participants: 6
Phd Student:
Amini-Afshar, Mostafa (Intern)
Supervisor:
Andersen, Poul (Intern)
Main Supervisor:
Bingham, Harry B. (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Faltinsen, Odd Magnus (Ekstern)
Henshaw, William D. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Optically Designed Anodized Aluminum Surfaces
Design and characterization of white surfaces based on anodized aluminum oxide.

Department of Photonics Engineering
Optical Microsensors and Micromaterials
Department of Mechanical Engineering
Danish Technological Institute
Bang & Olufsen A/S
Period: 01/09/2011 → 01/09/2015
Number of participants: 1
Acronym: ODAAS
Project participant:
Canulescu, Stela (Intern)

Computational modelling of rolling contact fatigue in wind turbines
Department of Mechanical Engineering
Failure mechanisms in metallic components of Wind turbine drive trains

Department of Mechanical Engineering
Period: 01/09/2011 → 23/02/2015
Number of participants: 7
Phd Student: West, Ole (Intern)
Supervisor: Christiansen, Thomas Lundin (Intern)
Main Supervisor: Somers, Marcel A. J. (Intern)
Examiner: Pantleon, Karen (Intern)
Slycke, Jan T. (Ekstern)
Wang, Ling (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

integrated analysis of the scavenging process in marine two stroke diesel engines

Department of Mechanical Engineering
Period: 01/09/2011 → 28/01/2016
Number of participants: 7
Phd Student: Andersen, Fredrik Herland (Intern)
Supervisor: Matlok, Simon (Intern)
Main Supervisor: Walther, Jens Honore (Intern)
Examiner: Sørensen, Jens Nærkær (Intern)
Mihaescu, Mihai (Ekstern)
Pedersen, Eilif (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU

Relations
Publications:
Integrated Analysis of the Scavenging Process in Marine Two-Stroke Diesel Engines
Project: PhD

Mechanics of sheet flow sediment transport in waves and current
Department of Mechanical Engineering
Period: 01/09/2011 → 19/03/2015
Number of participants: 7
Phd Student:
Jensen, Karsten Lindegård (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Hjelmager Jensen, Jacob (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Carstensen, Stefan (Intern)
Deigaard, Rolf (Intern)
Ribberink, Jan Sjoerd (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Modelling and experimental verification of fatigue failure development in rolling and sliding contacts
Department of Mechanical Engineering
Period: 01/09/2011 → 19/03/2015
Number of participants: 6
Phd Student:
Janakiraman, Shravan (Intern)
Supervisor:
Tvergaard, Viggo (Intern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Larsson, Roland (Ekstern)
Lethovaara, Arto (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Modelling of High Temperature Corrosion of Metals in Biomass-fired Power Plants
Department of Mechanical Engineering
Period: 01/09/2011 → 19/03/2015
Number of participants: 7
Phd Student:
Kiamehr, Saeed (Intern)
Supervisor:
Dahl, Kristian Vinter (Intern)
Montgomery, Melanie (Intern)
**Non-linear Analysis of Rotating Machines Supported by Air Foil Journal Bearings - Theory & Experiments**

Department of Mechanical Engineering  
Period: 01/09/2011 → 24/04/2015  
Number of participants: 6  
Phd Student: Larsen, Jon Steffen (Intern)  
Supervisor: Pföger, Frans (Ekstern)  
Main Supervisor: Santos, Ilmar (Intern)  
Examiner: Klit, Peder (Intern)  
Bonello, Philip (Ekstern)  
Liebich, Robert (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet  
Project: PhD

**Optimal design of porous materials**

Department of Mechanical Engineering  
Period: 01/09/2011 → 19/03/2015  
Number of participants: 7  
Phd Student: Andreassen, Erik (Intern)  
Supervisor: Sigmund, Ole (Intern)  
Thomsen, Jon Juel (Intern)  
Main Supervisor: Jensen, Jakob Søndergaard (Intern)  
Examiner: Høgsberg, Jan Becker (Intern)  
Guedes, José Arnaldo Pereira Leite Miranda (Ekstern)  
Lund, Erik (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD

**Radiation in pre-mixed flames**

Department of Mechanical Engineering  
Period: 01/09/2011 → 06/09/2015  
Number of participants: 3  
Phd Student:
Biosurface and biotribological properties of mucins and mucus gels

Department of Mechanical Engineering
Period: 01/08/2011 → 30/09/2014
Number of participants: 5
Phd Student: Madsen, Jan Busk (Intern)
Main Supervisor: Lee, Seunghwan (Intern)
Examiner: Chronakis, Ioannis S. (Intern)
Kocherbitov, Vitaly (Ekstern)
Zappone, Bruno (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Damage Tolerance Enhancement of sandwich Structures

Department of Mechanical Engineering
Period: 01/08/2011 → 24/09/2015
Number of participants: 6
Phd Student: Manca, Marcello (Intern)
Supervisor: Carlsson, Leif A. (Intern)
Main Supervisor: Berggreen, Christian (Intern)
Examiner: Nielsen, Kim Lau (Intern)
Hayman, Brian (Intern)
Stigh, Ulf (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet

Relations
Publications:
Fracture Characterization of Sandwich Face/Core Interfaces
Project: PhD

Improved design bases of welded joints in seawater

Department of Mechanical Engineering
Period: 01/08/2011 → 01/09/2016
Number of participants: 8
Phd Student:
Relations
Publications:
Improved design bases of welded joints in seawater
Project: PhD

Prediction of fatigue life of flexible pipes used in gas and oil industry
Department of Mechanical Engineering
Period: 01/08/2011 → 24/09/2015
Number of participants: 7
Phd Student:
Rogowska, Magdalena (Intern)
Supervisor:
Gudme, Jonas (Ekstern)
Pantleon, Karen (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Fontenay, Frank Le Sage De (Intern)
Dugstad, Arne (Ekstern)
Johnsen, Roy (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Process validation in micro and nano replication
Department of Mechanical Engineering
Period: 01/08/2011 → 03/12/2014
Number of participants: 6
Phd Student:
Calaon, Matteo (Intern)
Supervisor:
Tosello, Guido (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
da Costa Carneiro, Kim (Intern)
Whiteside, Benjamin Richard (Ekstern)
Worgull, Matthias (Ekstern)

Financing sources
Design of next generation wind turbine rotors

Department of Mechanical Engineering

LM Wind Power
Period: 01/07/2011 → 30/06/2014
Number of participants: 4
Acronym: NextRotor
Project ID: 76206
Project Manager, organisational:
Shen, Wen Zhong (Intern)
Sørensen, Jens Nørkær (Intern)
Zhu, Wei Jun (Intern)
Madsen, Jesper (Ekstern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 16,716,501.00 Danish Kroner
Project

Advanced Thermodynamic Methods for Optimization of Industrial Energy Consumption

Department of Mechanical Engineering
Period: 01/06/2011 → 31/10/2012
Number of participants: 4
Phd Student:
Nielsen, Daniel Rønne (Intern)
Supervisor:
Bang-Møller, Christian (Intern)
Luxhøj, Christian (Ekstern)
Main Supervisor:
Elmegaard, Brian (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Modelling the pultrusion process of off shore wind turbines blades

Department of Mechanical Engineering
Period: 01/06/2011 → 25/08/2014
Number of participants: 7
Phd Student:
Baran, Ismet (Intern)
Supervisor:
Nielsen, Per Hørlyk (Intern)
Tutum, Cem Celal (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Nunes, João Pedro Lourenco Gil (Ekstern)
Ersoy, Nuri (Ekstern)
Lilleheden, Lars Tilsted (Ekstern)

Financing sources
Source: Internal funding (public)
Density-driven currents and deposition of fine materials

Department of Mechanical Engineering
Period: 01/05/2011 → 25/08/2014
Number of participants: 7
Phd Student:
Saremi, Sina (Intern)
Supervisor:
Christensen, Erik Damgaard (Intern)
Petersen, Ole Svenstrup (Ekstern)
Main Supervisor:
Hjelmager Jensen, Jacob (Intern)
Examiner:
Fuhrman, David R. (Intern)
Mulder, Tom de (Ekstern)
Rhee, Cornelis van (Ekstern)

Financing sources
Source: Internal funding (public)

Characterization of vortex generator induced structures in high Reynolds number wall bounded flow

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Ecole Centrale de Lille
Period: 01/04/2011 → 30/06/2012
Number of participants: 4
Project ID: 76177
Project participant:
Velte, Clara Marika (Intern)
Braud, Caroline (Ekstern)
Foucaut, Jean Marc (Ekstern)
Cuvier, Christophe (Ekstern)

Brush-forming Polyelectrolytes for Biomimetic Lubrication

Department of Mechanical Engineering
Period: 01/04/2011 → 29/09/2014
Number of participants: 5
Phd Student:
Røn, Troels (Intern)
Main Supervisor:
Lee, Seunghwan (Intern)
Examiner:
Sivebæk, Ion Marius (Intern)
Daasbjerg, Kim (Ekstern)
Sotres, Javier (Ekstern)

Financing sources
Source: Internal funding (public)
Investigation of photocatalytic activity of TiO2 coatings on metallic substrates prepared using PVD process

Department of Mechanical Engineering
Period: 01/04/2011 → 19/12/2014
Number of participants: 6
PhD Student:
Daviðsdóttir, Svava (Intern)
Supervisor:
Dirscherl, Kai (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Nielsen, Lars Pleth (Ekstern)
Di Quarto, Francesco (Ekstern)
Kelly, Peter James (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Micro Mechanical Damage Tolerance improvements of Composites

Department of Mechanical Engineering
Period: 01/04/2011 → 25/08/2014
Number of participants: 8
PhD Student:
Ashouri Vajari, Danial (Intern)
Supervisor:
Berggreen, Christian (Intern)
Niordson, Christian Frithiof (Intern)
Serensen, Bent F. (Intern)
Main Supervisor:
Legarth, Brian Nyvang (Intern)
Examiner:
Mikkelsen, Lars Pilgaard (Intern)
Jensen, Henrik Myhre (Intern)
Yang, Qingda (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Modelling the deformation process of flexible stamps for nanoimprint lithography

Department of Mechanical Engineering
Period: 01/04/2011 → 03/12/2014
Number of participants: 6
PhD Student:
Sonne, Mads Rostgaard (Intern)
Supervisor:
Tutum, Cem Celal (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Hansen, Hans Nørgaard (Intern)
Kletschkowski, Thomas (Ekstern)
Taylor, Hayden (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Soft, Slimy, Sliding Interfaces: Biotribological Properties of Mucins and Mucus gies
Materials and Surface Engineering
Department of Mechanical Engineering
Period: 01/04/2011 → 31/03/2016
Number of participants: 1
Acronym: 3S-BTMUC
Project Manager, organisational:
Lee, Seunghwan (Intern)

Micro metal forming
Department of Mechanical Engineering
Period: 15/03/2011 → 19/12/2014
Number of participants: 6
Phd Student:
Mahshid, Rasoul (Intern)
Supervisor:
Arentoft, Mogens (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Bissacco, Giuliano (Intern)
Andreasen, Jan Lasson (Intern)
Vollertsen, Frank (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Adiabatic Liquid Piston Compressed Air Energy Storage
Traditional Compressed Air Energy Storage (CAES) is seen as one of the most cost effective technologies for the bulk energy storage in the future flexible grid. The project will investigate the possible lift of the round trip efficiency by the introduction of Adiabatic Liquid Piston CAES (ALP-CAES) which is expected to be highly competitive.

Department of Mechanical Engineering
Energy Engineering
Thermal Energy
Risø National Laboratory for Sustainable Energy
Secretariat, IT
Department of Energy Conversion and Storage
Materials Research Division
Nano-Microstructures in Materials
Administration Department
Functional organic materials
Period: 01/03/2011 → …
Number of participants: 6
Acronym: ALP-CAES
Project participant:
Development of modeling techniques for project management in product development

Department of Mechanical Engineering
Period: 01/03/2011 → 26/05/2014
Number of participants: 6
Phd Student:
Wörösch, Michael (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Lenau, Torben Anker (Intern)
Berard, Ole Bengt (Intern)
Brockmann, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Numerical modelling of defects distribution and residual stresses in forged components

Department of Mechanical Engineering
Period: 15/02/2011 → 25/08/2014
Number of participants: 6
Phd Student:
Christiansen, Peter (Intern)
Supervisor:
Bay, Niels Oluf (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thorborg, Jesper (Intern)
Lindgren, Lars-Erik (Ekstern)
Tekkaya, A. Erman (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Numerical modelling of tape casting of functionally graded ceramic materials

Department of Mechanical Engineering
Period: 01/02/2011 → 29/09/2014
Number of participants: 6
Phd Student:
Jabbaribehnam, Mirmasoud (Intern)
Supervisor:
Pryds, Nini (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Frandsen, Henrik Lund (Intern)
Mitsoulis, Evan (Ekstern)
Tok, Alfred (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

REWIND - Knowledge based engineering for improved reliability of critical wind turbine components
Department of Mechanical Engineering
Manufacturing Engineering
Solid Mechanics
Materials and Surface Engineering
Department of Wind Energy
Materials science and characterization
Wind Turbines
Aalborg University
Magma Gießereitechnologie GmbH
Michigan State University
Period: 01/01/2011 → 31/12/2016
Number of participants: 6
Acronym: REWIND
Project ID: 76142
Number of related Ph.D. students: 8
Project participant:
Tvergaard, Viggo (Intern)
Somers, Marcel A. J. (Intern)
Fæster, Søren (Intern)
Natarajan, Anand (Intern)
Klit, Peder (Intern)
Project Manager, academic:
Hattel, Jesper Henri (Intern)
Project

A Biomimetic Approach to Lubricate Engineering Materials
Department of Mechanical Engineering
BioChemical Engineering
Period: 01/01/2011 → 31/12/2011
Number of participants: 1
Acronym: BiomimLub
Project Manager, organisational:
Lee, Seunghwan (Intern)
Project

Aerodynamics and optimization of wind turbines in complex terrain
This is a Sino-Danish collaboration project funded by DSF. The objective of the project is to develop numerical tools to simulate wind turbine flows in complex terrain, and optimize and control wind turbines in complex terrain.
Department of Mechanical Engineering
Electroplating of Protective coatings on interconnects used for solid oxide fuel cell stacks

Department of Mechanical Engineering
Period: 01/01/2011 → 03/12/2014
Number of participants: 6
Phd Student:
Harthøj, Anders (Intern)
Supervisor:
Rasmussen, Jan Boye (Ekstern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Tang, Peter Torben (Intern)
Froitzheim, Jan (Ekstern)
Leisner, Peter (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Project

Improvement of Feeder Technologies for Energy Savings in Cast Iron Foundries

Department of Mechanical Engineering
Period: 01/01/2011 → 07/04/2016
Number of participants: 5
Phd Student:
Vedel-Smith, Nikolaj Kjelgaard (Intern)
Main Supervisor:
Tiedje, Niels Skat (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Pedersen, Karl Martin (Intern)
Sándor Diószegi, Attila (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Relations
Publications:
Spot Feeding Spheroidal Graphite Iron with Exothermic and Insulating Ram-Up Sleeves in Vertically Parted Moulds: Efficiency, Microstructure, Dimensional Accuracy, Deformation, and Driving Force and Feeding Criteria Identification
Project: PhD
Numerical modelling of extrusion of functionally graded ceramic materials
Department of Mechanical Engineering
Period: 01/01/2011 → 24/08/2015
Number of participants: 7
Phd Student: Comminal, Raphaël Benjamin (Intern)
Supervisor: Pryds, Nini (Intern)
Spangenberg, Jon (Intern)
Main Supervisor: Hattel, Jesper Henri (Intern)
Examiner: Walther, Jens Honore (Intern)
Alves, Manuel Antonio Moreira (Ekstern)
Kupferman, Raz (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Udvikling af mekatroniske platforme
Department of Mechanical Engineering
Period: 01/01/2011 → 23/02/2015
Number of participants: 6
Phd Student: Bruun, Hans Peter Lomholt (Intern)
Supervisor: Hvam, Lars (Intern)
Main Supervisor: Mortensen, Niels Henrik (Intern)
Examiner: Malmqvist, Johan (Ekstern)
Bysted, Tommy (Ekstern)
Welo, Torgeir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Udvikling og demonstration af ‘DryPack’ - energibesparelser på industrielle tørreanlæg
Thermal Energy
Department of Mechanical Engineering
Energy Engineering
Danish Technological Institute
Period: 01/01/2011 → 01/03/2013
Number of participants: 3
Project participant: Kærn, Martin Ryhl (Intern)
Project Manager, organisational: Schneider, Peter (Ekstern)
Project Manager, academic: Elmegaard, Brian (Intern)
Project
Aerodynamic and Mechanical System Modelling
Department of Mechanical Engineering
Period: 01/12/2010 → 24/03/2014
Number of participants: 6
Phd Student:
Jørgensen, Martin Felix (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Pedersen, Niels Leergaard (Intern)
Examiner:
Klit, Peder (Intern)
Hansen, Michael Rygaard (Ekstern)
Lethovaara, Arto (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Design and modelling of innovative machinery systems for large ships
Department of Mechanical Engineering
Period: 01/12/2010 → 26/01/2015
Number of participants: 7
Phd Student:
Larsen, Ulrik (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Gabriellii, Cecilia (Ekstern)
Main Supervisor:
Haglind, Fredrik (Intern)
Examiner:
Schramm, Jesper (Intern)
Thern, Marcus (Ekstern)
Zhou, Peilin (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Stability of stone covers
Department of Mechanical Engineering
Period: 01/12/2010 → 29/09/2014
Number of participants: 6
Phd Student:
Petersen, Thor Ugelvig (Intern)
Supervisor:
Christensen, Erik Damgaard (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Carstensen, Stefan (Intern)
Frigaard, Peter Bak (Ekstern)
Whitehouse, Richard J. S. (Ekstern)
Wave interaction with porous coastal structures

Department of Mechanical Engineering
Period: 01/12/2010 → 25/08/2014
Number of participants: 6
Phd Student:
Jensen, Bjarne (Intern)
Supervisor:
Sumer, B. Mutlu (Intern)
Main Supervisor:
Christensen, Erik Damgaard (Intern)
Examiner:
Fuhrman, David R. (Intern)
Allsop, William (Ekstern)
Troch, Peter (Ekstern)

Integreeret beslutningsstailtesystem for brug ombord i skibe

Department of Mechanical Engineering
Period: 01/11/2010 → 29/09/2014
Number of participants: 7
Phd Student:
Andersen, Ingrid Marie Vincent (Intern)
Supervisor:
Nielsen, Ulrik Dam (Intern)
Sinding, Peter (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Bingham, Harry B. (Intern)
Dietz, Jesper Skjoldager (Intern)

Fluid Dynamic Characterization of Vortex Generators and Two-dimensional Turbulent Wakes

A numerical investigation of the physics of the wake induced by vortex generators.

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Period: 01/10/2010 → 30/09/2013
Number of participants: 3
Number of related Ph.D. students: 1
Project participant:
Aluminium based plasma coatings for optical and corrosion resistant applications

Department of Mechanical Engineering
Period: 01/10/2010 → 28/04/2014
Number of participants: 5
Phd Student:
Aggerbeck, Martin (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Nielsen, Lars Pleth (Ekstern)
Afseth, Andreas (Ekstern)
Terryn, Herman (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Modeling and Dimensioning of Hydrogen Re-fuelling Stations

Department of Mechanical Engineering
Period: 01/10/2010 → 21/02/2014
Number of participants: 6
Phd Student:
Rothuizen, Erasmus Damgaard (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Main Supervisor:
Rokni, Masoud (Intern)
Examiner:
Li, Qingfeng (Intern)
Nielsen, Mads Pagh (Ekstern)
Woodfield, Peter Lloyd (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Modelling Nonlinear Wave Interaction with Floating Ocean Energy Devices

Department of Mechanical Engineering
Period: 01/10/2010 → 01/09/2015
Number of participants: 6
Phd Student:
Christiansen, Torben Robert Bilgrav (Intern)
Supervisor:
Engsig-Karup, Allan Peter (Intern)
Tribology of a Combined Yaw Bearing and Brake

Department of Mechanical Engineering
Period: 01/10/2010 → 24/03/2014
Number of participants: 5
Phd Student:
Poulios, Konstantinos (Intern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Jacobson, Staffan (Ekstern)
Schipper, Dik J. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD
Efficient CFD computation of extreme wave loads on wind turbine foundations

Department of Mechanical Engineering
Period: 01/09/2010 → 22/11/2013
Number of participants: 6
PhD Student:
Paulsen, Bo Terp (Intern)
Supervisor:
Bredmose, Henrik (Intern)
Main Supervisor:
Bingham, Harry B. (Intern)
Examiner:
Christensen, Erik Damgaard (Intern)
Grue, John (Ekstern)
Yeung, Ronald W. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Modeling of Rotating Structures

Department of Mechanical Engineering
Period: 01/09/2010 → 28/04/2014
Number of participants: 5
PhD Student:
Nielsen, Martin Bjerre (Intern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Hagsberg, Jan Becker (Intern)
Cardona, Alberto (Ekstern)
Romero, Ignacio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Scavenging and swirling flow in two-stroke diesel engines - An experimental study

Department of Mechanical Engineering
Period: 01/09/2010 → 24/03/2014
Number of participants: 6
PhD Student:
Ingvorsen, Kristian Mark (Intern)
Supervisor:
Walther, Jens Honore (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)
Examiner:
Hansen, Martin Otto Laver (Intern)
Alfredsson, Henrik (Ekstern)
Gervang, Bo Groht (Intern)

Financing sources
Source: Internal funding (public)
Svøvs betydning for drift af 2-takts dieselmotorer

Department of Mechanical Engineering
Period: 01/09/2010 → 20/06/2014
Number of participants: 5
Phd Student:
Cordtz, Rasmus Faurskov (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Ahrenfeldt, Jesper (Intern)
Cox, Ingemar (Intern)
Kjemstrup, Niels (Ekstern)

Financing sources
Source: Internal funding (public)

Topography Optimisation for Convection Problems
Bachelor of Engineering thesis and subsequent work in collaboration with FE-Design.

Department of Mechanical Engineering
Solid Mechanics
Period: 30/08/2010 → 30/09/2011
Number of participants: 2
Project participant:
Alexandersen, Joe (Intern)
Main Supervisor:
Sigmund, Ole (Intern)

Relations
Publications:
Topography Optimization for Convection Problems
Documents:
Alexandersen2011
Alexandersen2011a

High Strain Rate Performance of Composite Materials

Department of Mechanical Engineering
Period: 01/08/2010 → 25/08/2014
Number of participants: 7
Phd Student:
Eriksen, Rasmus Normann Wilken (Intern)
Supervisor:
Barton, Janice (Ekstern)
Toftegaard, Helmuth Langmaack (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Examiner:
Legarth, Brian Nyvang (Intern)
Carlsson, Leif A. (Intern)
Zenkert, Dan (Ekstern)

Financing sources
Isothermal Martensite Formation

Department of Mechanical Engineering
Period: 01/08/2010 → 21/02/2014
Number of participants: 6
PhD Student:
Villa, Matteo (Intern)
Supervisor:
Pantleon, Karen (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Examiner:
Hald, John (Intern)
Mittemeijer, Eric Jan (Ekstern)
Sietsma, Jilt (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

Lightweight Structural Protection Concepts against Blast Loading

Department of Mechanical Engineering
Period: 01/08/2010 → 25/08/2014
Number of participants: 7
PhD Student:
Giversen, Søren (Intern)
Supervisor:
Hayman, Brian (Intern)
Rüisgaard, Benjamin (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Examiner:
Legarth, Brian Nyvang (Intern)
Carlsson, Leif A. (Intern)
Echtermeyer, Andreas (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

New tribo-system for sheet metal forming of advanced high strength steel and stainless steel

Department of Mechanical Engineering
Period: 01/08/2010 → 27/01/2014
Number of participants: 8
PhD Student:
Ceron, Ermanno (Intern)
Supervisor:
Hörnström, Sven Erik (Ekstern)
Madsen, Erik (Ekstern)
Schedin, Erik (Ekstern)
Main Supervisor:
Bay, Niels Oluf (Intern)
Examiner:
De Chiffre, Leonardo (Intern)
Dubar, Laurent (Ekstern)
Olsson, David Dam (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Optimization of advanced liquid natural gas-fuelled machineries for a high-speed ferry
Thermal Energy
Department of Mechanical Engineering
Mols-Linien A/S
Period: 01/08/2010 → 18/11/2011
Number of participants: 2
Project participant:
Tveitaskog, Kari Anne (Intern)
Project Manager, organisational:
Haglind, Fredrik (Intern)

Quality Assurance and Automation of Industrial CT Scanning
Department of Mechanical Engineering
Period: 01/08/2010 → 25/08/2014
Number of participants: 7
Phd Student:
Angel, Jais Andreas Breusch (Intern)
Supervisor:
Cantatore, Angela (Intern)
Hansen, Hans Nørgaard (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
Tosello, Guido (Intern)
Andreasen, Jan Lasson (Intern)
Schmitt, Robert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Et rammeværk til konceptualicer og specifikation af PSS designs - Netværksbaserede udviklingsmodeller
Department of Mechanical Engineering
Period: 01/07/2010 → 28/01/2016
Number of participants: 6
Phd Student:
Mougaard, Krestine (Intern)
Supervisor:
Howard, Thomas J. (Intern)
Main Supervisor:
McAlone, Tim C. (Intern)
Examiner:
Maier, Anja (Intern)
Rönnbäck, Anna Öhrwall (Ekstern)
Storga, Mario (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering

**Relations**

Publications:

A framework for conceptualisation of PSS solutions: On network-based development models  
Project: PhD

**Fremstilling af carcass til fleksible rør**

Department of Mechanical Engineering  
Period: 01/07/2010 → 23/02/2015  
Number of participants: 6  
Phd Student:  
Nielsen, Peter Søe (Intern)  
Supervisor:  
Nielsen, Morten Storgård (Intern)  
Main Supervisor:  
Bay, Niels Oluf (Intern)  
Examiner:  
Tiedje, Niels Skat (Intern)  
Groche, Peter (Ekstern)  
Madsen Kvist, Poul (Ekstern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**High Temperature Resistant Exhaust Valve Spindle**

Department of Mechanical Engineering  
Period: 01/07/2010 → 28/04/2014  
Number of participants: 6  
Phd Student:  
Bihlet, Uffe Ditlev (Intern)  
Supervisor:  
Dahl, Kristian Vinter (Intern)  
Main Supervisor:  
Somers, Marcel A. J. (Intern)  
Examiner:  
Hald, John (Intern)  
Schneider, André (Ekstern)  
Østergård, Maria Jose Landeira (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: ErhvervsPhD-ordningen VTU  
Project: PhD

**A Global Condition Monitoring System for Wind Turbines**

Department of Mechanical Engineering  
Period: 01/06/2010 → 27/08/2013  
Number of participants: 5  
Phd Student:  
Schlechingen, Meik (Intern)  
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Bobi, Miguel A. Sanz (Ekstern)
Liebich, Robert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Characterization and testing of multifunctional surfaces
Department of Mechanical Engineering
Period: 01/05/2010 → 27/08/2013
Number of participants: 7
PhD Student:
Godi, Alessandro (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Klit, Peder (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
Andreasen, Jan Lasson (Intern)
Jiang, Xiangqian J. (Ekstern)
Rosén, Bengt-Göran (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Modelling the effect of micro alloying elements in ductile cast iron
Department of Mechanical Engineering
Period: 01/05/2010 → 30/09/2013
Number of participants: 7
PhD Student:
Moumeni, Elham (Intern)
Supervisor:
Horsewell, Andy (Intern)
Tiedje, Niels Skat (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Lacaze, Jacques (Ekstern)
Pedersen, Karl Martin (Ekstern)
Tonn, Babette (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Organisation for PSS delivery and management structures for PSS performance
Department of Mechanical Engineering
Period: 01/05/2010 → 29/01/2016
Number of participants: 2
Scavenging and Swirling Flow in Two-Stroke Diesel Engines - A Numerical Study

Department of Mechanical Engineering
Period: 01/05/2010 → 29/09/2016
Number of participants: 5

Phd Student:
Obeidat, Anas Hassan MohD (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Ellero, Marco (Ekstern)
Rosendahl, Lasse (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Danish Centre for Composites Structures and Materials for Wind Turbines
Some of the most critical components of a wind turbine are the rotor blades, which are usually made of polymer matrix composites and are the largest rotating components of a wind turbine. Different types of damage can develop at different length scales in wind turbine rotor blades. Therefore, the Danish Centre for Composite Structures and Materials for Wind Turbines (DCCSM) aims to develop a coherent, multiscale-based understanding of the mechanical behaviour of composite materials and structures for wind turbine blades. The length scale goes from nano- and microscale (materials) to product scale (the whole blade, which currently can be more than 60 meters in length), and covers manufacturing, materials design, damage detection, modelling and prediction of damage evolution in wind turbine blades. A coherent multiscale understanding of composite materials and structures will enable full optimisation, viz., optimisation at all length scales.

The Centre aims for the creation of new knowledge (e.g. material models), new experimental methods and new modeling methods. The Centre spans wide thematically and disciplinarily. The specific PhD, Post Doc and research projects funded by DCCSM (Core and Shell activities) are focused at smaller, well-defined topics. Therefore, the Centre will coordinate the research activities in Denmark in the area of composite structures and materials for wind turbines. That includes the Core and Shell activities of DCCSM and research projects that are not funded by the DSF funds but are thematically covered by the Centre. Such projects are called "Crust" projects.

DSF Strategic Research Centre (sags. nr. 09-067212).
Department of Wind Energy
Composites and Materials Mechanics
Department of Micro- and Nanotechnology
Amphiphilic Polymers in Biological Sensing
Wind Turbines
Solid Mechanics
Department of Mechanical Engineering

Department of Civil Engineering

Section for Structural Engineering
Period: 01/04/2010 → 31/03/2017
Number of participants: 11
Acronym: DCCSM
Project participant:
Almdal, Kristoffer (Intern)
Mikkelsen, Lars Pilgaard (Intern)
Branner, Kim (Intern)
Mishnaevsky, Leon (Intern)
Legarth, Brian Nyvang (Intern)
Berggreen, Christian (Intern)
Stang, Henrik (Intern)
PhD Student:
Zike, Sanita (Intern)
Hansen, Jens Zangenberg (Intern)
Ashouri Vajari, Danial (Intern)
Approving authority:
Sørensen, Bent F. (Intern)

Relations
Publications:
From Measurements Errors to a New Strain Gauge Design
Micro-Scale Experiments and Models for Composite Materials with Materials Research
Correction of Gauge Factor for Strain Gauges Used in Polymer Composite Testing
Fatigue damage propagation in unidirectional glass fibre reinforced composites made of a non-crimp fabric
Determination of the minimum size of a statistical representative volume element from a fibre-reinforced composite based on point pattern statistics
Quantitative study on the statistical properties of fibre architecture of genuine and numerical composite microstructures
Methodology for characterisation of glass fibre composite architecture
Design of a fibrous composite preform for wind turbine rotor blades
The effects of fibre architecture on fatigue life-time of composite materials
A numerical study of the influence of microvoids in the transverse mechanical response of unidirectional composites

Project

Photocatalytic TiO2 based coatings for self-cleaning and anti-microbial applications
Department of Mechanical Engineering
Period: 15/03/2010 → 15/02/2011
Number of participants: 2
PhD Student:
Soyama, Juliano (Intern)
Main Supervisor:
Ambat, Rajan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

BioSOFC - 3rd Generation Biomass Based Combined Heat and Power (CHP)
The aim of project is to investigate the combination of biomass gasification with SOFC in an efficient decentralized and flexible energy system for small scale combined heat and power production. The project work includes design, construction and long term operation of a gasifier-SOFC stack test set-up, analysis of performance and system analysis.

Department of Mechanical Engineering
Energy Engineering
Thermal Energy
Risø National Laboratory for Sustainable Energy
Department of Chemical and Biochemical Engineering
Biosystems Division
CHEC Research Centre
Biomass Gasification
Department of Energy Conversion and Storage
Fuel Cells and Solid State Chemistry Division
Applied Electrochemistry
Electrochemical Evaluation
Period: 01/03/2010 → 01/03/2013
Number of participants: 7
Acronym: BioSOFC
Project participant:
Bang-Møller, Christian (Intern)
Ahrenfeldt, Jesper (Intern)
Elmegaard, Brian (Intern)
Rokni, Masoud (Intern)
Hagen, Anke (Intern)
Hansen, John Begild (Ekstern)
Project Manager, academic:
Henriksen, Ulrik Birk (Intern)
Project

Grænsedragning mellem forskning og industri indenfor dansk rumfart
TeknologiHistorie DTU
Administration
Department of Mechanical Engineering
Kroppedal Museum
Danmarks Tekniske Museum
Period: 01/03/2010 → 01/12/2010
Number of participants: 4
space
Project participant:
Zwisler, Laila (Intern)
Bjørnvig, Thore (Ekstern)
Project Manager, organisational:
Tybjerg, Karin (Ekstern)
Skyggebjerg, Louise (Ekstern)
Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Project

Hybrid method simulation of slender marine structures
Department of Mechanical Engineering
Period: 01/03/2010 → 23/02/2015
Number of participants: 6
Phd Student:
Optimization of vortex generators on wind turbine blades
Experimental/theoretical optimization and model construction for the wake induced by vortex generators.

Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Department of Wind Energy
Fluid Mechanics
Aeroelastic Design

LM Glasfiber A/S
Period: 01/02/2010 → 31/07/2013
Number of participants: 5
Project ID: 76031
Project participant:
Velte, Clara Marika (Intern)
Hansen, Martin Otto Laver (Intern)
Okulov, Valery (Intern)
Sørensen, Niels N. (Intern)
Fuglsang, Peter (Intern)

Integrated modelling of the glass moulding process

Department of Mechanical Engineering
Period: 15/01/2010 → 29/09/2014
Number of participants: 7
PhD Student:
Sarhadi, Ali (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Tutum, Cem Celal (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thorborg, Jesper (Intern)
Yan, Jiwang (Ekstern)
Yi, Allen (Ekstern)
Additive manufacturing technology - process and product quality control

Department of Mechanical Engineering
Period: 01/01/2010 → 04/04/2013
Number of participants: 5
Phd Student: Pedersen, David Bue (Intern)
Supervisor: De Chiffre, Leonardo (Intern)
Main Supervisor: Hansen, Hans Nørgaard (Intern)
Examiner: Lenau, Torben Anker (Intern)
Andreasen, Jan Lasson (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Coordinate metrology by traceable CT scanning

Department of Mechanical Engineering
Period: 01/01/2010 → 04/04/2013
Number of participants: 7
Phd Student: Müller, Pavel (Intern)
Supervisor: Cantatore, Angela (Intern)
Main Supervisor: Hansen, Hans Nørgaard (Intern)
Examiner: Bissacco, Giuliano (Intern)
Carmignato, Simone (Ekstern)
Kruth, Jean-Pierre G. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Equation Free Analysis of Mechanical Vibrations

Department of Mechanical Engineering
Period: 01/01/2010 → 20/06/2014
Number of participants: 5
Phd Student: Bureau, Emil (Intern)
Main Supervisor: Santos, Ilmar (Intern)
Examiner: Hjorth, Poul G. (Intern)
Kerschen, Gaëtan (Ekstern)
Savi, Marcelo Amorim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Fuel Cell Hydrogen Manifold for Lift Trucks
Department of Mechanical Engineering
Period: 01/01/2010 → 04/04/2013
Number of participants: 6
Phd Student:
Hosseinzadeh, Elham (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Main Supervisor:
Rokni, Masoud (Intern)
Examiner:
Jensen, Jens Oluf (Intern)
Nielsen, Mads Pagh (Ekstern)
Yuan, Jinliang (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Modeling the manufacturing process of wind turbine blades
Department of Mechanical Engineering
Period: 01/01/2010 → 25/06/2013
Number of participants: 8
Phd Student:
Nielsen, Michael Wenani (Intern)
Supervisor:
Løgstrup Andersen, Tom (Intern)
Branner, Kim (Intern)
Nielsen, Per Hørlyk (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Thomsen, Ole Thybo (Ekstern)
Svanberg, Magnus (Ekstern)
Talreja, Ramesh (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Rullekæders Dynamik: Teoretisk Modellering og Analyse
Department of Mechanical Engineering
Period: 01/01/2010 → 19/03/2015
Number of participants: 5
Phd Student:
Fuglede, Niels (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Høgsberg, Jan Becker (Intern)
Eberhard, Peter (Ekstern)
Fidlin, Alexander (Ekstern)

Financing sources
Scavenging and Swirling Flow in Two-Stroke Diesel Engines

Department of Mechanical Engineering
Period: 01/01/2010 → 31/12/2012
Number of participants: 1
Project Manager, organisational: Walther, Jens Honore (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 4,363,000.00 Danish Kroner

2nd Generation Alkaline Electrolysis for Hydrogen Production

Department of Mechanical Engineering
Period: 01/11/2009 → 21/02/2014
Number of participants: 5
Phd Student: Kjartansdóttir, Cecilía Kristín (Intern)
Main Supervisor: Møller, Per (Intern)
Examiner: Tang, Peter Torben (Intern)
Jensen, Jens Arne Dahl (Intern)
Leisner, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Analysis of the physical structure of emulsions using advanced nanoscopy techniques

Department of Mechanical Engineering
Period: 01/11/2009 → 27/08/2013
Number of participants: 5
Phd Student: Jensen, Louise Helene Søgaard (Intern)
Main Supervisor: Horsewell, Andy (Intern)
Examiner: Wagner, Jakob Birkedal (Intern)
Hazekamp, Johan (Ekstern)
Qvortrup, Klaus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

3-D Modelling and Testing of Contact Problems in Resistance Welding

Department of Mechanical Engineering
Period: 01/10/2009 → 31/01/2013
Number of participants: 7
Phd Student:
Multi Physics Approach Applied to Model and Design og Grinding Facilities

Department of Mechanical Engineering
Period: 01/10/2009 → 04/04/2013
Number of participants: 5
Phd Student:
Andersen, Søren Bøgh (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Stidsen, Thomas Jacob Riis (Intern)
Achiche, Sofiane (Intern)
Bittencourt, Marco Lúcio (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut, samfinansiering
Project: PhD

Hydrodynamics of Marine Animals

Department of Mechanical Engineering
Period: 01/09/2009 → 31/03/2010
Number of participants: 2
Phd Student:
Storti, Francesca (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Mechatronics applied to Film Fluid Bearings - Towards More Efficient Machinery

Department of Mechanical Engineering
Period: 01/09/2009 → 24/04/2013
Number of participants: 5
Phd Student:
Cerda Varela, Alejandro Javier (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Glavatskih, Sergei (Ekstern)
Keogh, Patrick Sean (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Modeling of product- and process architecture
Department of Mechanical Engineering
Period: 01/09/2009 → 21/05/2015
Number of participants: 7
Phd Student:
Jepsen, Allan Dam (Intern)
Supervisor:
Hvam, Lars (Intern)
Skov, Lars (Ekstern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Hildre, Hans Petter (Ekstern)
Elgh, Fredrik (Ekstern)
Jensen, Lars Jepsen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Systematic design of nano-photonic systems
Department of Mechanical Engineering
Period: 01/09/2009 → 20/12/2012
Number of participants: 7
Phd Student:
Wang, Fengwen (Intern)
Supervisor:
Mørk, Jesper (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Jensen, Jakob Søndergaard (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Qiu, Min (Ekstern)
Tortorelli, Daniel A. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Udvikling og anvendelse af ikke-lineære svingningsanalyse værktøjer til industrielle roterende maskineri
Department of Mechanical Engineering
Period: 01/09/2009 → 04/04/2013
Number of participants: 6
Phd Student:
Lahriri, Said (Intern)
Supervisor:
Hartmann, Henning (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Pennacchi, Paolo (Ekstern)
Steffen Jr., Vaider (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Koordineret udvikling af produktarkitekturog forretningsprocesser
Department of Mechanical Engineering
Period: 01/08/2009 → 26/01/2015
Number of participants: 6
Phd Student:
Hansen, Christian Lindschou (Intern)
Supervisor:
Hvam, Lars (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Welo, Torgeir (Ekstern)
Johannesson, Hans (Ekstern)
Krause, Dieter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Marine solution decision support system for waste heat recovery systems
Thermal Energy
Department of Mechanical Engineering
Siemens
Period: 01/08/2009 → 31/05/2010
Number of participants: 2
Project participant:
Scappin, Fabio (Intern)
Project Manager, academic:
Haglind, Fredrik (Intern)
Project

Væskeslag og gensvar af skibsskrog
Department of Mechanical Engineering
Period: 01/05/2009 → 27/05/2013
Number of participants: 6
Phd Student:
Seng, Sopheak (Intern)
Supervisor:
Pedersen, Preben Terndrup (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Equation-Free Analysis of Mechanical Vibrations

Mechanical vibrations are the cause of substantial operational and safety related problems with many mechanical systems of major importance, in particular in transportation, energy production, and industry. This project aims towards the development of new mathematical techniques to systematically investigate the dependence of vibrations on model parameters (e.g. bearing or material coefficients). To achieve this, equation-free techniques (also called coarse analysis) will be used which allow to obtain an understanding of the dynamic behaviour on a macroscopic scale by disregarding large amounts of unimportant information on the microscopic scale. The method fills the gap between time simulations of complex numerical models, such as nonlinear finite element models (FEM), and stability and bifurcation analyses with much simpler analytical models. The reason is that it enables such informative analyses directly on the complex microscopic models without the (often approximative) derivation of equations of motion on a macroscopic level. Due to the high-dimensional variable and parameter spaces and resulting computational costs, it is not possible to obtain similar information by direct simulations. The scientific goal is to clarify the potential of this approach within an important area of mechanics, rotating machinery (e.g. a turbocharger), where the detailed understanding of time dependent complex models play important roles in the design process.
Numerisk modellering af formfyldning ved støbning i selvkompakterende beton

Department of Mechanical Engineering
Period: 01/04/2009 → 24/08/2012
Number of participants: 7
Phd Student:
Spangenberg, Jon (Intern)
Supervisor:
Geiker, Mette Rica (Intern)
Stang, Henrik (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Kanstad, Terje (Ekstern)
Barkhudarov, Michael R. (Ekstern)
Billberg, Peter H. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Statiskes og dynamiske egenskaber af hydrodynamiske glidelejer på vindmøllers hovedaksel

Department of Mechanical Engineering
Period: 01/04/2009 → 28/09/2012
Number of participants: 7
Phd Student:
Thomsen, Kim (Intern)
Supervisor:
Santos, Ilmar (Intern)
Valund, Anders (Intern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Pedersen, Niels Leergaard (Intern)
Glavatskh, Sergei (Ekstern)
Lehtovaara, Arto (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervPhD-ordningen VTU
Project: PhD

Interaction between seabed soil and offshore wind turbine foundations

Department of Mechanical Engineering
Period: 01/03/2009 → 25/06/2012
Number of participants: 6
Phd Student:
Hansen, Nilas Mandrup (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Hededal, Ole (Intern)
Gravesen, Helge (Intern)
Jeng, Dong-Sheng (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

Dynamisk modellering af indvendigt riflede fordamperrør, med henblik på øget driftsfleksibilitet af termiske kraftværker
Department of Mechanical Engineering
Period: 01/02/2009 → 24/03/2014
Number of participants: 6
Phd Student:
Johansen, Axel Vodder Ohrt (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Walther, Jens Honore (Intern)
Dahlquist, Erik (Ekstern)
Sørensen, Kim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Optimization of Metamaterials
Department of Mechanical Engineering
Period: 01/02/2009 → 02/05/2012
Number of participants: 7
Phd Student:
Andkjær, Jacob Anders (Intern)
Supervisor:
Breinbjerg, Olav (Intern)
Mortensen, N. Asger (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Lavriuenko, Andrei (Intern)
Bozhevolnyi, Sergey I. (Intern)
Leugering, Günter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Tolerance chains and their verification in micro-manufacturing
Department of Mechanical Engineering
Period: 01/02/2009 → 25/06/2012
Number of participants: 7
Phd Student:
Gasparin, Stefania (Intern)
Supervisor:
De Chiffre, Leonardo (Intern)
Tosello, Guido (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Metodisk konstruktion af produkter

Department of Mechanical Engineering

Period: 01/01/2009 → 27/08/2013

Number of participants: 5

Phd Student:
Torry-Smith, Jonas (Intern)

Main Supervisor:
Mortensen, Niels Henrik (Intern)

Examiner:
Johannesson, Hans L. (Ekstern)
McAloone, Tim C. (Intern)
Riitahuhta, Asko (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 FUU, 1/3 inst 1/3 Andet
Project: PhD

New Sol-Gel coatings to improve casting quality

Department of Mechanical Engineering

Period: 01/11/2008 → 23/05/2012

Number of participants: 5

Phd Student:
Nwaogu, Ugochukwu Chibuzoh (Intern)

Main Supervisor:
Tiedje, Niels Skat (Intern)

Examiner:
Thorborg, Jesper (Intern)
Schumacher, Peter (Ekstern)
Stötzel, Reinhard (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Prediction of flow induced inhomogeneities in self compacting concrete

The main objective of the project is to improve the basic understanding of the flow behaviour of SCC. The research will produce tools allowing for the prediction of the casting process itself (formwork filling and formwork pressure) along with the prediction of the occurrence of hidden defects such as heterogeneities and weak interfaces. The project will result in a modelling framework for numerical simulation of full scale casting of SCC. The framework will be established through a cross disciplinary collaboration. A project sponsored by the Danish Research Counsil

Section for Construction Materials
Department of Civil Engineering
Department of Mechanical Engineering
The Danish Polymer Centre
Department of Chemical and Biochemical Engineering
Period: 01/11/2008 → 31/10/2012
Number of participants: 6
Project ID: 25990
Project participant:
Stang, Henrik (Intern)
Roussel, Nicolas (Ekstern)
Thorborg, Jesper (Intern)
Szabo, Peter (Intern)
Project Manager, organisational:
Geiker, Mette Rica (Intern)
Hattel, Jesper Henri (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 4,179,427.00 Danish Kroner
Project

Rock Mechanics Model for Enhanced Oil Recovery
Department of Mechanical Engineering
Period: 01/11/2008 → 17/08/2009
Number of participants: 3
Phd Student:
Ankergren, Ulrik Mark Vilhof (Intern)
Supervisor:
Christensen, Helle Foged (Intern)
Main Supervisor:
Krenk, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Converging technologies for micro systems manufacturing
Department of Mechanical Engineering
FOTEC GmbH
Fundacion Tekniker
Albert Ludwigs Universität Freiburg
University of Bradford
Cardiff University
Nederlandse Organisatie voor Toegepast Natuurwetenschappelijk Onderzoek
Wittmann Battenfeld GmbH
Sarix SA
Commissariat a l'Energie Atomique
Alicona Imaging GmbH
Heptagon OY
be innovative GmbH
Centro Ricerche Plast-Optica S.p.A.
Atherm SAS
Gema Medical S.L.
Euroortodontica S.L.
Greiner Bio-One GmbH
Moldflow (Europe) Ltd.
Micro Systems (UK) Ltd.
Plastipolis
Forschungs Zentrum Karlsruhe GmbH
ALMA Consulting Group SAS
Pulse ApS
Fachhochschule Wiener Neustadt
Period: 01/10/2008 → 30/09/2012
Number of participants: 29
Acronym: COTECH
Project ID: 4192-75891
Project participant:
Islam, Aminul (Intern)
Gasparin, Stefania (Intern)
Quadroni, Angelo (Ekstern)
Rossi, Markus (Ekstern)
Jansen, Josef (Ekstern)
Savard, Jean Francois (Ekstern)
Borgos, Jose Miguel (Ekstern)
Cervera, alberto (Ekstern)
Schmid, Heinz (Ekstern)
Houtart, Franck (Ekstern)
Gary, Clark (Ekstern)
Deguerry, Paul (Ekstern)
Pramhas, Gerhard (Ekstern)
Project Manager, organisational:
Loibl, Helmut (Ekstern)
Noll, Humbert (Ekstern)
Azcarate, Sabino (Ekstern)
Hansen, Hans Nørgaard (Intern)
Tosello, Guido (Intern)
Schoth, Andreas (Ekstern)
Coates, Phil (Ekstern)
Dimov, Stefan (Ekstern)
Bolt, Jan Pieter (Ekstern)
Wittmann, Werner (Ekstern)
Fillon, Bertrand (Ekstern)
Prantl, Manfred (Ekstern)
Sinesi, Sabino (Ekstern)
Kutz, Alexander (Ekstern)
Lipskier, Jean-Francois (Ekstern)
Jørgensen, Martin Bondo (Ekstern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 3,250,000.00 Danish Kroner
Project
Micro alloyed high strength net shape components

Department of Mechanical Engineering
Period: 15/09/2008 → 28/02/2010
Number of participants: 2
Phd Student:
D'Angelo, Luca (Intern)
Main Supervisor:
Tiedje, Niels Skat (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Multiscale Modeling of Composites

Department of Mechanical Engineering
Period: 15/09/2008 → 21/12/2011
Number of participants: 7
Phd Student:
Azizi, Reza (Intern)
Supervisor:
Legarth, Brian Nyvang (Intern)
Tvergaard, Viggo (Intern)
Main Supervisor:
Niordson, Christian Frithiof (Intern)
Examiner:
Richelsen, Ann Bettina (Intern)
Fleck, Norman A. (Ekstern)
Jensen, Henrik Myhre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Multiscale Simulations using Particle-Vortex Methods with Application to Bluff Body Aerodynamics

Department of Mechanical Engineering
Period: 01/09/2008 → 24/08/2012
Number of participants: 5
Phd Student:
Rasmussen, Johannes Tophøj (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Chatelain, Philippe (Ekstern)
Rosendahl, Lasse (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Nanophotonics for terabit communications: VKR centre of excellence - NATEC

We propose to establish a Willum Kann Rasmussen Centre of Excellence that explores the fundamental physics and technology of nanophotonic materials and devices in order to reach data rates in the terabit per second regime. Following a brief introduction, the goals of the Centre, its organization, the main research activities, research plans and proposed budget are described.
Department of Photonics Engineering
Department of Mechanical Engineering
Department of Micro- and Nanotechnology

DTU Danchip

Center for Electron Nanoscopy
Period: 01/09/2008 → 31/08/2014
Number of participants: 13
Acronym: NATEC
Project participant:
Hvam, Jørn Marcher (Intern)
Yvind, Kresten (Intern)
Mortensen, N. Asger (Intern)
Jeppesen, Palle (Intern)
Oxenløwe, Leif Katsuo (Intern)
Peucheret, Christophe (Intern)
Chung, Il-Sug (Intern)
Sigmund, Ole (Intern)
Jensen, Jakob Søndergaard (Intern)
Jauho, Anti-Pekka (Intern)
Burrows, Andrew (Intern)
Hübner, Jörg (Intern)
Project Manager, organisational:
Mørk, Jesper (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt

Project

Optimization and Validation of Mathematical Ship Models used in Routing and Performances Systems

Department of Mechanical Engineering
Period: 01/09/2008 → 23/05/2012
Number of participants: 7
Phd Student:
Hansen, Søren Vinther (Intern)
Supervisor:
Lützen, Marie (Intern)
Petersen, Jakob Buus (Ekstern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Andersen, Poul (Intern)
Ringsberg, Jonas W. (Ekstern)
Steen, Sverre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Scour Protection of Offshore Wind Farms

Department of Mechanical Engineering
Period: 01/09/2008 → 21/12/2011
Number of participants: 7
Phd Student:
Grain boundary engineering of functional thin films

Department of Mechanical Engineering
Period: 15/08/2008 → 24/08/2012
Number of participants: 6
Phd Student:
Alimadadi, Hossein (Intern)
Supervisor:
Somers, Marcel A. J. (Intern)
Main Supervisor:
Pantleon, Karen (Intern)
Examiner:
Tang, Peter Torben (Intern)
Klement, Uta (Ekstern)
Nolze, Gert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Multiscale Simulation of Wave Forces on Ocean Energy Devices

Department of Mechanical Engineering
Period: 15/08/2008 → 28/08/2012
Number of participants: 7
Phd Student:
Lindberg, Ole (Intern)
Supervisor:
Engsig-Karup, Allan Peter (Intern)
Walther, Jens Honore (Intern)
Main Supervisor:
Bingham, Harry B. (Intern)
Examiner:
Bredmose, Henrik (Intern)
Dumbser, Michael (Ekstern)
Grue, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Microstructure Evolution during Friction Stir Welding
Department of Mechanical Engineering
Period: 01/08/2008 → 28/03/2012
Number of participants: 7
Phd Student:
Lomholt, Trine Nybo (Intern)
Supervisor:
Bastos da Silva Fanta, Alice (Intern)
Pantleon, Karen (Intern)
Main Supervisor:
Somers, Marcel A. J. (Intern)
Examiner:
Klaæstrup Kristensen, Jens (Intern)
Dos Santos, Jorge F. (Ekstern)
Zaefferer, Stefan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Scour Around Offshore Wind Turbine Foundations
Department of Mechanical Engineering
Period: 01/08/2008 → 31/03/2010
Number of participants: 3
Phd Student:
Jensen, Palle Martin (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Analysis of mal-distribution phenomena in evaporators
Department of Mechanical Engineering
Period: 15/07/2008 → 25/01/2012
Number of participants: 7
Phd Student:
Kærn, Martin Ryhl (Intern)
Supervisor:
Larsen, Lars F. S. (Ekstern)
Skovrup, Morten Juel (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Palm, Björn (Ekstern)
Tummescheit, Hubertus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD
Simulation of Moving Trailing Edge Flaps on a Wind Turbine Blade using Navier-Stokes based Immersed Boundary Method

Department of Mechanical Engineering
Period: 15/07/2008 → 21/12/2011
Number of participants: 8
Phd Student: Behrens, Tim (Intern)
Supervisor: Sørensen, Jens Nørkær (Intern)
Sørensen, Niels N. (Intern)
Wedel-Heinen, Jens Jakob (Ekstern)
Main Supervisor: Shen, Wen Zhong (Intern)
Examiner: Gaunaa, Mac (Intern)
Bijl, Hester (Ekstern)
Davidson, Lars (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Modelling and Control of Semi-Active Dampers

Department of Mechanical Engineering
Period: 01/06/2008 → 28/03/2012
Number of participants: 7
Phd Student: Bhowmik, Subrata (Intern)
Supervisor: Krenk, Steen (Intern)
Weber, Felix (Ekstern)
Main Supervisor: Høgsberg, Jan Becker (Intern)
Examiner: Jensen, Jørgen Juncher (Intern)
Basu, Biswajit (Ekstern)
Nielsen, Søren R. K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Developing Strategies for Corrosion Protection of Electronic Devices

Department of Mechanical Engineering
Period: 01/05/2008 → 21/12/2011
Number of participants: 6
Phd Student: Rathinavelu, Umadevi (Intern)
Supervisor: Møller, Per (Intern)
Main Supervisor: Ambat, Rajan (Intern)
Examiner: Nielsen, Lars Pleth (Ekstern)
Johnsen, Roy (Ekstern)
Leisner, Peter (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

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**Magnetic Foil Bearings - Theory and Experiment**
Department of Mechanical Engineering
Period: 15/04/2008 → 24/02/2012
Number of participants: 5
Phd Student:
Morosi, Stefano (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Lee, Chong-Won (Ekstern)
Stahl, Karsten (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

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**From Nanostructure to Micro Morphology in Polymers**
Department of Mechanical Engineering
Period: 01/04/2008 → 30/11/2011
Number of participants: 7
Phd Student:
Yu, Kaijia (Intern)
Supervisor:
Hansen, Hans Nørgaard (Intern)
Skov, Anne Ladegaard (Intern)
Main Supervisor:
Rasmussen, Henrik K. (Intern)
Examiner:
Szabo, Peter (Ekstern)
Stading, Mats (Ekstern)
Svaneborg, Carsten (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

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**Performance of slow-speed diesel engines with waste heat recovery - a system approach**
Thermal Energy
Department of Mechanical Engineering
Period: 01/04/2008 → 31/03/2009
Number of participants: 2
Project participant:
Barduca, Otello (Intern)
Project Manager, organisational:
Haglind, Fredrik (Intern)
Project
Quasi-3d aerodynamic code for analyzing dynamic flap response

Department of Mechanical Engineering
Period: 01/04/2008 → 28/09/2011
Number of participants: 6
Phd Student:
Ramos García, Néstor (Intern)
Supervisor:
Shen, Wen Zhong (Intern)
Main Supervisor:
Serensen, Jens Nørkær (Intern)
Examiner:
Andersen, Poul (Intern)
Sun, Yuping (Ekstern)
Voutsinas, Spyros (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Self cleaning paint: Introduction of Photocatalytic Particles into a Paint System

Department of Mechanical Engineering
Period: 01/04/2008 → 02/05/2012
Number of participants: 7
Phd Student:
Gunnarsson, Sverrir Grimur (Intern)
Supervisor:
Ottosen, Lisbeth M. (Intern)
Poulsen, Søren (Ekstern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Erik Weinell, Claus (Intern)
Paatsch, Wolfgang (Ekstern)
Larsson, Anders (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Topology Optimization of Transient Optoelastic Wave-interaction Problems

Department of Mechanical Engineering
Period: 01/04/2008 → 31/08/2011
Number of participants: 6
Phd Student:
Matzen, René (Intern)
Supervisor:
Jensen, Jakob Søndergaard (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Mørk, Jesper (Intern)
Diaz, Alejandro Rafael (Intern)
Kawamoto, Atsushi (Intern)
Analysis and Design of Wing Tips

Department of Mechanical Engineering
Period: 15/03/2008 → 28/04/2012
Number of participants: 3
Phd Student:
Borbye, Jakob (Intern)
Supervisor:
Brøns, Morten (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)

Numerisk modellering af kystmorfolegi

Department of Mechanical Engineering
Period: 01/02/2008 → 21/12/2011
Number of participants: 6
Phd Student:
Kærgaard, Kasper Hauberg (Intern)
Supervisor:
Deigaard, Rolf (Intern)
Main Supervisor:
Fredsøe, Jørgen (Intern)
Examiner:
Hjelmager Jensen, Jacob (Intern)
Falqués, Albert (Ekstern)
Larson, Magnus (Ekstern)

Multiscale Optimization of Materials Subjected to Impact Loading

Department of Mechanical Engineering
Period: 01/03/2008 → 28/09/2011
Number of participants: 5
Phd Student:
Andreasen, Casper Schousboe (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Jensen, Jakob Søndergaard (Intern)
Klarbring, Anders (Ekstern)
Rodrigues, Helder C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Financing sources
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU) Samf.
Project: PhD
Micro alloyed high strength net shape components

The need to reduce costs and save resources creates a natural drive towards the development of new stronger and/or lighter materials. The project aims at developing new low cost materials with increased strength so that wind turbines and other heavily loaded constructions can be made with reduced weight at no significant increase in production costs. The main scientific objective of the project is to investigate formation of microstructures in a new family of ductile cast irons experimentally and to develop models for formation of microstructures that can be implemented in numerical codes for process modelling. The first part of the project is directed towards analysis of how microstructures in the materials develop during solidification and subsequent cooling to room temperature. Highly advanced 3D analysis of microstructures using a range of new techniques provided by the new microscopes at CEN
d TU that allows us to characterise the materials from nano-scale to mm-scale will be used to describe the true 3D microstructure of highly complex high strength materials. The microstructure analysis will be used to develop models that describe the chemical and thermodynamic processes that lead to the formation of phases as a result of processing conditions. A valuable output of the project will be a better understanding of the evolution of the metallic structure during solidification and subsequent cooling to room temperature. The technological objectives are aimed at a more efficient exploitation of the material by supplying realistic mechanical characteristics in the design phase. Efficiency of design, achieved by means of the use of optimisation techniques, will in turn supply strong reductions on testing time, lead-time to market and costs for the industries and end users.

Administration
Department of Mechanical Engineering
Period: 01/01/2008 → 31/12/2010
Number of participants: 3
Acronym: MAHS
Project Manager, organisational:
Tiedje, Niels Skat (Intern)
Hattel, Jesper Henri (Intern)
Horsewell, Andy (Intern)

**Financing sources**
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 3,786,300.00 Danish Kroner

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**Modalkontrol af vindmøller**
Department of Mechanical Engineering
Period: 01/01/2008 → 06/04/2011
Number of participants: 7
Phd Student:
Svendsen, Martin Nymann (Intern)
Supervisor:
Høgsberg, Jan Becker (Intern)
Svendsen, Rasmus (Ekstern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Nielsen, Søren R. K. (Ekstern)
Preumont, André (Ekstern)
Rixen, Daniel J. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

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**Revolutionerende forbedring af støbeprocessen gennem udvikling af sværte baseret på Sol-Gel coating**
Department of Mechanical Engineering
Teknologisk Institut
Period: 01/01/2008 → 31/12/2010
Number of participants: 2
Project Manager, organisational:
Tiedje, Niels Skat (Intern)
Krøis, Arve (Ekstern)

**Financing sources**
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 5,315,000.00 Danish Kroner

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**Systematic Design of Miniaturized Devices for Energy Transfer**
Department of Mechanical Engineering
Period: 01/01/2008 → 31/08/2011
Number of participants: 7
Phd Student:
Aage, Niels (Intern)
Supervisor:
Breinbjerg, Olav (Intern)
Mortensen, N. Asger (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Stolpe, Mathias (Intern)
Diaz, Alejandro Rafael (Intern)
Kawamoto, Atsushi (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Institut stipendie (DTU)
Project: PhD

**Effects of oral salmon calcitonin in animal models of osteoarthritis - assessments of cartilage, bone and pain**

Department of Mechanical Engineering
Period: 01/12/2007 → 21/12/2011
Number of participants: 6
Phd Student:
Nielsen, Rasmus Høigaard (Intern)
Supervisor:
Karsdal, Morten A. (Ekstern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Lee, Seunghwan (Intern)
Azria, Moïse (Ekstern)
Hauge, Ellen (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

**Computational Nanofluidics. Multiscale Simulations of Flow in Nanochannels**

Department of Mechanical Engineering
Period: 01/11/2007 → 23/05/2012
Number of participants: 5
Phd Student:
Zambrano Rodriguez, Harvey Alexander (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)
Examiner:
Hassager, Ole (Intern)
Hansen, Jesper Schmidt (Ekstern)
Quirke, Nicholas (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Integrated Modeling of Process, Structures and Performance in Cast Parts**

Department of Mechanical Engineering
Period: 15/10/2007 → 01/06/2011
Number of participants: 5
Phd Student:
Kotas, Petr (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Tiedje, Niels Skat (Intern)
Huff, Richard K. (Ekstern)
Schneider, Marc C. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

En komplet hydro- og morfodynamisk beskrivelse af revleudvikling

Department of Mechanical Engineering
Period: 01/10/2007 → 29/06/2011
Number of participants: 9
Phd Student:
Jacobsen, Niels Gjøl (Intern)
Supervisor:
Deigaard, Rolf (Intern)
Fuhrman, David R. (Intern)
Hjelmager Jensen, Jacob (Intern)
Sumer, B. Mutlu (Intern)
Main Supervisor:
Fredsøe, Jørgen (Intern)
Examiner:
Christensen, Erik Damgaard (Intern)
Foster, Diane (Ekstern)
Roelvink, J. A. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Laser Induce Selective Activation For Subsequent Autocatalytic Electroless Plating

Department of Mechanical Engineering
Period: 01/10/2007 → 02/02/2011
Number of participants: 7
Phd Student:
Zhang, Yang (Intern)
Supervisor:
Tang, Peter Torben (Intern)
De Grave, Arnaud (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
De Chiffre, Leonardo (Ekstern)
Eberhardt, Wolfgang (Ekstern)
Leisner, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Optimal Design of Smart Composite Structures
Application of DME in Direct Injection Internal Combustion Engines

Department of Mechanical Engineering
Period: 01/09/2007 → 24/04/2013
Number of participants: 7
Phd Student: Hansen, Kim Rene (Intern)
Supervisor: Sivebæk, Ion Marius (Intern)
Main Supervisor: Schramm, Jesper (Intern)
Examiner: Ahrenfeldt, Jesper (Intern)
Jensen, Torben Kvist (Intern)
Nylund, Nils-Olof (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Computational Nanofluidics Multiscale Simulations of Flow in Nanochannels

Department of Mechanical Engineering
Period: 01/09/2007 → 31/10/2010
Number of participants: 1
Project Manager, organisational: Walther, Jens Honore (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,544,304.00 Danish Kroner
Project

Energy efficient and environmentally friendly cooling using magnetic refrigeration: Modeling of active magnetic regenerators for magnetic refrigeration at room temperature

Department of Mechanical Engineering
Period: 01/09/2007 → 31/08/2010
Number of participants: 1
Acronym: MAGCOOL
Project Manager, organisational:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 1,900,000.00 Danish Kroner

High-Efficiency Ship Propellers
Department of Mechanical Engineering
Period: 01/09/2007 → 06/04/2011
Number of participants: 6
Phd Student:
Shin, Keun Woo (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Andersen, Poul (Intern)
Examiner:
Hansen, Martin Otto Laver (Intern)
Gomaa, Moustafa Abdel-Maksoud (Ekstern)
Olsen, Anders Smærup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Modeling of Active Magnetic Regenerators for Magnetic Refrigeration at Room Temperature
Department of Mechanical Engineering
Period: 01/09/2007 → 21/12/2010
Number of participants: 8
Phd Student:
Nielsen, Kaspar Kirstein (Intern)
Supervisor:
Bahl, Christian (Intern)
Pryds, Nini (Intern)
Smith, Anders (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Veje, Christian T. (Ekstern)
Gutfleisch, Oliver (Ekstern)
Sandeman, Karl George (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Modelling of Solidification and Interdiffusion in Lead Free Solder Materials
Department of Mechanical Engineering
Period: 01/09/2007 → 29/09/2010
Number of participants: 6
Phd Student:
Nachiappan, Vivek Chidambaram (Intern)
Supervisor:
Hald, John (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Kodentsov, Alexsander (Ekstern)
Fredriksson, Hasse (Ekstern)
Leisner, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Onboard Decision Support Systems for Optimal Operation
Department of Mechanical Engineering
Period: 01/09/2007 → 02/02/2011
Number of participants: 6
Phd Student:
Lajic, Zoran (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Nielsen, Ulrik Dam (Intern)
Examiner:
Pedersen, Preben Terndrup (Intern)
Petersen, Jakob Buus (Ekstern)
Sørensen, Asgeir Johan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Universal and Flexible 3D Coordinate Metrology for Micro and Nano Components Production
Department of Mechanical Engineering
Period: 01/09/2007 → 02/02/2011
Number of participants: 8
Phd Student:
Carli, Lorenzo (Intern)
Supervisor:
Dirscherl, Kai (Intern)
Hansen, Hans Nørgaard (Intern)
Horsewell, Andy (Intern)
Main Supervisor:
De Chiffre, Leonardo (Intern)
Examiner:
da Costa Carneiro, Kim (Intern)
Bosse, Harald (Ekstern)
Savio, Enrico (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Factors affecting Coriolis flowmeter accuracy and precision
Department of Mechanical Engineering
Period: 01/08/2007 → 10/11/2010
Number of participants: 7
Phd Student:
Enz, Stephanie (Intern)
Supervisor:
Davidson, Lars (Ekstern)
Møller, Per (Ekstern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Jensen, Jakob Søndergaard (Intern)
Benra, Friedrich-Karl (Ekstern)
Sorokin, Sergey V. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervPhD-ordningen VTU
Project: PhD

Factors Affecting Coriolis Flowmeter Accuracy and Stability
Department of Mechanical Engineering
Period: 01/08/2007 → 31/03/2008
Number of participants: 3
Phd Student:
Dahl, Jonas (Intern)
Supervisor:
Paidoussis, Michael P. (Ekstern)
Main Supervisor:
Thomsen, Jon Juel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervPhD-ordningen VTU
Project: PhD

Surface Embedded Metal Oxide Sensors (SEMS)
Department of Mechanical Engineering
Period: 01/08/2007 → 06/04/2011
Number of participants: 6
Phd Student:
Ali, Syed Talat (Intern)
Supervisor:
Nielsen, Lars Pleth (Ekstern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Ambat, Rajan (Intern)
Hilbert, Lisbeth Rischel (Intern)
Leisner, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Nanotribology
Manufacturing Engineering
Department of Mechanical Engineering
Department of Management Engineering
Period: 01/07/2007 → 30/11/2009
Number of participants: 4
Project participant:
Tosello, Guido (Intern)
De Grave, Arnaud (Intern)
Sivebæk, Ion Marius (Intern)
Project Manager, organisational:
Hansen, Hans Nørgaard (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 750,000.00 Danish Kroner

Energrigtig renovering af større bygninger : fokus på installationer og energiforsyning
Department of Civil Engineering
Department of Mechanical Engineering
COWI A/S
Ellehauge og Kildemoes ApS
Period: 01/06/2007 → 31/12/2009
Number of participants: 5
Project ID: 25859
Contact person:
Olesen, Bjarne W. (Intern)
Project participant:
Tommerup, Henrik M. (Intern)
Ellehauge, Klaus (Ekstern)
Project Manager, organisational:
Mikkelsen, Svend Erik (Ekstern)
Svendsen, Svend (Intern)

Financing sources
Source: Program. Andre statslige danske - Andre prog.midler
Name of research programme: Program. Andre statslige danske - Andre prog.midler
Amount: 550,000.00 Danish Kroner

Design af fremtidens energianlæg
Department of Mechanical Engineering
Period: 15/05/2007 → 28/09/2011
Number of participants: 6
Phd Student:
Clausen, Lasse Røngaard (Intern)
Supervisor:
Houbak, Niels (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Jensen, Peter Arendt (Intern)
Nielsen, Poul Erik Højlund (Ekstern)
Larson, Eric D. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Design of metamaterials**
Metamaterials have interesting properties for wavepropagation and this project will investigate the use of topology optimization techniques for designing such materials and devices made from such materials.

Department of Mathematics
Department of Mechanical Engineering

Michigan State University
Period: 01/05/2007 → 31/12/2007
Number of participants: 3
Acronym: EDS
Project participant:
Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Diaz, Alejandro R. (Ekstern)

**Financing sources**
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 80,000.00 Danish Kroner
Project

**Investigation of Electronic Corrosion Mechanisms**
Department of Mechanical Engineering
Period: 01/04/2007 → 29/09/2010
Number of participants: 6
Phd Student:
Minzari, Daniel (Intern)
Supervisor:
Møller, Per (Intern)
Main Supervisor:
Ambat, Rajan (Intern)
Examiner:
Nielsen, Lars Pleth (Ekstern)
Azarian, Michael (Ekstern)
Mol, Arjan (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

**Verificering af modeller for 2-takts dieselmotorer**
Department of Mechanical Engineering
Period: 01/04/2007 → 31/01/2013
Number of participants: 5
Phd Student:
Christiansen, Caspar Ask (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Eimegaard, Brian (Intern)
Czerwinski, Jan (Ekstern)
Norman, Thomas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Heat Transfer in Large Two-Stroke Marine Diesel Engines
Department of Mechanical Engineering
Period: 01/03/2007 → 04/04/2013
Number of participants: 6
Phd Student:
Jensen, Michael Vincent (Intern)
Supervisor:
Schramm, Jesper (Intern)
Main Supervisor:
Walther, Jens Honore (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Davidson, Lars (Ekstern)
Rosendahl, Lasse (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

High Precision Characterization of Active Oil Film Forces
Department of Mechanical Engineering
Period: 01/03/2007 → 11/05/2011
Number of participants: 6
Phd Student:
Haugaard, Martin Asger (Intern)
Supervisor:
Santos, Ilmar (Intern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Starke, Jens (Intern)
Braun, Minel J. (Ekstern)
Lehtovaara, Arto (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Resistance Welding of Micro-Components of Complex Geometries and Material Combinations
Department of Mechanical Engineering
Period: 01/03/2007 → 29/09/2010
Number of participants: 6
Phd Student:
Friis, Kasper Storgaard (Intern)
Supervisor:
Somers, Marcel A. J. (Intern)
Main Supervisor:
Bay, Niels Oluf (Intern)
Examiner:
Pantleon, Karen (Intern)
Klæstrup Kristensen, Jens (Intern)
Link, Norbert Joseph (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Vessel Performance Control
Department of Mechanical Engineering
Period: 01/03/2007 → 19/03/2015
Number of participants: 7
Phd Student:
Pedersen, Benjamin Pjedsted (Intern)
Supervisor:
Larsen, Jan (Intern)
Sinding, Peter (Intern)
Main Supervisor:
Andersen, Poul (Intern)
Examiner:
Nielsen, Ulrik Dam (Intern)
Ringsberg, Jonas W. (Ekstern)
Steen, Sverre (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Design and Optimization of an Integrated Biomass Gasification and Solid Oxide Fuel Cell System
Department of Mechanical Engineering
Period: 01/02/2007 → 29/09/2010
Number of participants: 7
Phd Student:
Bang-Møller, Christian (Intern)
Supervisor:
Elmegaard, Brian (Intern)
Henriksen, Ulrik Birk (Intern)
Main Supervisor:
Rokni, Masoud (Intern)
Examiner:
Hendriksen, Peter Vang (Intern)
Nielsen, Mads Pagh (Ekstern)
Sundén, Bengt (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Modellering af skadeudvikling og brud i svejsninger
Department of Mechanical Engineering
Period: 01/01/2007 → 14/04/2010
Number of participants: 5
Phd Student:
Nielsen, Kim Lau (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Legarth, Brian Nyvang (Intern)
Jensen, Henrik Myhre (Intern)
Leblond, Jean-Baptiste Maurice (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Modellering og beregning af vindmøllegear - Teori og eksperimentel validering
Department of Mechanical Engineering
Period: 01/01/2007 → 09/06/2010
Number of participants: 6
Phd Student:
Pedersen, Rune (Intern)
Supervisor:
Hohle, Andreas Christian (Ekstern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Klit, Peder (Intern)
Angeles, Jorge (Ekstern)
Mahfoud, Jarir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Teaching, Studying and Learning : Undersøgelse af effekter og konsekvenser af intensiv og aktiverende undervisning
Department of Civil Engineering
Office for Study Programmes and Student Affairs
Administration
Department of Mechanical Engineering
Department of Micro- and Nanotechnology
Department of Chemical and Biochemical Engineering
Department of Management Engineering
Period: 01/01/2007 → 31/03/2009
Number of participants: 5
Acronym: TeSt-Learn
Project participant:
Vigild, Martin Etchells (Intern)
Horsewell, Andy (Intern)
Thomsen, Erik Vilain (Intern)
Szabo, Peter (Intern)
Project Manager, organisational:
Christensen, Hans Peter (Intern)

Financing sources
Multiphase Flow Evaluation

Department of Mechanical Engineering
Period: 01/11/2006 → 30/09/2010
Number of participants: 6
Phd Student: Kjærsgaard-Rasmussen, Jimmy (Intern)
Supervisor: Hallundbæk, Jørgen (Ekstern)
Main Supervisor: Meyer, Knud Erik (Intern)
Examiner: Knudsen, Kim (Intern)
Meyer, Stefan (Intern)
Vauhkonen, Marko (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Optimering af formalingsteknologi i cementindustrien

Department of Mechanical Engineering
Period: 01/10/2006 → 20/01/2010
Number of participants: 8
Phd Student: Jensen, Lucas Roald Dörig (Intern)
Supervisor: Brockhoff, Per B. (Intern)
Friis, Henrik (Ekstern)
Jespersen, Mads (Ekstern)
Main Supervisor: Møller, Per (Intern)
Examiner: Nielsen, Lars Pleth (Ekstern)
Johansen, Roy (Ekstern)
Sandvik, Knut Lyng (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Stressforebyggelse i videnarbejdet : - mellem begejstring og belastning

Manufacturing Engineering
Department of Mechanical Engineering
Department of Management Engineering
Period: 01/10/2006 → 31/12/2009
Number of participants: 7
Project ID: 80744
Project participant: Buch, Anders (Intern)
Weller, Tina (Intern)
Sørensen, Ole Henning (Intern)
Bramming, Pia (Intern)
Larsen, Henrik Holt (Intern)
Jensen, Per Langaa (Intern)
Project Manager, organisational:
Andersen, Vibeke (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 3,554,949.00 Danish Kroner

Project

Two Stroke Diesel Engines for Large Ship Propulsion
Department of Mechanical Engineering
Period: 01/10/2006 → 29/06/2011
Number of participants: 6
Phd Student:
Haider, Sajjad (Intern)
Supervisor:
Schramm, Jesper (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Revstedt, Johan (Ekstern)
Rosendahl, Lasse (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ekstern finansieret virksomhed
Project: PhD

Unconventional prime movers for large ships
Department of Mechanical Engineering
Thermal Energy
Period: 01/10/2006 → 30/09/2010
Number of participants: 2
Project participant:
Haglind, Fredrik (Intern)
Project Manager, organisational:
Carlsen, Henrik (Intern)

Project

Værktøjsteknologier til massefremstilling af metalliske komponenter
Department of Mechanical Engineering
Period: 01/10/2006 → 29/09/2010
Number of participants: 7
Phd Student:
Eriksen, Rasmus Solmer (Intern)
Supervisor:
Arentoft, Mogens (Intern)
Bissacco, Giuliano (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Bay, Niels Oluf (Intern)
Engel, Ulf (Ekstern)
Grønbæk, Jens (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie

Relations
Publications:
Tooling technology for bulk forming of micro components
Project: PhD

Advanced Anodising Technology (Avanceret Anodiserings Teknologi)
Department of Mechanical Engineering
Period: 01/09/2006 → 06/01/2010
Number of participants: 9
Phd Student:
Tabrizian-Ghalehno, Naja (Intern)
Supervisor:
Ambat, Rajan (Intern)
Kongstad, Ib (Ekstern)
Møller, Per (Intern)
Toftegård, Jørn (Ekstern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
De Chiffre, Leonardo (Intern)
Leisner, Peter (Intern)
Nielsen, Lars Pleth (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Alloy development for overlay welding in waste incineration plants
Manufacturing Engineering
Department of Mechanical Engineering
Department of Management Engineering
Period: 01/09/2006 → 31/08/2009
Number of participants: 1
Project ID: 80720
Project Manager, organisational:
Tiedje, Niels Skat (Intern)

Financing sources
Source: Forsk. Andre statslige danske i øvrigt
Name of research programme: Forsk. Andre statslige danske i øvrigt
Amount: 2,000,000.00 Danish Kroner
Project

Feasibility of Applying Active Lubrication Techniques to Internal Combustion Engines
Department of Mechanical Engineering
Period: 01/09/2006 → 14/04/2010
Number of participants: 5
Phd Student: Estupinan, Edgar Alberto (Intern)
Main Supervisor: Santos, Ilmar (Intern)
Examiner: Achiche, Sofiane (Intern)
Glavatskikh, Sergei (Ekstern)
Weber, Hans Ingo (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Friplads
Project: PhD

**Propulsion of Ships in Waves**
Department of Mechanical Engineering
Period: 01/09/2006 → 02/12/2009
Number of participants: 6
Phd Student: Joncquez, Soizic Annick Gabrielle (Intern)
Supervisor: Bingham, Harry B. (Intern)
Main Supervisor: Andersen, Poul (Intern)
Examiner: Jensen, Jørgen Juncher (Intern)
Grilli, Stéphan (Ekstern)
Petersen, Jakob Buus (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

**Efficient solutions to the exact Laplace problem for nonlinear water waves**
Coastal, Maritime and Structural Engineering
Department of Mechanical Engineering
Period: 01/08/2006 → 15/08/2008
Number of participants: 2
Contact person: Bingham, Harry B. (Intern)
Project Manager, organisational: Engsig-Karup, Allan Peter (Intern)

**Financing sources**
Source: Forskningsrådene - SNF
Name of research programme: Forskningsrådene - STVF
Project

**Kinetics of Metal Dusting Corrosion of Fe-Ni-Cr(-Al) alloys**
Department of Mechanical Engineering
Period: 01/08/2006 → 09/06/2010
Number of participants: 7
Phd Student: Hummelshej, Thomas Strabo (Intern)
Supervisor: Appel, Charlotte Clausen (Intern)
Second International Symposium on Bifurcations and Instabilities in Fluid Dynamics

Hydrodynamic stability is of fundamental importance in fluid dynamics and is a well-established subject of scientific investigation that continues to attract great interest of the fluid mechanics community. Hydrodynamic instabilities of prototypical character are, for example, the Rayleigh-Bénard, the Taylor-Couette, the Bénard-Marangoni, the Rayleigh-Taylor, and the Kelvin-Helmholtz instabilities. A fundamental understanding of various patterns of bifurcations such as identifying the most dominant mechanisms responsible for the instability threshold is also required if one is to design reliable and efficient industrial processes and applications, such as melting, mixing, crystal growth, coating, welding, flow re-attachment over wings, and others. The symposium aimed at bringing together scholars with mutual interest in computational, experimental, and theoretical methods for the analysis of bifurcation and instability phenomena in fluid dynamics. The conference took place 15-18 August 2006 with 40 participants. Proceedings will appear as a volume in Journal of Physics: Conference Series.

Thermomechanical Modelling and Optimization of Dynamic Process Conditions in Friction Stir Welding

Department of Mechanical Engineering
Period: 01/07/2006 → 06/01/2010
Number of participants: 7
Phd Student:
Tutum, Cem Celal (Intern)
Supervisor:
Bendsøe, Martin P. (Intern)
Schmidt, Henrik Nikolaj Blicher (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Lindgren, Lars-Erik (Ekstern)
Deb, Kalyanmoy (Ekstern)
Thorborg, Jesper (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Numerical Procedures for Non-Linear Dynamics of Structures and Machinery

Department of Mechanical Engineering
Period: 15/06/2006 → 01/08/2006
Number of participants: 2
Phd Student:
Risvig, Søren (Intern)
Main Supervisor:
Krenk, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Analyse og optimering af energisystemer baseret på en kombination af termodynamiske og fluidmekaniske beregningsmetoder

Department of Mechanical Engineering
Period: 01/06/2006 → 29/09/2010
Number of participants: 8
Phd Student:
Markussen, Wiebke Brix (Intern)
Supervisor:
Carlsten, Henrik (Intern)
Hansen, Martin Otto Laver (Intern)
Jakobsen, Arne (Intern)
Main Supervisor:
Elmegaard, Brian (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Palm, Björn (Ekstern)
Thybo, Claus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Homogeneous Charge Compression Ignition Engines

Department of Mechanical Engineering
Period: 01/06/2006 → 11/05/2011
Number of participants: 5
Phd Student:
Pedersen, Troels Dyhr (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Ahrenfeldt, Jesper (Intern)
Løvås, Terese (Ekstern)
Norman, Thomas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD
Wind Profiles above Forests
Department of Mechanical Engineering
Period: 01/06/2006 → 24/03/2010
Number of participants: 6
Phd Student: Bingöl, Ferhat (Intern)
Supervisor: Mann, Jakob (Ekstern)
Main Supervisor: Sørensen, Jens Nørkær (Intern)
Examiner: Mikkelsen, Torben Krogh (Intern)
Chaviaropoulos, Panagiotis K. (Ekstern)
Harris, Michael (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

Fuldskala demonstration af termoaktive konstruktioner : Fase 3: Demonstration, evaluering og formidling
Section for Building Physics and Services
Department of Civil Engineering
Department of Mechanical Engineering
COWI A/S
Spæncom A/S
Middelfart Sparekasse A/S
Period: 01/03/2006 → 31/12/2008
Number of participants: 4
Project participant: Passov, Finn (Ekstern)
Weitzmann, Peter (Intern)
Olesen, Bjarne W. (Intern)
Project Manager, organisational: Hummelshøj, Reto Michael (Ekstern)

Financing sources
Source: Forsk. Private danske - Andre
Name of research programme: Forsk. Private danske - Andre
Amount: 246,000.00 Danish Kroner
Project

High temperature solder for MEMS packaging
Department of Mechanical Engineering
Period: 01/02/2006 → 02/09/2009
Number of participants: 8
Phd Student: Bergmann, René (Intern)
Supervisor: Johansen, Leif (Intern)
Møller, Per (Intern)
Tang, Peter Torben (Intern)
Main Supervisor: Hansen, Hans Nørgaard (Intern)
Examiner:
Innovative Joining Processes Applying Integrated Modelling

Advanced industrial product development is faced with steadily growing demands for joining new materials, often in dissimilar combinations, implying complicated joining problems. It is therefore imperative that manufacturing of joints in...
high tech products should be treated with scientific engineering methods. This is, however, seldom done to an extent justified by its importance. Although traditional arc welding processes have been subjected to numerical analysis of isolated problems such as temperature analysis, weld pool dynamics, microstructural evolution as well as transient and residual stress/strain and distortion analysis the idea of modeling with the aim of optimizing the entire process is still in its infancy state, and when it comes to more sophisticated processes like resistance welding (RW) and friction stir welding (FSW) even more basic numerical studies are in an early stage of development. Both of these processes need complex thermo-mechanical calculations, microstructural predictions as well as thorough analysis of large plastic deformations in order to predict weld strength and optimum welding parameters as well as final geometry. These problems are challenging and of multi-physics nature involving complex mechanisms comprising several cross-disciplinary areas such as materials science, thermodynamics, solid and fluid mechanics as well as process technology and applied numerical analysis. The objective of the present project is to develop advanced numerical models applicable for simulation of RW and FSW aiming at possible optimization of the entire processes. Focus will be set on overall numerical modelling strategies specific for each of the two welding processes as well as more detailed investigations of microstructures, mechanical properties, strength and weld quality.

Department of Management Engineering

Department of Mathematics

Department of Mechanical Engineering

Period: 01/01/2006 → 31/12/2009
Number of participants: 5
Acronym: INNOJoint
Project ID: 80700
Project participant:
Bay, Niels Oluf (Intern)
Somers, Marcel A. J. (Intern)
Hattel, Jesper Henri (Intern)
Bendsøe, Martin P. (Intern)
Tvergaard, Viggo (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 20,000,000.00 Danish Kroner

Quality and values in the job

Manufacturing Engineering

Department of Mechanical Engineering

Department of Management Engineering

Roskilde University

Skovtofte College
Period: 01/01/2006 → 31/12/2008
Number of participants: 3
Meaningful work, Developmental work, Employee participation, Service quality
Project participant:
Jørgensen, Michael Søgaard (Intern)
Bilfeldt, Annette (Ekstern)
Meyer-Johansen, Hanne (Ekstern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 0.00 Danish Kroner

3D Modelling of Laminar-Turbulent Transition on Wind Trubine Blades

Department of Mechanical Engineering
Period: 01/12/2005 → 09/11/2011  
Number of participants: 6  
Phd Student: Martinez Hernandez, Gabriel Gerardo (Intern)  
Supervisor: Shen, Wen Zhong (Intern)  
Main Supervisor: Sørensen, Jens Nørkær (Intern)  
Examiner: Sørensen, Niels N. (Intern)  
Matsubara, Masaharu (Ekstern)  
Olesen, Niels Anker (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Institut/centerfinansieret  
Project: PhD  

Simulation and Control of Wind Turbine Flows using Vortex Generators  
Department of Mechanical Engineering  
Period: 01/12/2005 → 04/11/2009  
Number of participants: 7  
Phd Student: Velte, Clara Marika (Intern)  
Supervisor: George, William K (Intern)  
Meyer, Knud Erik (Intern)  
Main Supervisor: Hansen, Martin Otto Laver (Intern)  
Examiner: Larsen, Poul Scheel (Intern)  
Buchhave, Preben (Intern)  
Stanislas, Michel (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsfinansiering  
Project: PhD  

Theoretical Nano Scale Polymer Processing  
Department of Mechanical Engineering  
Period: 01/11/2005 → 21/10/2009  
Number of participants: 6  
Phd Student: Román Marín, José Manuel (Intern)  
Supervisor: Hassager, Ole (Intern)  
Main Supervisor: Rasmussen, Henrik K. (Intern)  
Examiner: Szabo, Peter (Ekstern)  
Eriksson, Torbjörn Gerhard (Intern)  
Harlen, Oliver Guy (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: DTU, Samfinansiering  
Project: PhD
Center for metalliske mikroprodukter

Manufacturing Engineering

Department of Mechanical Engineering

Department of Management Engineering

Period: 01/10/2005 → 30/09/2010
Number of participants: 3
Project ID: 80589
Project participant:
Eriksen, Rasmus Solmer (Intern)

Project Manager, organisational:
Hansen, Hans Nørgaard (Intern)
Bay, Niels Oluf (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 6,078,000.00 Danish Kroner

Interaction between Seabed and Scour Protection

Department of Mechanical Engineering
Period: 01/09/2005 → 06/03/2009
Number of participants: 5
Phd Student:
Dixen, Martin (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Cheng, Liang (Ekstern)
Foster, Diane (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Rapid Prototyping by Asymmetric Single Point Incremental Forming of Sheet Metal

Department of Mechanical Engineering
Period: 01/09/2005 → 19/12/2008
Number of participants: 6
Phd Student:
Skjødt, Martin (Intern)
Supervisor:
Lenau, Torben Anker (Intern)
Main Supervisor:
Bay, Niels Oluf (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Bariani, Paolo Francesco (Ekstern)
Danckert, Joachim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Research in System Deliveries within Construction
Manufacturing Engineering
Department of Mechanical Engineering
Department of Management Engineering
Byggeriets Innovation
Period: 01/09/2005 → 01/03/2006
Number of participants: 3
Project participant:
Tølle, Martin (Intern)
Thomassen, Mikkel (Ekstern)
Project Manager, organisational:
Hvam, Lars (Intern)

Financing sources
Source: Forsk. Private danske - Fonde
Name of research programme: Forsk. Private danske - Fonde
Amount: 800,000.00 Danish Kroner

Udvikling og afprøvning af motorkoncept optimeret til motordrift på forgasningsgas
Department of Mechanical Engineering
Period: 01/09/2005 → 30/08/2008
Number of participants: 2
Contact person:
Ahrenfeldt, Jesper (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Program. Andre statslige danske - Andre prog.midler
Name of research programme: Program. Andre statslige danske - Andre prog.midler
Amount: 1,968,600.00 Danish Kroner

Antifouling surfaces
Department of Mechanical Engineering
Period: 01/08/2005 → 06/01/2010
Number of participants: 7
Phd Student:
Chiang, Wen-Chi (Intern)
Supervisor:
Hilbert, Lisbeth Rischel (Intern)
Tolker-Nielsen, Tim (Intern)
Main Supervisor:
Møller, Per (Intern)
Examiner:
Ambat, Rajan (Intern)
Bjarnsholt, Thomas (Intern)
Leisner, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD
Manufacturing Imperfections in FRP Structures and their Influence on Buckling Behaviour

Department of Mechanical Engineering
Period: 01/08/2005 → 31/07/2006
Number of participants: 5
Phd Student:
Schultz, Jacob Pagh (Intern)
Supervisor:
Berggreen, Christian (Intern)
Branner, Kim (Intern)
Hayman, Brian (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

SPACES-workshops : cipu

Department of Mechanical Engineering
Period: 28/06/2005 → 01/07/2008
Number of participants: 1
Project ID: 75487
Project Manager, organisational:
McAloone, Tim C. (Intern)

Financing sources
Source: [Ordinær drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Project

Structural Analysis of Wind Turbines

Department of Mechanical Engineering
Period: 01/05/2005 → 10/11/2006
Number of participants: 2
Phd Student:
Jensen, Jacob Fisker (Intern)
Main Supervisor:
Krenk, Steen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Programbevilling
Project: PhD

Estimering og forbedring af skades tolerance for komposit materiale

Department of Mechanical Engineering
Period: 15/03/2005 → 06/03/2009
Number of participants: 7
Phd Student:
Lundsgaard-Larsen, Christian (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Sørensen, Bent F. (Intern)
Main Supervisor:
Berggreen, Christian (Intern)
Examiner:
Stang, Henrik (Intern)
Barton, Janice (Ekstern)
Stigh, Ulf (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lånnet stipendie
Project: PhD

Micro insert moulding
Department of Mechanical Engineering
Period: 01/03/2005 → 29/08/2008
Number of participants: 7
Phd Student:
Tosello, Guido (Intern)
Supervisor:
Kjær, Erik Michael (Intern)
Tang, Peter Torben (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Dimov, Stefan Simeonov (Ekstern)
Weckenmann, Albert (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lånnet stipendie
Project: PhD

Polymerer udsat for store deformationer
Department of Mechanical Engineering
Period: 01/03/2005 → 04/07/2008
Number of participants: 5
Phd Student:
Lindgreen, Britta (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Richelsen, Ann Bettina (Intern)
25.NN_Studenter/Øvrige medarb. (Ekstern)
Jensen, Henrik Myhre (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lånnet stipendie
Project: PhD

Two component micro injection moulding for moulded interconnect devices
Department of Mechanical Engineering
Period: 01/03/2005 → 04/07/2008
Number of participants: 7
Phd Student:
Islam, Aminul (Intern)
Measures to Reduce Oil Spill in Tanker Collisions

Department of Mechanical Engineering
Period: 15/02/2005 → 09/03/2007
Number of participants: 6
Phd Student:
Yamada, Yasuhira (Intern)
Supervisor:
Friis-Hansen, Peter (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Amdahl, Jørgen Juncher (Intern)
Kierkegaard, Henning (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Numerical Simulation of Wakes of Wind Turbines in Wind Farms

Department of Mechanical Engineering
Period: 01/02/2005 → 12/01/2009
Number of participants: 6
Phd Student:
Troldborg, Niels (Intern)
Supervisor:
Mikkelsen, Robert Flemming (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Examiner:
Hansen, Martin Otto Laver (Intern)
Madsen, Jens Ingemann (Ekstern)
Masson, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Thermal and Indoor Air Quality Effects on Physiological Responses, Perception and Performance of Tropically Acclimatized People
Department of Mechanical Engineering
Period: 01/02/2005 → 27/12/2006
Number of participants: 3
Phd Student:
Willem, Henry Cahyadi (Ekstern)
Supervisor:
Wargocki, Pawel (Intern)
Main Supervisor:
Olesen, Bjarne W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Joint degree
Project: PhD

Safety at Sea
Maritime Engineering

Department of Mechanical Engineering
Period: 10/01/2005 → 31/12/2007
Number of participants: 2
Project ID: 75454
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Friis-Hansen, Peter (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 1,872,360.00 Danish Kroner
Project

Simulation and control of Wind Turbine flows using Vortex Generators
Fluid Mechanics

Department of Mechanical Engineering
Period: 01/01/2005 → 31/12/2007
Number of participants: 2
Project ID: 75456
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Hansen, Martin Otto Laver (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 2,373,000.00 Danish Kroner
Project

STVF - Offshore wind power
Fluid Mechanics

Department of Mechanical Engineering
Period: 01/01/2005 → 31/12/2007
Number of participants: 1
Project ID: 75461
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)
Financing sources
Source: Sektorforskningen - RISØ
Name of research programme: Sektorforskningen - RISØ
Amount: 443,000.00 Danish Kroner

Project

Anvendelse af AIS data til vurdering af sejlsikkerhed
Department of Mechanical Engineering
Period: 17/12/2004 → 31/01/2005
Number of participants: 2
Project ID: 75451
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Friis-Hansen, Peter (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 50,000.00 Danish Kroner

Project

Findings and Literature regarding indoor Air Quality
Department of Mechanical Engineering
Period: 12/12/2004 → 31/01/2005
Number of participants: 1
Project ID: 75453
Project Manager, organisational:
Olesen, Bjarne W. (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 30,000.00 Danish Kroner

Project

Cantion A/S
Department of Mechanical Engineering
Cantion A/S
Period: 01/12/2004 → 31/12/2005
Number of participants: 3
Project ID: 75450
Project participant:
Kjær, Christian (Ekstern)
Hein, Lars (Intern)
Project Manager, organisational:
Christensen, Torben Bender (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 10,000.00 Danish Kroner

Project

Noise from Wind Turbines due to Inflow Turbulence
Department of Mechanical Engineering
Period: 01/12/2004 → 27/01/2010
Number of participants: 6
Phd Student:
Broe, Brian Riget (Intern)
Supervisor:
Mann, Jakob (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Examiner:
Jacobsen, Finn (Intern)
Graham, J. Michael R. (Ekstern)
Keith, Graeme (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Len)
Project: PhD

Analyse af revner i store diselmotorer
Department of Mechanical Engineering
Period: 01/10/2004 → 11/04/2008
Number of participants: 7
Phd Student:
Lucht, Tore (Intern)
Supervisor:
Brøndsted, Povl (Intern)
Jensen, Søren Helmut (Ekstern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Niordson, Christian Frithiof (Intern)
Maier, Giulio (Ekstern)
Redanz, Pia (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Building a Fast Time Numerical Navigator for Assessing Collision and Grounding Frequencies in a Given Navigational Area
Department of Mechanical Engineering
Period: 01/10/2004 → 31/05/2006
Number of participants: 3
Phd Student:
Søborg, Anders Veldt (Intern)
Supervisor:
Blank, Mogens (Intern)
Main Supervisor:
Friis-Hansen, Peter (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Magnetisk køling
Department of Mechanical Engineering
Period: 01/10/2004 → 06/02/2008
Number of participants: 9
Topographic optimization of photonic crystals and application to ultra-small and ultra-fast optical signal processing devices

A domestic team in the present proposal has so far proposed an ultra-small and ultra-fast symmetrical Mach-Zehnder (SMZ)-type all-optical switch (PC-SMZ) based on two-dimensional photonic crystals (2DPCs) and optical non-linear quantum dots (QDs) for the future WDM/OTDM system, and demonstrated basic technologies inevitable for the PC-SMZ, such as ultra-low propagation loss, excellent directional-coupler and interferometric optical-switch functions. An oversea team has, on the other hand, proposed an innovative 2DPC simulation method, i.e., topology optimization (TO) method and remarkably improved bandwidth and transmittance properties of 2DPC waveguides. The current proposal involves complementary international collaborations based on these excellent results for establishment of an excellent 2DPC design technology for innovative ultra-small and ultra-fast optical switch with a latch function. The result is definitely thought to pave the road to a optical logic element inevitable for the future photonic net work system.

Nanophotonics
Department of Photonics Engineering
Department of Mechanical Engineering
University of Tsukuba
Aarhus University
Ghent University

Period: 01/10/2004 → 30/09/2006
Number of participants: 11
Project ID: 70281

Sugimoto, Yoshimasa (Ekstern)
Watanabe, Yoshinori (Ekstern)
Nakamura, Shigeru (Ekstern)
Ishikawa, Hiroshi (Ekstern)
Awazu, Kouichi (Ekstern)
Watanabe, Akira (Ekstern)
Kristensen, Martin (Ekstern)
Borel, Peter Ingo (Intern)
Sigmund, Ole (Intern)
Baets, Roel (Ekstern)

Project Manager, organisational: Asakawa, Kiyoshi (Ekstern)

Financing sources
Source: Samarb. aftaler - Udenlandske offentlige og private
Name of research programme: Samarb. aftaler - Udenlandske offentlige og private
Amount: 430,000.00 Danish Kroner

ALLHOME – A study on the Relation between Allergy/Asthma and Indoor Air Quality in Homes in Bulgaria

Department of Mechanical Engineering
Department of Civil Engineering
Section for Indoor Environment
Number of participants: 1
Project Manager, organisational:
Melikov, Arsen Krikor (Intern)

Alternative Additiver

Department of Mechanical Engineering
Risø National Laboratory for Sustainable Energy
Energi E2 A/S
Elsam Engineering A/S
ReaTech
Danmarks Jordbrugsforskning
De Nationale Geologiske Undersøgelser for Danmark og Grønland
Period: 01/09/2004 → 31/12/2006
Number of participants: 2
Project ID: 75442
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 132,000.00 Danish Kroner

GreenFuelCell

Energy Engineering
Department of Mechanical Engineering
Number of participants: 2
Project ID: 75441
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Carlsen, Henrik (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 3,340,068.00 Danish Kroner

In-process kvalitetskontrol og måling af mikrokomponenter

Department of Mechanical Engineering
Period: 01/09/2004 → 13/05/2008
Number of participants: 6
Phd Student:
Fugl, Jimmy (Intern)
Supervisor:
De Chiffre, Leonardo (Intern)
Main Supervisor:
Hansen, Hans Nørgaard (Intern)
Examiner:
Andreasen, Jan Lasson (Intern)
Arentoft, Mogens (Intern)
Savio, Enrico (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Modellering af varmefrigivelse og emissioner fra dråbeforbrænding af multikomponentbrændstof i dieselmotorer
Department of Mechanical Engineering
Period: 01/08/2004 → 06/01/2010
Number of participants: 5
Phd Student:
Ivarsson, Anders (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Glarborg, Peter (Intern)
Bengtsson, Per-Erik Christer (Ekstern)
Jensen, Torben Kvist (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Multi-sensor for indoor environment control (MUSIC)
Indoor Environment
Department of Mechanical Engineering
Period: 01/07/2004 → 31/12/2004
Number of participants: 1
Project ID: 75435
Project Manager, organisational:
Olesen, Bjarne W. (Intern)

Financing sources
Source: Forsk. Andre offentlige og private - Nordiske
Name of research programme: Forsk. Andre offentlige og private - Nordiske
Amount: 54,000.00 Danish Kroner
Project

Stirlingmotorer, proces- og komponentforbedringer
Energy Engineering
Department of Mechanical Engineering
Period: 30/06/2004 → 28/06/2005
Number of participants: 1
Project ID: 75311
Project Manager, organisational:
Carlsen, Henrik (Intern)

**Financing sources**
*Source: Sam.arb.aftaler, Private danske - Andre virksomheder*
*Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder*
*Amount: 1,550,000.00 Danish Kroner*

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**Indoor Environmental Quality in the office-space**

Fluid Mechanics

Department of Mechanical Engineering
*Period: 18/06/2004 → 31/10/2004*
*Number of participants: 1*

Project Manager, organisational:
Olesen, Bjarne W. (Intern)

**Financing sources**
*Source: Sam.arb.aftaler - Udenlandske offentlige og private*
*Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private*
*Amount: 104,000.00 Danish Kroner*

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**DCAMM**

Department of Mechanical Engineering
*Period: 01/06/2004 → 07/03/2008*
*Number of participants: 6*
*Phd Student: Zhu, Wei Jun (Intern)*
*Supervisor: Sørensen, Jens Nørkær (Intern)*
*Main Supervisor: Shen, Wen Zhong (Intern)*
*Examiner: Sørensen, Niels N. (Intern)*
*Ekaterianris, Ioannis A. (Ekstern)*
*Thomsen, Per Grove (Intern)*

**Financing sources**
*Source: Internal funding (public)*
*Name of research programme: Forskningsrådsfinansiering*
*Project: PhD*

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**Indpasning af totrinsforgasser i et energisystem**

Energy Engineering

Department of Mechanical Engineering
*Period: 25/05/2004 → 31/12/2006*
*Number of participants: 2*
*Project ID: 75427*

Project participant:
Carlsen, Henrik (Intern)

Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

**Financing sources**
*Source: Forsk. Private danske - Andre*
*Name of research programme: Forsk. Private danske - Andre*
*Amount: 2,700,000.00 Danish Kroner*
BIOCELLUS
Department of Mechanical Engineering
Period: 30/04/2004 → 31/12/2006
Number of participants: 2
Project ID: 75437
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 249,312.00 Danish Kroner

Brudmekanismer i kompositmateriater - effekt af fiber/matrix grænsefladens mekaniske egenskaber
Department of Mechanical Engineering
Period: 15/04/2004 → 11/04/2008
Number of participants: 7
Phd Student:
Østergaard, Rasmus Christian (Intern)
Supervisor:
Mikkelsen, Lars Pilgaard (Intern)
Sørensen, Bent F. (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Niordson, Christian Frithiof (Intern)
Jensen, Henrik Myhre (Intern)
Östlund, Sören (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Risø (Løn)
Project: PhD

Dynamic Heat Storage - DSM
Department of Mechanical Engineering
Period: 01/04/2004 → 01/03/2005
Number of participants: 2
Project ID: 75420
Project participant:
Carlsen, Henrik (Ekstern)
Project Manager, organisational:
Bøhm, Benny (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 307,270.00 Danish Kroner

Thermonet EU
Energy Engineering
Department of Mechanical Engineering
Period: 01/04/2004 → 31/12/2005
Number of participants: 2
Project ID: 75462
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Forsk. EU - Ramme program
Name of research programme: Forsk. EU - Ramme program
Amount: 42,000.00 Danish Kroner

Project

Assessment of Thermal Environment in Aircraft Cabin
Department of Mechanical Engineering
Department of Civil Engineering
Section for Indoor Environment
Boeing Commercial Airplanes
Period: 01/03/2004 → 30/11/2004
Number of participants: 1
Project Manager, organisational:
Melikov, Arsen Krikor (Intern)

Project

Indoor Environmental Effects on Performance of School Work by Children
Indoor Environment
Department of Mechanical Engineering
Period: 01/03/2004 → 31/08/2005
Number of participants: 2
Project ID: 75412
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Wyon, David Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 1,170,000.00 Danish Kroner

Project

Pyrotar
Energy Engineering
Department of Mechanical Engineering
Period: 01/03/2004 → 31/12/2006
Number of participants: 2
Project ID: 75411
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 450,000.00 Danish Kroner
Project

Ventilation
Indoor Environment

Department of Mechanical Engineering
Period: 01/03/2004 → 28/02/2007
Number of participants: 2
Project ID: 75413
Project participant:
Clausen, Geo (Intern)

Project Manager, organisational:
Langkilde, Gunnar (Intern)

Financing sources
Source: Forsk. Private danske - Andre
Name of research programme: Forsk. Private danske - Andre
Amount: 675,000.00 Danish Kroner
Project

Experimental Contribution to the Problem of Model Parameter Identification in Rotating Machines via Active Magnetic Bearings

Department of Mechanical Engineering
Period: 01/02/2004 → 11/04/2008
Number of participants: 5
Phd Student:
Kjølhede, Klaus Kirkebæk (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Braun, Minel J. (Ekstern)
Blanke, Mogens (Intern)
Dmochowski, Waldemar M. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Kontrolleret vindmølle dynamik

Department of Mechanical Engineering
Period: 01/02/2004 → 15/08/2007
Number of participants: 6
Phd Student:
Kallesøe, Bjarne Skovmose (Intern)
Supervisor:
Hansen, Morten Hartvig (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Krenk, Steen (Intern)
Chaviaropoulos, Panagiotis K. (Ekstern)
Langthjem, Mikael Andersen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Luftkvalitet og luftskifte for sunde boliger

Department of Mechanical Engineering
Period: 01/02/2004 → 14/11/2007
Number of participants: 6
Phd Student:
Strøm-Tejsen, Peter (Intern)
Supervisor:
Olesen, Bjarne W. (Intern)
Main Supervisor:
Wargocki, Pawel (Intern)
Examiner:
Spengler, John Daniel (Intern)
Holm, Andreas (Intern)
Melikov, Arsen Krikor (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Eksternt finansieret virksomhed
Project: PhD

Marstruct

Maritime Engineering

Department of Mechanical Engineering
Period: 01/02/2004 → 28/02/2008
Number of participants: 2
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,668,064.00 Danish Kroner
Project:

Methods for Measurements of Ventilation in Homes, and Ventilation Requirements for Healthy Indoor Home Environments

Department of Mechanical Engineering
Period: 01/02/2004 → 15/08/2007
Number of participants: 7
Phd Student:
Naydenov, Kiril Georgiev (Intern)
Supervisor:
Bornehag, Carl-Gustaf (Ekstern)
Melikov, Arsen Krikor (Intern)
Stankov, Peter (Ekstern)
Main Supervisor:
Sundell, Jan (Intern)
Examiner:
Kjærgaard, Søren Kenneth (Ekstern)
Wargocki, Pawel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD
Dynamisk wakemodel til detaljeret aerøelastisk simulering af møller i parker

Department of Mechanical Engineering
Period: 01/01/2004 → 31/12/2006
Number of participants: 2
Project ID: 75422
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Okulov, Valery (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energimisteriet
Name of research programme: Forskningsprojekter - Miljø- og Energimisteriet
Amount: 512,000.00 Danish Kroner
Project

Modellering af statiske og transiente fænomener i en termostatisk ekspansionsventil anvendt i et kølekredsløb

Department of Mechanical Engineering
Period: 01/01/2004 → 07/11/2007
Number of participants: 7
Phd Student:
Langmaack, Lasse Nikolai (Intern)
Supervisor:
Funder-Kristensen, Torben (Ekstern)
Knudsen, Hans-Jørgen Høgaard (Intern)
Main Supervisor:
Carlsen, Henrik (Intern)
Examiner:
Paul, Joachim (Intern)
Palm, Björn (Ekstern)
Süss, Jürgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Prediction and Reduction of Noice from Wind Turbines

Fluid Mechanics

Department of Mechanical Engineering
Period: 01/01/2004 → 31/12/2007
Number of participants: 1
Project ID: 75407
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 5,000,000.00 Danish Kroner
Project

Program for forskning i anvendt aerøelasticitet

Fluid Mechanics

Department of Mechanical Engineering
Topological design optimization of structures, machines and materials: IUTAM-SYMPOSIUM

It is now more than 15 years ago that the so-called homogenization method was proposed as a basis for computational means to optimize the topology and shape of continuum structures. From initially being capable mainly of treating minimum compliance design we now see the basic material distribution idea of the methodology applied to a wide range of structural and mechanical problems as well as to problems that couple structural response to other physical responses. Also, the method has provided insight for micro-mechanical studies, meaning that the method has given feedback to the area which provided impetus to the field of topological design optimization in its creation. Finally, topological design is now an integral part of most FEM software systems and it has become a standard industrial tool in some fields. The IUTAM
Symposium provided a forum for the exchange of ideas for future developments in the area of topological design optimization. This encompassed the application to fluid-solid interaction problems, acoustics problems, and to problems in biomechanics, as well as to other multiphysics problems. New basic modelling paradigms, covering new geometry modelling such as level-set methods and topological derivatives, as well as developments in computational approaches were also focus areas. Without the sponsorship from the International Union of Theoretical and Applied Mechanics (IUTAM) and the International Society for Structural and Multidisciplinary Optimization (ISSMO), and the financial support from the Danish Center for Applied Mathematics and Mechanics (DCAMM), the Villum Kann Rasmussen Foundation, and the Poul Due Jensen Foundation, the symposium and this book would not have been possible. The financial support from the Department of Mechanical Engineering, Aalborg University, and from the Department of Mathematics and the Department of Mechanical Engineering, Technical University of Denmark, is also gratefully acknowledged.

Department of Mathematics

Department of Mechanical Engineering

Aalborg University
Period: 01/01/2004 → 31/12/2005
Number of participants: 3
Project Manager, organisational:
Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Olhoff, Niels (Ekstern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 100,000.00 Danish Kroner
Source: [Ordinær drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Amount: 250,000.00 Danish Kroner

Modellering af materialeflow i termomekaniske materialeprocesser

Department of Mechanical Engineering
Period: 15/11/2003 → 07/03/2008
Number of participants: 5
Phd Student:
Gjesing, Rasmus (Intern)
Main Supervisor:
Hattel, Jesper Henri (Intern)
Examiner:
Hansen, Preben N. (Ekstern)
Fritsching, Udo W. (Ekstern)
Pryds, Nini (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

PIV målinger i GCT skalamodel

Fluid Mechanics

Department of Mechanical Engineering
Period: 15/11/2003 → 31/08/2004
Number of participants: 2
Project ID: 75394
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Meyer, Knud Erik (Intern)
Large-Eddy Simulation of atmospheric flow over complex terrain

Department of Mechanical Engineering
Period: 01/10/2003 → 15/08/2007
Number of participants: 8
Phd Student:
Bechmann, Andreas (Intern)
Supervisor:
Johansen, Jeppe (Intern)
Mann, Jakob (Intern)
Sørensen, Niels N. (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Examiner:
Bingham, Harry B. (Intern)
Fuchs, Laszlo (Ekstern)
Gryning, Sven-Erik (Intern)

Optimering af biomasse forgasningskoncept til effektiv storskala elfremstilling

Department of Mechanical Engineering
Period: 01/10/2003 → 08/11/2007
Number of participants: 7
Phd Student:
Nielsen, Rasmus Glar (Intern)
Supervisor:
Henriksen, Ulrik Birk (Intern)
Stoholm, Peder Christian (Intern)
Main Supervisor:
Qvale, Einar Bjørn (Intern)
Examiner:
Jensen, Anker Degn (Intern)
Hustad, Johan Einar (Ekstern)
Teislev, Bjørn Ivan Bach (Ekstern)

Promoting and Assisting Engineering Design Education in China

Department of Mechanical Engineering
Period: 01/10/2003 → 30/09/2006
Number of participants: 1
Project ID: 75385
Project Manager, organisational:
Hein, Lars (Intern)
Indsprøjtningsforhold i store dieselmotorer

Department of Mechanical Engineering
Number of participants: 7
Phd Student:
Dam, Bjarke Skovgård (Intern)
Supervisor:
Mayer, Stefan (Intern)
Sorensen, Spencer C (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)
Examiner:
Wachtmeister, Georg (Ekstern)
Hjertager, Bjørn H. (Ekstern)
Westergaard, Carsten Hein (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: ErhvervsPhD-ordningen VTU
Project: PhD

Modeling plasticity at the micron scale

Solid Mechanics
Department of Mechanical Engineering
Period: 01/09/2003 → 31/12/2006
Number of participants: 1
Project ID: 75365
Project Manager, organisational:
Tvergaard, Viggo (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 2,500,000.00 Danish Kroner
Project

A Multidomain Spectral Method for Nonlinear Water Waves

Department of Mechanical Engineering
Period: 01/08/2003 → 02/01/2007
Number of participants: 5
Phd Student:
Engsig-Karup, Allan Peter (Intern)
Supervisor:
Bingham, Harry B. (Intern)
Main Supervisor:
Madsen, Per A. (Intern)
Examiner:
Thomsen, Per Grove (Intern)
Grue, John (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Forsøg med energirigtige stikledninger

Department of Mechanical Engineering
Period: 01/08/2003 → 31/12/2004
Number of participants: 2
Project ID: 75392
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Bøhm, Benny (Intern)

Financing sources
Source: Sam arb aftaler - Amter og kommuner
Name of research programme: Sam arb aftaler - Amter og kommuner
Amount: 94,000.00 Danish Kroner

Strutural Control and Passive Damping Mechanisms

Maritime Engineering

Department of Mechanical Engineering
Period: 01/08/2003 → 31/07/2005
Number of participants: 2
Project ID: 75370
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Rüdinger, Finn (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,058,000.00 Danish Kroner

Tilting-Pad Thrust Bearings under Elasto-Thermo-Hydride Lubrication - Theory, Experiment and Inudstrial Application

Department of Mechanical Engineering
Period: 01/08/2003 → 25/06/2007
Number of participants: 5
Phd Student:
Heinrichson, Niels (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Egusquiza, Eduard (Ekstern)
Arghir, Mihai (Ekstern)
Thomsen, Klaus K. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Human Perception, SBS Symptoms and Performance of Office Work during Exposure to Air Polluted by Building Materials ans Personal Computers

Department of Mechanical Engineering
Period: 01/07/2003 → 29/10/2004
Number of participants: 5
Phd Student: Bako Biro, Zsolt (Ekstern)
Supervisor: Wargocki, Pawel (Intern)
Main Supervisor: Fanger, Povl Ole (Intern)
Examiner: Seppänen, Olli (Ekstern)
Sundell, Jan (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Friplads
Project: PhD

Udvikling og kommercialisering af Maritime beslutningssystemer
Maritime Engineering
Department of Mechanical Engineering
Period: 01/06/2003 → 07/06/2004
Number of participants: 2
Project ID: 75387
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Baatrup, Jan (Intern)

Financing sources
Source: Forsk. Andre statslige danske i øvrigt
Name of research programme: Forsk. Andre statslige danske i øvrigt
Amount: 52,500.00 Danish Kroner
Project

Optimal Seat Control Algorithm
Department of Mechanical Engineering
Department of Civil Engineering
Section for Indoor Environment
Johnoson Control
Period: 01/05/2003 → 30/11/2005
Number of participants: 1
Project participant:
Melikov, Arsen Krikor (Intern)

Evaluation Prästmarken, Wäxjö
Energy Engineering
Department of Mechanical Engineering
Period: 30/04/2003 → 30/04/2004
Number of participants: 2
Project ID: 75393
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Bøhm, Benny (Intern)
Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 118,400.00 Danish Kroner
Project

DeSiK Design af Indirekte Køleanlæg
Department of Mechanical Engineering
Period: 01/04/2003 → 31/03/2005
Number of participants: 2
Project ID: 75.353
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Knudsen, Hans-Jørgen Høgaard (Intern)

Financing sources
Source: Forsk. Private danske - Andre
Name of research programme: Forsk. Private danske - Andre
Amount: 514,000.00 Danish Kroner
Project

Langtidsundersøgelser af totrinsforgasser
Energy Engineering
Department of Mechanical Engineering
Period: 01/04/2003 → 30/06/2005
Number of participants: 2
Project ID: 75368
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 2,000,000.00 Danish Kroner
Project

Stirling K Plus
Energy Engineering
Department of Mechanical Engineering
Period: 01/04/2003 → 31/03/2005
Number of participants: 1
Project ID: 75376
Project Manager, organisational:
Carlsen, Henrik (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 315,716.00 Danish Kroner
Project

MOBE
Energy Engineering
Department of Mechanical Engineering
Period: 24/02/2003 → 30/09/2006
Number of participants: 2
Project ID: 75349
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Houbak, Niels (Intern)

Financing sources
Source: Forsk. Private danske - Andre
Name of research programme: Forsk. Private danske - Andre
Amount: 1,990,000.00 Danish Kroner
Project

Kokspartiklers nedbrydning under termisk omsætning
Department of Mechanical Engineering
Period: 15/02/2003 → 09/03/2007
Number of participants: 7
Phd Student:
Hindsgaul, Claus (Intern)
Supervisor:
Henriksen, Ulrik Birk (Intern)
Jensen, Anker Degn (Intern)
Main Supervisor:
Qvale, Einar Bjørn (Intern)
Examiner:
Johnsson, Jan Erik (Intern)
Hustad, Johan Einar (Ekstern)
Teislev, Bjørn Ivan Bach (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Aeroakustisk modellering af støjudbredelse fra vindmøllevinger
Department of Mechanical Engineering
Period: 01/02/2003 → 28/05/2008
Number of participants: 2
Phd Student:
Heilskov, Nicolai Francis (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU, Samfinansiering
Project: PhD

Biostøvning
Department of Mechanical Engineering
Period: 01/02/2003 → 31/12/2004
Number of participants: 2
Project ID: 75344
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Amount: 300,000.00 Danish Kroner
Project

LES-beregninger for industrielle strømninger
Department of Mechanical Engineering
Period: 01/02/2003 → 16/04/2007
Number of participants: 5
Phd Student:
Cavar, Dalibor (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)
Examiner:
Davidson, Lars (Ekstern)
Bingham, Harry B. (Intern)
Sørensen, Niels N. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Teri technology development India
To colaborate in developing biomass based energy systems for rural application in India and other developing countries. The Biomass Energy Technology Applications (BETA) group in TERI is engaged in the development af thermal and power gasifiers since last two decades, and has the task to bring a reliable and rugged power gasifier operation (100% wood gas based) to the field by end of 2003. The BETA group has been looking for a partnership to improve its capacities in achieving this goal. DTU BGG is also engaged in the developemt og power gasifiers since the last two decades. Sorane has been working with the Energy Environment Technology Division of Teri in the development of thermal gasifiers applications (silk), and has been initiating the partnership between TERI and DTU BGG, and will bring its expweience in the technology development in India to the project.

Energy Engineering
Department of Mechanical Engineering
Period: 01/02/2003 → 31/07/2004
Number of participants: 2
Project ID: 75382
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Sam.arb.aftaler, Private danske - Andre virksomheder
Name of research programme: Sam.arb.aftaler, Private danske - Andre virksomheder
Amount: 327,000.00 Danish Kroner
Project

EFP-2002 Aeroelastisk integreret vindmøllestyring
Department of Mechanical Engineering
Period: 01/01/2003 → 31/12/2004
Number of participants: 2
Project ID: 75400
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Metal Release by Corrosion and Wear in the Food Industry

The objectives of this project are to identify the sources of metal contamination from stainless steel equipment in food industry, analyse the impact of the contamination and finally to suggest solutions for the problem. Metal release can cause a health risk for consumers with nickel allergy and the acquisition of data on metal content in not only raw products but also in manufactured food and ready-to-eat dishes will be an improvement of the present status.

The role of the National Food Institute is to analyse trace elements in processed raw materials and foodstuffs sampled at various sites along the process line in the food industry. The trace element content is determined by Inductively Coupled Plasma Mass Spectrometry (ICPMS) equipped with a collision/reaction cell for interference reduction/removal. The obtained data on food products will be analysed and the health risk evaluated by comparison with the estimated daily intake.

By materials selection and development of more wear and corrosion resistant surfaces the general food quality can be improved, metal release reduced and longer lifetime of process equipment obtained – all leading to better products. So by technological solutions safe and high quality food production can be made possible.
The project is funded by The Directorate for Food, Fisheries and Agri Business, DFFE and has a total budget of 6.1 mill kroner. The National Food Institute has a budget of 0.9 mill kr.

National Food Institute
Division of Food Chemistry
Department of Mechanical Engineering
Materials and Surface Engineering
Rigshospitalet
Period: 01/01/2003 → 01/01/2007
Number of participants: 4
Project participant:
Larsen, Erik Huusfeldt (Intern)
Møller, Per (Intern)
Poulsen, Lars Kærgaard (Intern)
Sloth, Jens Jørgen (Intern)

EFP - 2002, Vind
Fluid Mechanics
Department of Mechanical Engineering
Period: 10/12/2002 → 31/12/2002
Number of participants: 1
Project ID: 75333
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)

SPACES
Department of Management Engineering
Department of Mechanical Engineering
Period: 01/12/2002 → 01/12/2007
Number of participants: 8
Project participant:
Broberg, Ole (Intern)
Jørgensen, Michael Søgaard (Intern)
Yoshinaka, Yutaka (Intern)
Lindegaard, Hanne (Intern)
Lenau, Torben Anker (Intern)
McAloone, Tim C. (Intern)
Project Manager, organisational:
Jørgensen, Ulrik (Intern)
Clausen, Christian (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 568,000.00 Danish Kroner

Financing sources
Source: [Ordinær drift UK 10]
Name of research programme: [Ordinær drift UK 10]
Boeing
Department of Mechanical Engineering
Period: 21/11/2002 → 28/10/2005
Number of participants: 2
Project ID: 75328
Project participant:
Clausen, Geo (Intern)
Project Manager, organisational:
Wyon, David Peter (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 5,260,000.00 Danish Kroner

Ship Propeller Cavitation
Department of Mechanical Engineering
Period: 15/10/2002 → 28/02/2003
Number of participants: 2
Phd Student:
Boudant, Pauline (Intern)
Main Supervisor:
Andersen, Poul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

EXAUSTO
Department of Mechanical Engineering
Period: 04/10/2002 → 31/10/2004
Number of participants: 2
Project ID: 75322
Project participant:
Clausen, Geo (Intern)
Project Manager, organisational:
Fanger, Povl Ole (Intern)

Financing sources
Source: Gaver, Private danske Fonde
Name of research programme: Gaver, Private danske Fonde
Amount: 675,000.00 Danish Kroner

Pulverforbrænding til Stirlingmotor
Energy Engineering
Period: 19/09/2002 → 31/12/2004
Number of participants: 1
Project ID: 75316
Project Manager, organisational:
Carlsen, Henrik (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 276,800.00 Danish Kroner
Human response to Personalized Ventilation
Department of Mechanical Engineering
Department of Civil Engineering
Section for Indoor Environment
STVF
Period: 01/09/2002 → 30/11/2005
Number of participants: 1
Project Manager, organisational:
Melikov, Arsen Krikor (Intern)

Comfort requirements for heat flow to/from vehicle seats
Department of Mechanical Engineering
Period: 01/09/2002 → 31/12/2002
Number of participants: 2
Project ID: 75317
Project participant:
Clausen, Geo (Intern)
Project Manager, organisational:
Fanger, Povl Ole (Intern)

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 517,284.00 Danish Kroner

Modelling of Dampers and Damping in structures
Department of Mechanical Engineering
Period: 01/09/2002 → 22/05/2006
Number of participants: 5
PhD Student:
Høgsberg, Jan Becker (Intern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Nielsen, Søren R. K. (Ekstern)
Brennan, Michael John (Ekstern)
Preumont, André (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Numerisk simulering af cykliske termodynamiske processor
Department of Mechanical Engineering
Number of participants: 6
PhD Student:
Andersen, Stig Kildegård (Intern)
Supervisor:
Thomsen, Per Grove (Intern)
Experimental Investigation of Turbulence Structures in Wave Boundary Layers

Department of Mechanical Engineering
Period: 01/08/2002 → 30/06/2006
Number of participants: 6
PhD Student:
Carstensen, Stefan (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Meyer, Knud Erik (Intern)
Garcia, Marcelo H. (Ekstern)
Soulsby, Richard L. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Composite/Hybrid modelling in coastal and ocean engineering

Department of Mechanical Engineering
Period: 01/07/2002 → 31/03/2006
Number of participants: 6
PhD Student:
Zhang, Haiwen (Ekstern)
Supervisor:
Schäffer, Hemming Andreas (Intern)
Main Supervisor:
Bingham, Harry B. (Intern)
Examiner:
Madsen, Per A. (Intern)
Brorsen, Michael Christian (Ekstern)
Otta, Ashwini Kumar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Leading Edge

Maritime Engineering
Department of Mechanical Engineering
Period: 01/07/2002 → 31/08/2005
Number of participants: 1
Sensation of "Dryness" humidity of air, comfort and health

Department of Mechanical Engineering
Period: 01/07/2002 → 02/02/2006
Number of participants: 5
Phd Student:
Lagercrantz, Love Per (Intern)
Main Supervisor:
Sundell, Jan (Intern)
Examiner:
Kjærgaard, Søren Kenneth (Ekstern)
Knudsen, Henrik Nellemane (Intern)
Toftum, Jørn (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Grant and Equipment Loan Agreement

Indoor Environment

Department of Mechanical Engineering
Period: 30/06/2002 → 09/10/2002
Number of participants: 2
Project ID: 75325
Project participant:
Clausen, Geo (Intern)
Project Manager, organisational:
Fanger, Povl Ole (Intern)

Financing sources
Source: Gaver, Udenlandske offentlige og private
Name of research programme: Gaver, Udenlandske offentlige og private
Amount: 800,000.00 Danish Kroner
Project

Videncentret for termisk forgasning og slutkonvertering af biomasse til el og varme

Energy Engineering

Department of Mechanical Engineering
Period: 22/04/2002 → …
Number of participants: 2
Project ID: 75304
Project participant:
Carstensen, Stefan (Intern)
Project Manager, organisational:
Carlsen, Henrik (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Hydroelastic Response of Ships
Department of Mechanical Engineering
Period: 01/03/2002 → 28/09/2005
Number of participants: 6
Phd Student: Vidic-Perunovic, Jelena (Intern)
Supervisor: Bingham, Harry B. (Intern)
Main Supervisor: Jensen, Jørgen Juncher (Intern)
Examiner: Andersen, Poul (Intern)
Cerup-Simonsen, Bo (Intern)
Moan, Torgeir (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Monitorering og beslutningsstøtte for skibes sødygtighed
Department of Mechanical Engineering
Period: 01/03/2002 → 28/09/2005
Number of participants: 6
Phd Student: Nielsen, Ulrik Dam (Intern)
Supervisor: Bastrup, Jan (Intern)
Main Supervisor: Jensen, Jørgen Juncher (Intern)
Examiner: Bingham, Harry B. (Intern)
Cerup-Simonsen, Bo (Intern)
Myrhaug, Dag (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Offentlig finansiering
Project: PhD

Strength of Composite Structures in Compression
Department of Mechanical Engineering
Period: 01/03/2002 → 01/10/2003
Number of participants: 3
Phd Student: Rasmussen, Jeppe (Intern)
Supervisor: Pedersen, Preben Terndrup (Intern)
Main Supervisor: Cerup-Simonsen, Bo (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
**En 3D Windsimulator til bestemmelse af ekstremlaster og udmattelsesiaster**

Department of Mechanical Engineering  
Period: 14/01/2002 → 31/12/2002  
Number of participants: 2  
Project ID: 75265  
Project participant:  
Sørensen, Jens Nørkær (Intern)  
Project Manager, organisational:  
Hansen, Kurt Schaldemose (Intern)  

**Financing sources**  
Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 150,317.00 Danish Kroner

**KNOW-BLADE**

Fluid Mechanics  
Department of Mechanical Engineering  
Period: 07/01/2002 → 30/11/2004  
Number of participants: 2  
Project ID: 75262  
Project participant:  
Sørensen, Jens Nørkær (Intern)  
Project Manager, organisational:  
Hansen, Martin Otto Laver (Intern)  

**Financing sources**  
Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Amount: 4,397,700.00 Danish Kroner

**AFFORHD**

Department of Mechanical Engineering  
Period: 01/01/2002 → 01/01/2005  
Number of participants: 2  
Project ID: 75275  
Project participant:  
Carlsen, Henrik (Intern)  
Project Manager, organisational:  
Sorenson, Spencer C (Intern)  

**Financing sources**  
Source: Forskningsprojekter - Miljø- og Energimæssige  
Name of research programme: Forskningsprojekter - Miljø- og Energimæssige  
Amount: 1,318,141.00 Danish Kroner

**SYNOPSIS**: Udredningsarbejde vedrørende et rammesystem for Integreret Innovation i Produkt-, System- og Serviceudvikling  

Engineering Design and Product Development  
Department of Mechanical Engineering  
Period: 01/01/2002 → 31/12/2004  
Number of participants: 7  
Project ID: 75312
Project participant:
Andreasen, Mogens Myrup (Intern)
Clausen, Christian (Intern)
Hansen, Claus Thorp (Intern)
Boelskifte, Per (Intern)
Hein, Lars (Intern)
Jørgensen, Ulrik (Intern)
Project Manager, organisational:
McAlone, Tim C. (Intern)

Financing sources
Source: Forskningsprojekter - Andre ministerier og styrelser
Name of research programme: Forskningsprojekter - Andre ministerier og styrelser
Amount: 1,500,000.00 Danish Kroner

MEXICO

Fluid Mechanics
Department of Mechanical Engineering
Period: 21/12/2001 → 31/12/2003
Number of participants: 1
Project ID: 75270
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 581,000.00 Danish Kroner

Smart indpakning af fiber lasere

Department of Mechanical Engineering
Period: 01/12/2001 → 18/05/2005
Number of participants: 8
Phd Student:
Voxen, Lars Holfort (Intern)
Supervisor:
Pedersen, Jens Engholm (Intern)
Poulsen, Christian (Intern)
Thomsen, Jon Juel (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Santos, Ilmar (Intern)
Hald, Jan (Ekstern)
Tinnsten, Mats (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: 1/3 DTU-stip, 2/3 FUR/andet
Project: PhD

Program for forskning i aeroelasticitet 2001-2002

Fluid Mechanics
Department of Mechanical Engineering
Period: 23/10/2001 → 31/12/2003
Number of participants: 1
Project ID: 75235
Project participant:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 1,563,000.00 Danish Kroner

Design and Implementation of Automatic Ckoæntrol in High Efficiency Tractors for Agricultural Applications
Department of Mechanical Engineering
Period: 01/09/2001 → 11/02/2005
Number of participants: 6
Phd Student:
Christensen, Rene Hardam (Intern)
Supervisor:
Klit, Peder (Intern)
Main Supervisor:
Santos, Ilmar (Intern)
Examiner:
Blanke, Mogens (Intern)
Keogh, Patrick Sean (Ekstern)
Nordmann, Rainer (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Simulation and Analysis of Roller Chain Drive Systems
Department of Mechanical Engineering
Period: 01/09/2001 → 23/03/2005
Number of participants: 6
Phd Student:
Pedersen, Sine Leergaard (Intern)
Supervisor:
Hansen, John Michael (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Byskov, Esben (Intern)
Hansen, Michael Rygaard (Ekstern)
Nikravesh, Parviz E. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Design Strategies for Personalized Ventilation Systems
Department of Mechanical Engineering
Period: 01/08/2001 → 20/10/2004
Number of participants: 5
Phd Student:
Cermak, Radim (Intern)
Main Supervisor:
Melikov, Arsen Krikor (Intern)
Examiner:
Nielsen, Peter Vilhelm (Ekstern)
Kato, Shinsuke (Ekstern)
Olesen, Bjarne W. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Motordrift på forgasningsgas
Department of Mechanical Engineering
Period: 01/07/2001 → 06/02/2008
Number of participants: 6
Phd Student:
Ahrenfeldt, Jesper (Intern)
Supervisor:
Henriksen, Ulrik Birk (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Sorenson, Spencer C (Intern)
Hustad, Johan Einar (Ekstern)
Norman, Thomas (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden sektorministeriel finans
Project: PhD

Numerical techniques for solving Boussinesq equations for fully nonlinear and extremely dispersive water waves
Department of Mechanical Engineering
Period: 01/06/2001 → 27/10/2004
Number of participants: 7
Phd Student:
Fuhrman, David R. (Intern)
Supervisor:
Madsen, Per A. (Intern)
Thomsen, Per Grove (Intern)
Main Supervisor:
Bingham, Harry B. (Intern)
Examiner:
Nielsen, Hans Bruun (Intern)
Hesthaven, Jan (Intern)
Rasmussen, Jens Juul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

S@S Safety at Speed
Maritime Engineering
Department of Mechanical Engineering
LIMAS
Department of Mechanical Engineering
Period: 07/05/2001 → 29/06/2004
Number of participants: 2
Project ID: 75256
Project participant:
Fredsoe, Jørgen (Intern)
Project Manager, organisational:
Sumer, B. Mutlu (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 1,358,000.00 Danish Kroner

Modellering af modstrømsforgasser EFP 2001
Energy Engineering
Department of Mechanical Engineering
Period: 07/05/2001 → 31/12/2003
Number of participants: 2
Project ID: 75215
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 1,000,000.00 Danish Kroner

Modellering af trinopdelt forgasning EFP-2001
Energy Engineering
Department of Mechanical Engineering
Period: 07/05/2001 → 31/12/2004
Number of participants: 2
Project ID: 75212
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Henriksen, Ulrik Birk (Intern)

Financing sources
Comfort Monitoring System for High Speed Passenger Ferries

Department of Mechanical Engineering
Period: 01/05/2001 → 01/11/2004
Number of participants: 5
Phd Student: Folsø, Rasmus (Intern)
Main Supervisor: Jensen, Jørgen Juncher (Intern)
Examiner: Bastrup, Jan (Intern)
Birmingham, Richard (Ekstern)
Petersen, Jakob Buus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Belastningsudjævning og driftsoptimering FJV

Department of Mechanical Engineering
Period: 22/04/2001 → 31/12/2004
Number of participants: 2
Project ID: 75208
Project participant: Carlsen, Henrik (Intern)
Project Manager, organisational: Bøhm, Benny (Intern)

Financing sources
Source: Forskningsprojekter - Miljø- og Energiministeriet
Name of research programme: Forskningsprojekter - Miljø- og Energiministeriet
Amount: 688,000.00 Danish Kroner
Project

Dampblade

Department of Mechanical Engineering
Period: 06/04/2001 → 31/03/2004
Number of participants: 2
Project ID: 75205
Project participant: Sørensen, Jens Nørkær (Intern)
Project Manager, organisational: Hansen, Martin Otto Laver (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 406,958.00 Danish Kroner
Project

Aerodynamisk modellering af vindmøllevinge

Department of Mechanical Engineering
Period: 01/04/2001 → 28/09/2005
Number of participants: 7
Phd Student:
Reck, Mads (Intern)
Supervisor:
Michelsen, Jess (Intern)
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Hansen, Martin Otto Laver (Intern)
Examiner:
Thomsen, Per Grove (Intern)
Fuchs, Laszlo (Ekstern)
Sørensen, Niels N. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering
Project: PhD

Application of conditional waves as critical episodes for extreme loads on marine structures

Department of Mechanical Engineering
Period: 01/04/2001 → 21/01/2005
Number of participants: 6
Phd Student:
Dietz, Jesper Skjoldager (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Friis-Hansen, Peter (Intern)
Examiner:
Pedersen, Preben Terndrup (Intern)
Moan, Torgeir (Ekstern)
Torhaug, Rune (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

DELOS

Department of Mechanical Engineering
Period: 02/03/2001 → 31/03/2004
Number of participants: 1
Project ID: 75255
Project Manager, organisational:
Fredsoe, Jørgen (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 1,077,350.00 Danish Kroner
Project

HUMOR

Department of Mechanical Engineering
Period: 02/03/2001 → 31/03/2004
Number of participants: 2
Project ID: 75254
Project participant:
Fredsøe, Jørgen (Intern)
Project Manager, organisational:
Deigaard, Rolf (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 1,068,200.00 Danish Kroner

Project
Indflydelse af anisotropi plasticitet på brudmekanik
Department of Mechanical Engineering
Period: 01/02/2001 → 05/07/2004
Number of participants: 5
Phd Student:
Legarth, Brian Nyvang (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Krenk, Steen (Intern)
Jensen, Henrik Myhre (Intern)
Lemaitre, Jean (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering

Project: PhD
Micro Total Analysis Systems
Fluid Mechanics
Department of Mechanical Engineering
Department of Micro- and Nanotechnology
Period: 08/01/2001 → 01/08/2005
Number of participants: 1
Project ID: 75180
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 815,000.00 Danish Kroner

Project
Syntese af produktarkitekturer
Department of Mechanical Engineering
Period: 01/01/2001 → 08/11/2006
Number of participants: 6
Phd Student:
Harlou, Ulf (Intern)
Supervisor:
Andreasen, Mogens Myrup (Intern)
Main Supervisor:
Mortensen, Niels Henrik (Intern)
Examiner:
Riitahuhta, Asko (Intern)
FINANCING SOURCES
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

WASP-ENGINEERING (WEng) COURSES
Department of Wind Energy
Resource Assessment Modelling
Risø National Laboratory for Sustainable Energy
Meteorology
Department of Mechanical Engineering
Period: 01/01/2001 → 31/12/2017
Number of participants: 6
site assessment, wind engineering, wind energy, meteorology, turbulence, extreme winds, site suitability, IEC standards
Acronym: WEng-courses
Project participant:
Nielsen, Morten (Intern)
Kelly, Mark C. (Intern)
Berg, Jacob (Intern)
Sempreviva, Anna Maria (Intern)
Ejsing Jørgensen, Hans (Intern)
Mann, Jakob (Intern)

SYNOPSIS
Department of Management Engineering
Manufacturing Engineering
Department of Mechanical Engineering
Period: 01/12/2000 → 01/06/2006
Number of participants: 4
Project participant:
Jørgensen, Ulrik (Intern)
Yoshinaka, Yutaka (Intern)
Project Manager, organisational:
Clausen, Christian (Intern)
McAloone, Tim C. (Intern)

FINANCING SOURCES
Source: Forsk. Andre statslige danske i øvrigt
Name of research programme: Forsk. Andre statslige danske i øvrigt
Amount: 400,000.00 Danish Kroner
Project

SMALL-SCALE CHP PLANT ON A HERMITIC FOUR CYLINDER STIRLING ENGINE FOR BIOMASS FUELS
Department of Mechanical Engineering
Period: 13/10/2000 → 31/12/2004
Number of participants: 1
Project ID: 75143
Project Manager, organisational:
Carlsen, Henrik (Intern)
Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,750,000.00 Danish Kroner
Project

**Strukturel design af vægtkritiske konstruktioner**
Department of Mechanical Engineering
Period: 01/09/2000 → 21/01/2005
Number of participants: 6
Phd Student:
Berggreen, Christian (Intern)
Supervisor:
Pedersen, Preben Terndrup (Intern)
Main Supervisor:
Cerup-Simonsen, Bo (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Carlsson, Leif A. (Intern)
Sørensen, Bent F. (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Strømning i industrielle procesanlæg**
Department of Mechanical Engineering
Period: 15/08/2000 → 12/02/2004
Number of participants: 8
Phd Student:
Ullum, Thorvald Uhrskov (Intern)
Supervisor:
Lind, Leif (Ekstern)
Meyer, Knud Erik (Intern)
Finderup Nielsen, Niels (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Jacobsen, Chr. Hau (Intern)
Tropea, Cam (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Air Pollutant Emissions from Rail and Ship Transport**
Department of Mechanical Engineering
Period: 01/08/2000 → 26/02/2004
Number of participants: 6
Phd Student:
Georgakaki, Aliki (Intern)
Supervisor:
Kronbak, Jacob (Intern)
Main Supervisor:
Sorenson, Spencer C (Intern)
Examiner:
Schramm, Jesper (Intern)
Jensen, Steen Solvang (Ekstern)
Samaras, Zissis (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Implementering af en procesmodel til identifikation, styring og simulering af lysbuesvejseprocessen ved anvendelse af kunstig intelligens
Department of Mechanical Engineering
Period: 01/08/2000 → 26/02/2004
Number of participants: 6
Phd Student:
Christensen, Kim Hardam (Intern)
Supervisor:
Klaæstrup Kristensen, Jens (Intern)
Main Supervisor:
Sørensen, Torben (Intern)
Examiner:
Holm, Hans (Ekstern)
Bro, Carsten (Ekstern)
Lucas, William (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Personalized ventilation
Department of Mechanical Engineering
Period: 01/08/2000 → 21/10/2003
Number of participants: 5
Phd Student:
Kaczmarczyk, Jan (Intern)
Supervisor:
Fanger, Povl Ole (Intern)
Main Supervisor:
Melikov, Arsen Krikor (Intern)
Examiner:
Holmér, Ingvar (Ekstern)
Toftum, Jørn (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Effect of Anisotropic Plasticity on Frac
Solid Mechanics
Department of Mechanical Engineering
Period: 28/07/2000 → 31/12/2004
Number of participants: 1
Project ID: 75009
Project participant:
Tvergaard, Viggo (Intern)
MONITUS
Maritime Engineering
Department of Mechanical Engineering
Period: 10/07/2000 → 28/02/2005
Number of participants: 2
Project ID: 75061
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Jensen, Jørgen Juncher (Intern)

Limiting Criteria for Human Exposure to Low Humidity
Indoor Environment
Department of Mechanical Engineering
Period: 18/05/2000 → 31/12/2003
Number of participants: 2
Project ID: 75137
Project participant:
Clausen, Geo (Intern)
Project Manager, organisational:
Fanger, Povl Ole (Intern)

Crashcoaster
Department of Mechanical Engineering
Period: 01/05/2000 → 01/05/2004
Number of participants: 2
Project ID: 75060
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 1,800,000.00 Danish Kroner
Project

Financing sources
Source: Forskningsprojekter - Erhvervsministeriet
Name of research programme: Forskningsprojekter - Erhvervsministeriet
Amount: 5,678,496.00 Danish Kroner
Project

Financing sources
Source: Sam.arb.aftaler - Udenlandske offentlige og private
Name of research programme: Sam.arb.aftaler - Udenlandske offentlige og private
Amount: 975,000.00 Danish Kroner
Project

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 819,144.00 Danish Kroner
Project
Flow Boiling of Pure and Oil Contaminated Carbon Dioxide as Refrigerant With focus on heat transfer and pressure drop

Department of Mechanical Engineering
Period: 01/05/2000 → 02/02/2004
Number of participants: 5
Phd Student:
Mohamed Hassan, Mohamed Abdel-Rahman (Ekstern)
Main Supervisor:
Knudsen, Hans-Jørgen Høgaard (Intern)
Examiner:
Paul, Joachim (Intern)
Radwan, Mohsen S. (Ekstern)
Rasmussen, Bjarne Dindler (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Privatist
Project: PhD

Measurement and modelling of stress distributions and failure in finite structures
Danish Research Academy-financed project 9901360 (Materials Science)

Department of Solid Mechanics
Department of Manufacturing Engineering
Department of Chemical Engineering
Period: 01/05/2000 → 01/01/9999
Number of participants: 3
Project participant:
Somers, Marcel A. J. (Intern)
Horsewell, Andy (Intern)
Project Manager, organisational:
Jensen, Henrik Myhre (Intern)

Financing sources
Source: Unknown
Name of research programme: Uendt
Amount: 3,000,000.00 Danish Kroner
Project

Design of crashworthy ship structures
Department of Mechanical Engineering
Period: 15/03/2000 → 23/10/2003
Number of participants: 6
Phd Student:
Toernqvist, Rikard (Intern)
Supervisor:
Cerup-Simonsen, Bo (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Atkins, Tony (Ekstern)
Langseth, Magnus (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønned stipendie
Project: PhD
HARDER

Energy Engineering

Department of Mechanical Engineering
Period: 07/03/2000 → 31/05/2003
Number of participants: 2
Project ID: 75057
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,943,862.00 Danish Kroner

Project

Stor-skala kystmorfolologisk modellering

Department of Mechanical Engineering
Period: 01/03/2000 → 31/12/2002
Number of participants: 3
Phd Student:
Petersen, Dorthe Pia (Intern)
Supervisor:
Fredøe, Jørgen (Intern)
Main Supervisor:
Deigaard, Rolf (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Kyst- og tidevandsløb

Department of Mechanical Engineering
Period: 11/02/2000 → 01/12/2005
Number of participants: 2
Project ID: 75249
Project participant:
Predisøe, Jørgen (Intern)
Project Manager, organisational:
Deigaard, Rolf (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 3,000,000.00 Danish Kroner
Project

Måling af turbulens og strømningsstrukturer med PIV

Department of Mechanical Engineering
Period: 01/02/2000 → 27/06/2003
Number of participants: 6
Phd Student:
Pedersen, Jakob Martin (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Meyer, Knud Erik (Intern)
Examiner:
Sumer, B. Mutlu (Intern)
George, William K (Intern)
Westergaard, Carsten Hein (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Smøring og slid ved anvendelse af dimetylæter (DME) i dieselmotorer
Department of Mechanical Engineering
Period: 01/02/2000 → 02/12/2003
Number of participants: 6
Phd Student: Sivebæk, Ion Marius (Intern)
Supervisor: Jakobsen, Jørgen (Intern)
Main Supervisor: Sorenson, Spencer C (Intern)
Examiner: Klit, Peder (Intern)
Jacobson, Bo Olov (Ekstern)
Lacey, Paul I. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

ARTEMIS
Department of Mechanical Engineering
Period: 28/01/2000 → 31/03/2005
Number of participants: 2
Project ID: 75127
Project participant: Carlsen, Henrik (Intern)
Project Manager, organisational: Sorenson, Spencer C (Intern)

Financing sources
Source: Forsk. EU - Rammeprogram
Name of research programme: Forsk. EU - Rammeprogram
Amount: 2,545,706.00 Danish Kroner
Project

Identifikation ved dybtrækning
Department of Mechanical Engineering
Period: 01/01/2000 → 20/01/2004
Number of participants: 5
Phd Student: Dornonville de la Cour, Dorthe (Intern)
Main Supervisor: Pedersen, Pauli (Intern)
Examiner: Olhoff, Niels (Intern)
Nielsen, Karl Brian (Ekstern)
Ottosen, Niels Saabye (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Product/service-systems
This research project describes the efforts made in the direction of service-oriented product development, and has phd-projects, final year projects, industry research collaboration and teaching activities within it.

Department of Mechanical Engineering
Period: 01/01/2000 → 01/01/2014
Number of participants: 5
Acronym: PSS
Project participant:
Andreasen, Mogens Myrup (Intern)
Tan, Adrian Ronald (Intern)
Matzen, Detlef (Intern)
Bey, Niki (Intern)

Project Manager, organisational:
McAloone, Tim C. (Intern)

Financing sources
Source: Udenfor rammen
Name of research programme: Ukendt
Project

Probabilistic Concept for Assessing the Damage Stability of Ships

Department of Mechanical Engineering
Period: 01/12/1999 → 15/10/2003
Number of participants: 5
PhD Student:
Ravn, Erik Sonne (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Bastrup, Jan (Intern)
Kristensen, Hans Otto Holmegaard (Intern)
Papanikolaou, Apostolos D. (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden EU-finansiering
Project: PhD

Vinddatabase

Fluid Mechanics

Department of Mechanical Engineering
Period: 26/11/1999 → …
Number of participants: 2
Project ID: 75120
Project participant:
Sørensen, Jens Nørkær (Intern)
Project Manager, organisational:
Hansen, Kurt Schaldemose (Intern)

Financing sources
Source: Sam.arb.aftaler - Statslige danske
Damping generated by local pulse like energy dissipation

Department of Mechanical Engineering
Period: 15/11/1999 → 27/06/2003
Number of participants: 5
PhD Student:
Lazarov, Boyan Stefanov (Intern)
Main Supervisor:
Ditlevsen, Ove Dalager (Intern)
Examiner:
Friis-Hansen, Peter (Intern)
Lindgren, Georg (Ekstern)
Næss, Arvid (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsfinansiering
Project: PhD

Fluid morfologi

Department of Mechanical Engineering
Period: 01/10/1999 → 26/03/2004
Number of participants: 5
PhD Student:
Niemann, Sanne Lina (Intern)
Main Supervisor:
Fredsøe, Jørgen (Intern)
Examiner:
Madsen, Per A. (Intern)
Foster, Diane (Ekstern)
Nelson, Jonathan (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Matematisk/numerisk modellering af uregelmæssige ikke-lineære vandbølger

Department of Mechanical Engineering
Period: 01/10/1999 → 28/03/2003
Number of participants: 6
PhD Student:
Bredmose, Henrik (Intern)
Supervisor:
Schäffer, Henning Andreas (Intern)
Main Supervisor:
Madsen, Per A. (Intern)
Examiner:
Aage, Christian (Intern)
Liu, Philip L.-F. (Ekstern)
Rasmussen, Jens Juul (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
**Ikke-lokal modellering af materialer**

Department of Mechanical Engineering  
Period: 01/09/1999 → 14/01/2003  
Number of participants: 5  
Phd Student:  
Niordson, Christian Frithiof (Intern)  
Main Supervisor:  
Tvergaard, Viggo (Intern)  
Examiner:  
Jensen, Henrik Myhre (Intern)  
Fleck, Norman A. (Ekstern)  
Sørensen, Niels Jakob (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  

**Modellering og regulering af fordampere**

Department of Mechanical Engineering  
Period: 01/09/1999 → 15/10/2003  
Number of participants: 5  
Phd Student:  
Jensen, Jakob Munch (Intern)  
Supervisor:  
Conrad, Finn (Intern)  
Main Supervisor:  
Knudsen, Hans-Jørgen Høgaard (Intern)  
Examiner:  
Rasmussen, Bjarne Dindler (Intern)  
Åström, Karl Johan (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  

**Numerical modelling of scour protection layer**

Department of Mechanical Engineering  
Period: 01/09/1999 → 10/04/2003  
Number of participants: 5  
Phd Student:  
Truelsen, Christoffer (Intern)  
Supervisor:  
Fredsøe, Jørgen (Intern)  
Main Supervisor:  
Sumer, B. Mutlu (Intern)  
Examiner:  
Brørs, Bård (Ekstern)  
Whitehouse, Richard J. S. (Ekstern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Programbevilling  

Topology optimization of non-linear compliant systems

Department of Mechanical Engineering  
Period: 01/09/1999 → 18/02/2003  
Number of participants: 6  
Phd Student:  
Buhl, Thomas (Intern)  
Supervisor:  
Sigmund, Ole (Intern)  
Main Supervisor:  
Pedersen, Pauli (Intern)  
Examiner:  
Olhoff, Niels (Intern)  
Bestle, Dieter (Ekstern)  
Bletzinger, Kai-Uwe (Ekstern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD

Development and design of pressure control valves for oil hydraulic systems.

The objectives are analysis, modelling, simulation, development and design of intelligent two stage pressure control valves for oil hydraulic control systems. Concepts with poppet valve and concepts with spool valve are undertaken for evaluation and validation. Results will be used as a platform for development and design of a tap water hydraulic two stage pressure control valve. Joint venture research project with professor Jacek Stecki, Dept. of Mechanical Eng., Monash Univ., Melbourne, Australia.

Department of Control and Engineering Design  
Department of Mechanical Engineering  
Monash University  
Period: 01/08/1999 → 31/12/2001  
Number of participants: 2  
Project participant:  
Stecki, Jacek (Ekstern)  
Project Manager, organisational:  
Conrad, Finn (Intern)  
Project

Incompressible Boundary Layer Instability and Transition

Department of Mechanical Engineering  
Period: 01/07/1999 → 15/09/2004  
Number of participants: 6  
Phd Student:  
Hjort, Søren (Intern)  
Supervisor:  
Michelsen, Jess (Intern)  
Main Supervisor:  
Sørensen, Jens Nørkær (Intern)  
Examiner:  
Thomsen, Per Grove (Intern)  
Henningsson, Dan (Ekstern)  
Sørensen, Niels N. (Intern)  

Financing sources  
Source: Internal funding (public)  
Name of research programme: DTU-lønnet stipendie  
Project: PhD
Topology Optimization of Non-linear Structures
Department of Mechanical Engineering
Period: 01/07/1999 → 18/11/2002
Number of participants: 7
PhD Student:
Pedersen, Claus B. Wittendorf (Intern)
Supervisor:
Bendsøe, Martin P. (Intern)
Sigmund, Ole (Intern)
Main Supervisor:
Pedersen, Pauli (Intern)
Examiner:
Lund, Erik (Ekstern)
Diaz, Alejandro Rafael (Intern)
Nilsson, Larsgunnar (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Bestemmelse af bølge overskylninger på skibe
Department of Mechanical Engineering
Period: 01/06/1999 → 21/10/2003
Number of participants: 7
PhD Student:
Nielsen, Kristian Bendix (Intern)
Supervisor:
Andersen, Poul (Intern)
Mayer, Stefan (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Buchner, Bastiaan (Ekstern)
Christensen, Erik Damgaard (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Ansat eksternt
Project: PhD

Computational Hydrodynamics / rammeprogram
Department of Mechanical Engineering
Period: 26/04/1999 → 31/12/2006
Number of participants: 2
Project ID: 75266
Project participant:
Cerup-Simonsen, Bo (Intern)
Project Manager, organisational:
Madsen, Per A. (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 18,100,000.00 Danish Kroner
Project
FREJA materialemøddinger

Department of Mechanical Engineering
Period: 20/04/1999 → 31/12/2004
Number of participants: 2
Project ID: 75005
Project participant:
Tvergaard, Viggo (Intern)
Project Manager, organisational:
Richelsen, Ann Bettina (Intern)

Financing sources
Source: Forskningsrådene - Andre
Name of research programme: Forskningsrådene - Andre
Amount: 4,000,000.00 Danish Kroner
Project

Minimering af friktionstab i 2-takt skibsdielsemotor

Department of Mechanical Engineering
Period: 01/04/1999 → 06/12/2002
Number of participants: 7
Phd Student:
Vølund, Anders (Intern)
Supervisor:
Jacobson, Bo Olov (Ekstern)
Knudsen, Thomas (Ekstern)
Main Supervisor:
Klit, Peder (Intern)
Examiner:
Frêné, Jean (Ekstern)
Thomsen, Klaus K. (Ekstern)
Wachtmeister, Georg (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Computational Hydrodynamics

Department of Mechanical Engineering
Period: 11/03/1999 → 31/12/2006
Number of participants: 1
Project ID: 75247
Project Manager, organisational:
Fredsøe, Jørgen (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 3,170,000.00 Danish Kroner
Project

Model af traditionel medstrømsforgasser

Energy Engineering
Department of Mechanical Engineering
Period: 02/02/1999 → 31/12/2002
Number of participants: 2
Rational design of light-weight structures for accidental loads
Department of Mechanical Engineering
Period: 01/02/1999 → 16/07/2003
Number of participants: 6
Phd Student:
Urban, Jesper (Intern)
Supervisor:
Pedersen, Preben Terndrup (Intern)
Main Supervisor:
Cerup-Simonsen, Bo (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Abramowicz, Wlodek (Ekstern)
Amdahl, Jørgen (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Wave boundary layer over a porous bed
Department of Mechanical Engineering
Period: 01/02/1999 → 02/12/2003
Number of participants: 7
Phd Student:
Buxbom, Iris Pernille (Intern)
Supervisor:
Christensen, Erik Damgaard (Intern)
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Hansen, Martin Otto Laver (Intern)
Davies, Allan (Ekstern)
Myrhaug, Dag (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Strømning og erosion omkring moler
Department of Mechanical Engineering
Period: 01/01/1999 → 15/10/2003
Number of participants: 6
Phd Student:
Gislason, Kjartan (Intern)
Supervisor:
Sumer, B. Mutlu (Intern)
Main Supervisor:
Fredsøe, Jørgen (Intern)
Examiner:
Madsen, Per A. (Intern)
Hansen, Erik Asp (Ekstern)
Losada, Miguel (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Dual fuel Brændersimulering**
Department of Mechanical Engineering
Period: 15/12/1998 → 31/05/2001
Number of participants: 2
Phd Student:
Hostrup, Astrid Jørdis Kuijers (Intern)
Main Supervisor:
Houbak, Niels (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Køleprofessor**
Energy Engineering
Department of Mechanical Engineering
Period: 14/12/1998 → 12/05/2005
Number of participants: 2
Project ID: 75094
Project participant:
Carlsen, Henrik (Intern)
Project Manager, organisational:
Paul, Joachim (Intern)

**Financing sources**
Source: Sam arb aftaler, Private danske - Andre virksomheder
Name of research programme: Sam arb aftaler, Private danske - Andre virksomheder
Amount: 1,780,000.00 Danish Kroner

**Accidental load modelling for ship structures**
Department of Mechanical Engineering
Period: 01/09/1998 → 30/05/2002
Number of participants: 5
Phd Student:
Lützen, Marie (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)
Kristensen, Hans Otto Holmegaard (Intern)
Papanikolaou, Apostolos D. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Modelling and estimation of damping in non-linear random vibration**
Department of Mechanical Engineering
Period: 01/09/1998 → 18/02/2003
Number of participants: 5
Phd Student:
Rüdinger, Finn (Intern)
Main Supervisor:
Krenk, Steen (Intern)
Examiner:
Nielsen, Søren R. K. (Ekstern)
Lindgren, Georg (Ekstern)
Naess, Arvid (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

**Multi-scale Representations in Design Optimization**
Department of Mechanical Engineering
Number of participants: 7
Phd Student:
Poulsen, Thomas Agersten (Intern)
Supervisor:
Bendsøe, Martin P. (Intern)
Pedersen, Pauli (Intern)
Main Supervisor:
Sigmund, Ole (Intern)
Examiner:
Lund, Erik (Ekstern)
Petersson, Joakim (Ekstern)
Soto, Ciro A. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

**Aeroelastisk analyse af vindmøllerotor**
Department of Mechanical Engineering
Period: 01/08/1998 → 05/12/2002
Number of participants: 6
Phd Student:
Gaunaa, Mac (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Meyer, Stefan (Intern)
Nim, Erik (Intern)
Walther, Jens Honore (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Simulering af DME forbrænding i Dieselmotorer

Department of Mechanical Engineering
Period: 01/08/1998 → 11/01/2005
Number of participants: 2
Phd Student:
Bek, Bjarne Hjort (Intern)
Main Supervisor:
Sorenson, Spencer C (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Kulbrinteemmisioner fra naturgasmotorer

Department of Mechanical Engineering
Period: 01/06/1998 → 24/05/2002
Number of participants: 7
Phd Student:
Jensen, Torben Kvist (Intern)
Supervisor:
Houbak, Niels (Intern)
Sorenson, Spencer C (Intern)
Main Supervisor:
Schramm, Jesper (Intern)
Examiner:
Henningsen, Svend (Ekstern)
Glarborg, Peter (Intern)
Odaka, Matsuo (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Aerodynamisk modellering af vindmøller

Department of Mechanical Engineering
Period: 01/05/1998 → 12/02/2004
Number of participants: 5
Phd Student:
Mikkelsen, Robert Flemming (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Examiner:
Andersen, Poul (Intern)
Aagaard Madsen, Helge (Intern)
Masson, Christian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: **Forskningsrådsstipendium**  
Project: PhD

**Skibspropellere i medstrømsfelt**

Department of Mechanical Engineering  
Period: 01/05/1998 → 09/07/2002  
Number of participants: 5  
Phd Student:  
Olsen, Anders Smærup (Intern)  
Main Supervisor:  
Andersen, Poul (Intern)  
Examiner:  
Sørensen, Jens Nørkær (Intern)  
Andersen, Svend Vogt (Ekstern)  
Rutgersson, Olle (Ekstern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Eksternt EU-finansieret  
Project: PhD

**Ventilationsfiltres indflydelse på den oplevede luftkvalitet**

Department of Mechanical Engineering  
Period: 01/05/1998 → 03/12/2001  
Number of participants: 6  
Phd Student:  
Alm, Ole Martin (Intern)  
Supervisor:  
Clausen, Geo (Intern)  
Main Supervisor:  
Fanger, Povl Ole (Intern)  
Examiner:  
Olesen, Bjarne W. (Intern)  
Pejtersen, Jan (Intern)  
Sundell, Jan (Intern)

**Financing sources**
Source: Internal funding (public)  
Name of research programme: Ansat eksternt  
Project: PhD

**Biologiske smøreolier**

Department of Mechanical Engineering  
Period: 26/03/1998 → 31/12/2004  
Number of participants: 2  
Project ID: 75087  
Project participant:  
Carlsen, Henrik (Intern)  
Project Manager, organisational:  
Schramm, Jesper (Intern)

**Financing sources**
Source: Forsk. Andre offentlige og private - Udenlandske  
Name of research programme: Forsk. Andre offentlige og private - Udenlandske  
Amount: 867,000.00 Danish Kroner  
Project
Damping Mechanisms in Dynamics

Department of Mechanical Engineering
Period: 20/03/1998 → 31/12/2005
Number of participants: 2
Project ID: 75289
Project participant:
Andersen, Poul (Intern)
Project Manager, organisational:
Krenk, Steen (Intern)

Financing sources
Source: Forskningsrådene - STVF
Name of research programme: Forskningsrådene - STVF
Amount: 8,500,000.00 Danish Kroner

Material mechanics and micromechanics
Various projects including studies of damage in metal matrix composites, micromechanical evaluation of characteristic length in ductile fracture, modelling of creep fracture in polycrystalline material under cyclic loading, and the effects of
interaction between micro-porosities of different size on ductile fracture in metals.

Department of Solid Mechanics
Department of Mechanical Engineering

Brown University

Delft University of Technology
Period: 01/01/1998 → 31/12/1999
Number of participants: 3
Project participant:
Needleman, Alan (Ekstern)
vander Giessen, Erik (Ekstern)

Department of Management Engineering
Department of Manufacturing Engineering
Department of Mechanical Engineering
Chemnitz University of Technology
University of Warwick
Bayer AG
Institut für Werkstofftechnik
Fertigungszentrum Mashinenbau GmbH
Rubert & Co. Ltd.

NPL Management Ltd.
Period: 01/12/1997 → 30/11/2000
Number of participants: 3
Project participant:
Andreasen, Jan Lasson (Intern)
Malberg, Maria Pia Sammartini (Intern)

Project Manager, organisational:
De Chiffre, Leonardo (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 800,000.00 Danish Kroner

3D-roughness standards SMT4-CT97-2176

Development and production of calibration standards covering the whole measuring ranges of available instruments in X, Y and Z

Department of Management Engineering
Department of Manufacturing Engineering
Department of Mechanical Engineering
Chemnitz University of Technology
University of Warwick
Bayer AG
Institut für Werkstofftechnik
Fertigungszentrum Mashinenbau GmbH
Rubert & Co. Ltd.

NPL Management Ltd.
Period: 01/12/1997 → 30/11/2000
Number of participants: 3
Project participant:
Andreasen, Jan Lasson (Intern)
Malberg, Maria Pia Sammartini (Intern)

Project Manager, organisational:
De Chiffre, Leonardo (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 800,000.00 Danish Kroner

Forbedret hydrodynamiske grundlag for konstruktion og analyse af propellere med ukonventionel geometri

Department of Mechanical Engineering
Period: 01/10/1997 → 09/04/2001
Number of participants: 5
Phd Student:
Krishnaswamy, Paddy (Intern)
Main Supervisor:
Andersen, Poul (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)
Andersen, Svend Vogt (Ekstern)
Financing sources
Source: Internal funding (public)
Name of research programme: DTU-lønnet stipendie
Project: PhD

Objekt-orienteret simuleringstærkt til dynamisk simulering af energitekniske systemer

Department of Mechanical Engineering
Period: 01/10/1997 → 02/10/2001
Number of participants: 5
Phd Student:
Wagner, Falko Jens (Intern)
Supervisor:
Thomsen, Per Grove (Intern)
Main Supervisor:
Houbak, Niels (Intern)
Examiner:
Madsen, Henrik (Ekstern)
Mølbak, Tommy (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Undersøgelse af strømningsstrukturer i punpegeometrier ved anvendelse af PIV og LES

Department of Mechanical Engineering
Period: 01/09/1997 → 09/04/2001
Number of participants: 3
Phd Student:
Pedersen, Nicholas (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering-SU
Project: PhD

Morfologisk modellering i brændingszonen

Department of Mechanical Engineering
Period: 01/07/1997 → 27/03/2002
Number of participants: 5
Phd Student:
Drønen, Nils Kjetil (Intern)
Main Supervisor:
Deigaard, Rolf (Intern)
Examiner:
Zyserman, Julio Alejandro (Ekstern)
Holman, Robert A. (Ekstern)
Stive, Marcel (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Development of Product families
Department of Mechanical Engineering
Period: 01/06/1997 → 01/12/2002
Number of participants: 2
Phd Student:
Pedersen, Per Erik Elgård (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Residualspændinger i varmvalsende plader
Department of Mechanical Engineering
Period: 01/06/1997 → 28/03/2001
Number of participants: 7
Phd Student:
Fuglsang, Lars (Intern)
Supervisor:
Kierkegaard, Henning (Ekstern)
Richelsen, Ann Bettina (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Hattel, Jesper Henri (Intern)
Jensen, Bent (Ekstern)
Lindgren, Lars-Erik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Intermediate Scale Coastal Behaviour (NICOP)
The project aims to achieve better understanding and predictions of coastal behaviour at intermediate (event, season, year, decade) scales.
Department of Hydrodynamics and Water Resources
Department of Mechanical Engineering
University of Plymouth
DHI Denmark
University of Twente
Hydraulic Research Wallingford
Period: 01/05/1997 → 30/04/2001
Number of participants: 3
Project participant:
Fredsoe, Jorgen (Intern)
Drønen, Nils Kjetil (Intern)
Project Manager, organisational:
Deigaard, Rolf (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
**3-dimensional struktur i bølgenoucerede strømninger**

Department of Mechanical Engineering  
Period: 01/04/1997 → 01/12/2000  
Number of participants: 3  
Phd Student:  
Frederiksen, Jørgen Hansgaard (Intern)  
Supervisor:  
Mayer, Stefan (Intern)  
Main Supervisor:  
Deigaard, Rolf (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Selvfinansierende (privatist)  
Project: PhD

**Computational and Experimental Prediction of Indoor Environmental Quality**

Department of Mechanical Engineering  
Period: 01/04/1997 → 15/03/2002  
Number of participants: 7  
Phd Student:  
Voigt, Lars Peter Kølgaard (Intern)  
Supervisor:  
Melikov, Arsen Krikor (Intern)  
Nielsen, Peter Vilhelm (Ekstern)  
Main Supervisor:  
Sørensen, Jens Nørkær (Intern)  
Examiner:  
Clausen, Geo (Intern)  
Davidson, Lars (Ekstern)  
Olesen, Bjarne W. (Intern)

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: Forskningsrådsstipendium  
Project: PhD

**EFFORTS - Enhanced framework for forging design using reliable three-dimensional simulation**

Brite-Euram project with 10 partners focusing on development of the finite element method to 3D problems for the application as a process and product development and quality assurance system related to metal forming production. Research work at IPT is associated with development of realistic constitutive laws describing: 1. the material behaviour in cold forming operations involving non-linear strain paths, 2. the tool/workpiece interface conditions as regards friction in cold as well as warm forging and heat transfer in warm forging. Furthermore IPT has the task to verify 3-D FEM analyses of forging simple primitives as well as complex industrial components.

Department of Management Engineering  
Manufacturing Engineering  
Department of Mechanical Engineering  
ARMINES-CEMEF  
DIMEG  
KTH - Royal Institute of Technology  
Transvalor
RATEC
SIFCOR
Teksid S.p.A
DELCAM
TA Hydronics A/S
Period: 01/04/1997 → 31/03/2000
Number of participants: 11
Project participant:
Wanheim, Tarras (Intern)
Eriksen, Morten (Intern)
Lindegren, Maria (Intern)
Andreasen, Jan Lasson (Intern)
Tan, Xincai (Intern)
Post-Pedersen, Bente (Intern)
Wibom, Ole (Intern)
Henningsen, Poul (Intern)
Christensen, Thomas Vennick (Intern)
Olsson, David Dam (Intern)
Project Manager, organisational:
Bay, Niels Oluf (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 2,300,000.00 Danish Kroner

Shoreface Sedimenttransport
Department of Mechanical Engineering
Period: 01/04/1997 → 21/09/2001
Number of participants: 5
Phd Student:
Madsen, Erik Østergaard (Intern)
Main Supervisor:
Fredøe, Jørgen (Intern)
Examiner:
Deigaard, Rolf (Intern)
Foster, Diane (Ekstern)
Vriend, Huib J. de (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Undersøgelse af Strømning
Department of Mechanical Engineering
Period: 01/03/1997 → 15/01/1998
Number of participants: 2
Phd Student:
Rasmussen, Christian (Intern)
Main Supervisor:
Houbak, Niels (Intern)

Financing sources
Source: Internal funding (public)
Forbedret beskrivelse af skibes ...

Department of Mechanical Engineering
Period: 01/02/1997 → 21/06/2000
Number of participants: 3
Phd Student:
Simonsen, Claus Daniel (Intern)
Main Supervisor:
Andersen, Poul (Intern)
Examiner:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)

Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Modular engineering for production plants

Department of Mechanical Engineering
Period: 01/02/1997 → 01/01/2001
Number of participants: 6
Phd Student:
Miller, Thomas Dedenroth (Intern)
Supervisor:
Michelsen, Aage U (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)
Examiner:
Gade, Niels (Ekstern)
Riitahuhta, Asko (Ekstern)
Sanchez, Ron (Ekstern)

Financing sources
Source: Internal funding (public)

Name of research programme: Erhvervsforskerordningen
Project: PhD

Multi-Parameter Linear Periodic Systems, Stability Analysis and Applications

For stability analysis of linear periodic systems with more than one degree of freedom, the Floquet method is a general and valuable practical method. In a multi-parameter periodic systems repeated numerical integration may be a limiting factor, and effective sensitivity analysis is therefore needed.

Department of Solid Mechanics

Department of Mechanical Engineering
Period: 01/02/1997 → 01/01/9999
Number of participants: 3
Project participant:
Solem, Frederik (Ekstern)
Seyranian, Alexander P. (Ekstern)
Project Manager, organisational:
Pedersen, Pauli (Intern)

Plate Forming by Line Heating

Department of Mechanical Engineering
Field investigations of transport and fate of pesticides in a sandy aquifer
The behaviour of selected pesticides will be studied in the field e.g. migration, sorption, and degradation. A continuous injection experiment has been conducted for ambient flow gradients in an aerobic sandy aquifer. Hydrological and geochemical characteristics of the aquifer are already known. The microbiological and sorption characteristics of the aquifer will be characterized. Selected pesticides and conservative tracer will continuously be injected for a period of 0.5-1 year. Multilevel samplers installed downstream of the injection will be monitored frequently during a period of about two years. The experiment will be evaluated based on: (1) breakthrough curves at sampling points downstream of the injection and (2) reactive solute transport simulation of the pesticide plume using a model developed and evaluated in this project. From the breakthrough data, dilution, sorption, and degradation can be determined and field degradation rates calculated. The spatial distribution of the pesticide plume will be determined by synoptic sampling at all monitoring points (2-3 times). The field investigation will be planned in detail autumn 1997. The project is made in collaboration with GEUS and Department of Hydrodynamics and Water resources (ISVA). The project is funded by The Danish Environmental Research Programme. The project period is 1997-1999.

Department of Environmental Science and Engineering
Department of Hydrodynamics and Water Resources
Department of Environmental Engineering
Department of Mechanical Engineering

Modelling of multipass rolling
Numerical analysis of multi pass cold rolling of commercial purity aluminium is performed. The focus is on the influence of the roll gap geometry and the reduction sequence on the residual stress and strain distributions.

Department of Solid Mechanics
The way in which the industry has involved the human resources in production systems, has changed in last decades. Previously the human resources were mainly considered as means to link together the technical systems, while today they are key resources responsible for development, planning and production. This development has been a continuous process, and it has been supported by several research- and development projects in cooperation with Danish Industry, COindustry and The Technical University of Denmark. MERIP (Human resources in production) is a continuation of this type of projects, aiming at increasing the competitive power of the companies. However MERIP scientists want to involve the human resources in the production in new ways. Therefore the objective of the project is to develop methods for design of production systems, that use every possibility in human resources supported by the technology aiming at increasing the competitive power of the companies. The project has contact to a number of companies who contribute with data about construction and function of their production systems. Those "Case-companies" will form an important basis for the development of production systems, and they will function as sparring partners for the project. MERIP will in this way be able to inform the industry about new ways in development of production systems - and suggest how the industry could prepare themselves for competitive production systems of the future. A production system is surrounded by groups of partners with different interests in the design of the system. The interests sets the boundaries for the production system. Based on an analysis of these interests the production system will be designed on four subjects, · The structuring of production tasks, · Competence, · Technology · Information
production tasks, · Competence, · Technology · Information

Department of Management Engineering

Department of Applied Engineering Design and Production

Department of Mechanical Engineering

The Royal Danish School of Educational Studies

Copenhagen Business School

University of Copenhagen
Number of participants: 4
Project participant:
Jacobsen, Peter (Intern)
Knudsen, Mads Kristian Lund (Intern)
Rudolph, Carsten (Intern)

Project Manager, organisational:
Alting, Leo (Intern)

Financing sources
Source: Unknown
Name of research programme: U Fen
Amount: 7,500,000.00 Danish Kroner
Project

Computersimuleringer og fysiske overvejelser i granulære mediers stokastiske mekanik

Department of Mechanical Engineering
Period: 01/10/1996 → 10/01/2002
Number of participants: 5
Phd Student:
Bernts, Kasper Nikolaj (Intern)
Main Supervisor:
Ditlevsen, Ove Dalager (Intern)
Examiner:
Krenk, Steen (Intern)
Herrmann, Hans Jürgen (Ekstern)
Jensen, Mogens Høgh (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Styring og diagnostisering af ikke lineære systemer

Department of Mechanical Engineering
Period: 01/10/1996 → 01/10/1996
Number of participants: 2
Phd Student:
Jensen, Kim (Intern)
Main Supervisor:
Christensen, Georg Kronborg (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Udvikling af metoder og systemer til planlægning og styring af decentrale kraftvarmekærer
**Fluid-Structure interaction**

Department of Mechanical Engineering  
Period: 01/09/1996 → 17/12/1999  
Number of participants: 4  
Phd Student: 
Hansen, Morten Hartvig (Intern)  
Supervisor: 
Sørensen, Jens Nørkær (Intern)  
Main Supervisor: 
Thomsen, Jon Jucl (Intern)  
Examiner: 
Jensen, Jørgen Juncher (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-Su Stipendium, Eksperiment  
Project: PhD

**Hydroelasticity of high speed ships**

Department of Mechanical Engineering  
Number of participants: 2  
Phd Student: 
Wang, Zhaohui (Intern)  
Main Supervisor: 
Jensen, Jørgen Juncher (Intern)  

**Financing sources**  
Source: Internal funding (public)  
Name of research programme: DTU-Su Stipendium, Eksperiment  
Project: PhD

**Simulering og identifikation af strukturer i komplexe fluidstrømninger**

Department of Mechanical Engineering  
Period: 01/09/1996 → 26/03/2000  
Number of participants: 7  
Phd Student: 
Jørgensen, Bo Hoffmann (Intern)  
Supervisor: 
Brøns, Morten (Intern)  
Larsen, Rasmus (Intern)  
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Examiner:
Meyer, Knud Erik (Intern)
Mann, Jakob (Ekstern)
Veldman, A.E.P. (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Mathematical/Numerical modelling of 3D-flow and scour around marine structures**
Department of Mechanical Engineering
Period: 01/08/1996 → 15/09/2000
Number of participants: 6
Phd Student:
Roulund, Andreas (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Deigaard, Rolf (Intern)
Nilsson-Tillgren, Torsten (Ekstern)
Simons, Richard (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Numerisk simulering af industrielle strømninger**
Department of Mechanical Engineering
Period: 01/07/1996 → 30/03/2001
Number of participants: 3
Phd Student:
Myllerup, Lisbeth (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Hansen, Martin Otto Laver (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Blandet Finansiering-SU
Project: PhD

**Simulation of multi-phase and reactive transport in heterogeneous aquifers**
The project uses supercomputing on UNI-C's IBM SP2/40 machine. This allows for detailed long-term simulations with numerical mesh sizes that retains the heterogeneous physical and chemical properties of groundwater aquifers. Non-linear effects of the correlation structure between the physical and chemical properties on transport can then be explored and quantified.

Department of Hydrodynamics and Water Resources
Department of Mechanical Engineering

UNI-C
Period: 01/07/1996 → 31/12/1999
Number of participants: 2
The Mechanics of Ship Collisions
Department of Mechanical Engineering
Period: 01/07/1996 → 21/06/1999
Number of participants: 3
Phd Student:
Zhang, Shengming (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Blandet Finansiering-SU
Project: PhD

Development of End-fitting for the NKT Flexible Pipe
The flexible pipes studied in this project are designed for transportation of fluids like oil and gas under high pressure. Pipes used for transportation of fluid from seabed to sea level are called risers, while pipes placed on the seabed are called flowlines. Flowlines and risers are designed slightly differently due to the different loadings. While the risers are designed for dynamic loadings, the flowlines may appear as a static loaded construction. In addition to the static loading, the risers also undergo hydrodynamic loadings and, due to the flexibility of the pipe, the determination of the load reactions and deformations in the riser is governed by a complex non-linear hydroelastic problem. Especially, self-induced vibrations and complex resonance are considered. The reaction forces from the flexible riser are transferred to the production vessel through the end-fitting, which is designed to transfer these reactions during the expected lifetime of the pipe without occurrence of rupture or lack of sealing. From a scientific point of view, the project contains several difficult problems: 1.Determination of the forces and deformations in a flexible riser undergoing static and dynamic loading. 2.Determination of the stresses and strains in the different layers of a flexible riser. 3.Construction of an end-fitting, which is able to carry the stresses from the different layers in a rational way. 4.Evaluation of the reliability of the end-fitting as regards both extreme loadings and fatigue

Department of Naval Architecture and Offshore Engineering
Department of Mechanical Engineering
Period: 01/05/1996 → 31/10/1999
Number of participants: 1
Project Manager, organisational:
Banke, Lars (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 180,000.00 Danish Kroner
Project:

Social Learning in Multimedia
Social Learning in Multimedia, SLIM is a project under Targeted Socio-Economic Research (TSER) Programme funded by EC, involving 8 national research centres. The web-site is situated in Edinburgh: http://www.ed.ac.uk/~rcss/SLIM/SLIMhome.html. The project has produced national surveys, and will make integrated studies on multimedia in education, in the home, multimedia and cultural content etc.

Department of Technology and Social Sciences
Department of Mechanical Engineering
Period: 01/05/1996 → 31/10/1998
Number of participants: 4
Project participant:
Clausen, Christian (Intern)
Jæger, Birgit (Ekstern)
Williams, Robin (Ekstern)
Project Manager, organisational:
Hansen, Finn J. S. (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 619,000.00 Danish Kroner

Project

Udvikling af endeafslutning til NKT's fleksible rør

Department of Mechanical Engineering
Period: 01/05/1996 → 07/03/2000
Number of participants: 4
PhD Student:
Banke, Lars (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Berge, Stig (Ekstern)
Klit, Peder (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

3-D flodmorfologi

Department of Mechanical Engineering
Period: 01/03/1996 → 26/03/2000
Number of participants: 3
PhD Student:
Christensen, H. Bo (Intern)
Main Supervisor:
Fredsøe, Jørgen (Intern)
Examiner:
Sumer, B. Mutlu (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Cybernetic modelling and control in intelligent manufacturing

Department of Mechanical Engineering
Period: 01/03/1996 → 01/09/1996
Number of participants: 2
PhD Student:
Flyvholm, Morten (Intern)
Main Supervisor:
Conrad, Finn (Intern)
**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Kraftværkers dynamiske forhold**
Department of Mechanical Engineering
Period: 01/03/1996 → 27/01/2000
Number of participants: 3
Phd Student:
Elmegaard, Brian (Intern)
Main Supervisor:
Houbak, Niels (Intern)
Examiner:
Mølbak, Tommy (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

**Akustisk hastighedsmåling i 3 dimensioner**
Department of Mechanical Engineering
Period: 01/02/1996 → 06/03/2001
Number of participants: 7
Phd Student:
Lohmann, Martin Schwalbe (Intern)
Supervisor:
Hansen, Niels-Erik Ottesen (Ekstern)
Jensen, Leif Bjørnø (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Examiner:
Buch, Erik (Ekstern)
Bjørnø, Irina (Intern)
Staunstrup, Jørgen (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

**En tredimensional Anden Ordens Randintegralligningsmodel for bølger og strøm m.v.**
Department of Mechanical Engineering
Period: 01/02/1996 → 28/10/1999
Number of participants: 4
Phd Student:
Büchmann, Bjarne (Intern)
Supervisor:
Skourup, Jesper (Intern)
Main Supervisor:
Deigaard, Rolf (Intern)
Examiner:
Brorsen, Michael Christian (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Hydrodynamiske påvirkninger på skibe

Department of Mechanical Engineering
Period: 01/02/1996 → 02/03/2000
Number of participants: 2
Phd Student:
Pedersen, Tommy (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Modellering af biomaterialer ved analyse/design af proteser

Department of Mechanical Engineering
Period: 01/02/1996 → 21/06/1999
Number of participants: 3
Phd Student:
Bagge, Mette (Intern)
Supervisor:
Bendsae, Martin P. (Intern)
Examiner:
Olhoff, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Modelling of Nonlinear Dynamical System

This project was carried out under a cooperation with the Institute of Mathematical Modeling (IMM), DTU. Simulation and practice experiments were performed using a hydraulic robot. The obtained model was intended to provide a basis for model-based control of the robot. The physical model was formulated in continuous time and was derived by application of the laws of physics on the system. The unknown (or uncertain) parameters were estimated with Maximum Likelihood (ML) parameter estimation. The identified model was evaluated by comparing the measurements with simulation of the identified model.

Department of Control and Engineering Design
Department of Informatics and Mathematical Modeling
Department of Mechanical Engineering
Period: 01/02/1996 → 31/12/1998
Number of participants: 2
Project participant:
Kroszynski, Uri (Intern)
Project Manager, organisational:
Zhou, Jianjun (Intern)

Nonlinear Fluid -

Department of Mechanical Engineering
Period: 01/02/1996 → 21/06/1999
Number of participants: 5
Phd Student:
Jensen, Jakob Søndergaard (Intern)
Main Supervisor:
Thomsen, Jon Juel (Intern)
Examiner:
Blekhman, Iliya (Ekstern)
Brøns, Morten (Intern)
Olhoff, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Simulering af svejsedeformationer i skibssektioner
Department of Mechanical Engineering
Period: 01/02/1996 → 10/08/1999
Number of participants: 4
Phd Student:
Birk-Sørensen, Martin (Intern)
Supervisor:
Kierkegaard, Henning (Ekstern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Hattel, Jesper Henri (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Turbulensmodellering
Department of Mechanical Engineering
Period: 01/02/1996 → 01/02/1996
Number of participants: 2
Phd Student:
Bak, Christian (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Actuator-disk model for windturbine (EFP)
Department of Energy Engineering
Department of Mechanical Engineering
Period: 01/01/1996 → …
Number of participants: 1
Project Manager, organisational:
Sørensen, Jens Nørkær (Intern)

Code calibration
The objective of this project is to establish a framework within which a design formula may be calibrated such that a uniform safety level is obtained for the structures encompassed by the considered formula. A computer program will be established such that the probabilistic calibration of the partial safety factors (in the design formula) will be performed automatically.
**Database on wind characteristics**

An establishment of a database containing and describing wind measurements in different types of terrain is an important ongoing project funded by EU. In the database a full description of the equipment used for the measurements is also given and the database is made available through the Internet. The database will be an important tool in determining standards of how the turbulence should be implemented in aeroelastic computations of wind turbines and can also be used to estimate the loading on other in/offshore structures. Furthermore, the database can be used to estimate the maximum wind speed, which a wind turbine will see in its lifetime.

**Fracture of ductile materials**

Various projects including analysis of crack growth based on modelling of cohesive forces between crack faces application of non-local continuum model for numerical prediction of crack growth, and fully three-dimensional numerical analysis of dynamic crack growth by the use of massively parallel computers.

**Morphology of ripples beneath surface waves**

Using k-omega turbulence modelling the flow over ripples in oscillatory flow is calculated. Using this the bed load and the suspended transport can be calculated. Methods for making a phase-resolved update of the bottom is being developed.
Open Modular Robot Controller (OMRC)
Open modular robot controllers allow the integration of off-the-shelf hardware and software components into a "de facto" standard environment and permit "plug and play" of scalable components. Scalable components enable easy and efficient reconfiguration to meet specific application needs. Open modular controllers are supposed to be economical - achieving low life cycle cost, maintainable - supporting robust plant floor operation (maximum uptime), expeditious repair (minimal downtime). The main research issues at IKS related to OMRC concern the development and integration of advanced and efficient low-level control algorithms as well as software modules for sensor integration. Another research area of interest for IKS concerns the development and integration of modules for trajectory planning and generation.

The integration of systems in customer order management in small and medium-size companies.
The purpose of the project is to develop methods that will aid the implementation of more cost-effective work routines and their support systems in customer order management in small and medium-size companies. The project is based on the fact that the work routines in order management adapt faster to changes in competition than the support systems. In the project, an attempt will be made to field theories and generate methods that may help in redesigning work routines and support systems. Also, this will include the integration of the systems in order management. A central aspect of the project will be to expose the capability of current function-oriented support systems in relation to the implementation of redesigned work routines. A book of 118 pp., entitled "Ordrestyring - Tidens indsatsområde" (approx. Order management - Today's focus.) has been published, and two seminars, of one half and a full day's duration respectively, have been held, with a total of 158 representatives from universities and commerce attending.

The integration of systems in customer order management in small and medium-size companies.
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Modellering af luftkvalitet i bygninger og køretøjer

Department of Mechanical Engineering
Period: 01/12/1995 → 22/03/2000
Number of participants: 2
PhD Student: Gholami, Siroos (Intern)
Main Supervisor: Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Selvfinansierende (privatist)
Project: PhD

Luftkvalitet i kontorbygninger

Department of Mechanical Engineering
Period: 01/11/1995 → 19/08/1996
Number of participants: 3
PhD Student: Nielsen, Jan Bach (Intern)
Supervisor: Andersen, Karl Terager (Intern)
Main Supervisor: Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Samarbejdsaftale-Finan-SU
Project: PhD

Numerisk og Eksperimentel Fluid Mekanik

Department of Mechanical Engineering
Period: 01/11/1995 → 27/10/1999
Number of participants: 3
PhD Student: Ullum, Ulrik (Intern)
Main Supervisor: Larsen, Poul Scheel (Intern)
Examiner: Sumer, B. Mutlu (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Cyklisk plasticitet og udmattelse af værktøjsmaterialer

Department of Mechanical Engineering
Period: 01/10/1995 → 05/02/1999
Number of participants: 4
PhD Student: Pedersen, Thomas Ø (Intern)
Supervisor: Christoffersen, Jes (Intern)
Main Supervisor: Tvergaard, Viggo (Intern)
Structural studies of inorganic materials

Crystal structures, i.e. the atomic arrangements in crystalline materials, form the basis for our understanding and development of inorganic materials. In this project crystal structures are determined and studied by means of single-crystal and powder diffraction methods using conventional and synchrotron X-rays, as well as neutron sources. It is also the aim of this project to explore the possibilities and develop crystallography as a tool for structural studies. The crystallographic studies are complemented by electron microscopy, spectroscopy, thermal, electro-chemical and kinetic methods. Among the materials studied are vanadium containing catalysts, where the catalytic properties are relying on the variability of the oxidation state of vanadium, which in turn depends on the structure hosting the vanadium ions. Another group of materials studied is optically and electro-optically active ceramics, whose polar properties can be directly related to their atomic arrangements. In yet another group of materials, minerals, new structures are determined and structurally related to known materials, and the stability fields and structural variations of solid solutions are explored.

Department of Chemistry
Indoor Environment
Department of Mechanical Engineering
Department of Physics
University of Milan
Lund University
Chalmers University of Technology
University of Copenhagen
Brookhaven National Laboratory
Period: 01/09/1995 → ...
Number of participants: 10
Project participant:
Nielsen, Kurt (Intern)
Artioli, Gilberto (Ekstern)
Hansen, Staffan (Ekstern)
Albertsson, Jørgen (Ekstern)
Johnsen, Ole (Ekstern)
Hansen, Jonathan (Ekstern)
Fehrmann, Rasmus (Intern)
Eriksen, Kim Michael (Intern)
Jiang, Jianzhong (Intern)
Project Manager, organisational:
Ståhl, Kenny (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 15,000.00 Danish Kroner
Project

Arbejdsformer i produktudviklingen
Department of Mechanical Engineering
Period: 01/08/1995 → 31/01/1999
Number of participants: 3
Phd Student:
Terkelsen, Søren Bendix (Intern)
Supervisor:
Riis, Jens Ove (Ekstern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Center-Finansieret-SU
Project: PhD

Systematisk fremgangsmåde ved modellering og simulering af køleanlæg
Department of Mechanical Engineering
Period: 01/08/1995 → 09/04/2001
Number of participants: 3
Phd Student:
Skovrup, Morten Juel (Intern)
Main Supervisor:
Knudsen, Hans-Jørgen Høgaard (Intern)
Examiner:
Thomsen, Per Grove (Intern)

Financing sources
Source: Internal funding (public)
Udvikling og integration af værktøjer til en designers workbench

Department of Mechanical Engineering
Period: 01/06/1995 → 06/01/2000
Number of participants: 4
Phd Student:
Jensen, Thomas Aakjær (Intern)
Supervisor:
Hansen, Claus Thorp (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)
Examiner:
Weber, Christian (Ekstern)

Financing sources
Source: Internal funding (public)

Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Human Thermal Sen

Department of Mechanical Engineering
Period: 01/05/1995 → 18/10/1999
Number of participants: 2
Phd Student:
Zhou, Genhong (Intern)
Main Supervisor:
Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)

Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Belastninger på maritime konstruktioner bestemt ved stokastisk ikke-lineær bølgeteori

Department of Mechanical Engineering
Period: 01/04/1995 → 01/06/1997
Number of participants: 4
Phd Student:
Kristensen, Mette Kramer (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Skourup, Jesper (Intern)
Main Supervisor:
Aage, Christian (Intern)

Financing sources
Source: Internal funding (public)

Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Ikke-stationære turbulente strømninger og sedimenttransport

Department of Mechanical Engineering
Period: 01/04/1995 → 26/02/1999
Number of participants: 4
Phd Student:
Hjelmager Jensen, Jacob (Intern)
Design and Modelling of Production Systems
The mission of the project is to develop new ways of designing and modelling production systems. The project will compare the design of a production for an electro-mechanical production system with the design for a production system inside healthcare and non-mechanical production. The term production system should be defined widely. One goal for a production system is to minimize the throughput time with a minimal usage of resources. This goal should be obtained by fulfilling the specified mission and politics for the system. Simulation will be used as a tool to describe the different production systems. Possibilities for transferring theories developed inside traditional electro-mechanical production into areas such as healthcare will be investigated by analysing the result of the comparison. Specified companies will be used as cases.

Department of Applied Engineering Design and Production
Department of Management Engineering
Department of Mechanical Engineering
The Royal Danish School of Educational Studies
Copenhagen Business School
University of Copenhagen
Period: 01/03/1995 → 01/03/1998
Number of participants: 2
Project participant:
Barfod, Ari (Intern)
Jacobsen, Peter (Intern)

Financing sources
Source: Unknown
Name of research programme: Unknown
Amount: 7,500,000.00 Danish Kroner
Project

EPOS: Efficient Parallel algorithms for Optimization and Simulation
The goal is to develop efficient and reliable parallel algorithms that can utilize supercomputers for solving large-scale optimization and simulation problems.

Department of Informatics and Mathematical Modeling
Fluid Mechanics
UNI-C
Period: 03/02/1995 → …
Number of participants: 10
Project participant:
Clausen, Jens (Intern)
Barker, Vincent A. (Intern)
Hansen, Per Christian (Intern)
Madsen, Oli B.G. (Intern)
Nielsen, Hans Bruun (Intern)
Thomsen, Per Grove (Intern)
Design og optimering af komplekse mekaniske systemer

Sørensen, Jens Nørkær (Intern)
Wasniewski, Jerzy (Ekstern)
Other:
Caprani, Ole (Ekstern)
Project Manager, organisational:
Madsen, Kaj (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 5,758,000.00 Danish Kroner

Project

Design og optimering af komplekse mekaniske systemer

Department of Mechanical Engineering
Period: 01/02/1995 → 20/04/1998
Number of participants: 4
Phd Student:
Pedersen, Niels Leergaard (Intern)
Main Supervisor:
Hansen, John Michael (Intern)
Examiner:
Bendsøe, Martin P. (Intern)
Olhoff, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Failure of a porous solid from a deep notch

A Ph.D. study. Two porous material models have been implemented in a finite element programme and failure from a deep notch in sintered metal components has been studied numerically. Plastic zones at the notch tip, stress localization and mesh dependence under tensile loading are studied with the Gurson model (1977) for low porosity materials and the FKM model developed by Fleck, Kuhn and McMeeking (1992) for highly porous solids. This kind of analysis is useful for prediction of the notched strength of porous metals.

Department of Solid Mechanics

Department of Mechanical Engineering
Period: 01/02/1995 → 31/01/1998
Number of participants: 4
Project participant:
Redanz, Pia (Intern)
Fleck, Norman A. (Ekstern)
McMeeking, Robert M. (Ekstern)
Project Manager, organisational:
Tvergaard, Viggo (Intern)

Identifikation og styring af ulinære dynamiske systemer

Department of Mechanical Engineering
Period: 01/02/1995 → 01/02/1995
Number of participants: 2
Phd Student:
Izadi-Zamanabadi, Roozbeh (Intern)
Main Supervisor:
Christensen, Georg Kronborg (Intern)

Financing sources
Modellering af emnefremstilling ved pulvermetallurgisk komprimering

Department of Mechanical Engineering
Period: 01/02/1995 → 09/07/1998
Number of participants: 4
Phd Student:
Redanz, Pia (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Byksov, Esben (Intern)
Danckert, Joachim (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Program Stipendium-SU, Eksp
Project: PhD

Modelling the impact of air pollutant atmospheres on human response and emissions from materials

Department of Mechanical Engineering
Period: 01/02/1995 → 01/03/1999
Number of participants: 2
Phd Student:
Wargocki, Pawel (Intern)
Main Supervisor:
Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Study and development of a design management method for selection of design tools according to context

Department of Mechanical Engineering
Period: 01/02/1995 → 24/01/2001
Number of participants: 2
Phd Student:
De Araujo, Claudiano Sales (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden International Finan-SU
Project: PhD

Systematisk syntese og optimering af mekanismer

Department of Mechanical Engineering
Period: 01/02/1995 → 20/04/1998
Number of participants: 4
Phd Student:
Ravn, Peter (Intern)
Main Supervisor:
Hansen, John Michael (Intern)
DIMEC Danish InfoMechatronic Control Design
DIMEC is associated with the IMCIA Research Programme supported by the Danish Technical Research Council. The focus is on the mechatronics approach in the integration of computer science, control engineering and mechanical design, in particular hydraulic actuator systems.

Department of Control and Engineering Design
Department of Mechanical Engineering

Monash University
Period: 23/01/1995 → 31/12/1996
Number of participants: 6
Project participant:
Zhou, Jianjun (Intern)
Christensen, Jacob Vejby (Intern)
Hansen, Poul Erik (Intern)
Dransfield, Peter (Ekstern)
Stecki, Jacek (Ekstern)
Project Manager, organisational:
Conrad, Finn (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 400,000.00 Danish Kroner
Project

Skibstekniske beregninger for fortidens skibe
Department of Mechanical Engineering
Period: 01/01/1995 → 20/10/1999
Number of participants: 3
Phd Student:
Jensen, Vagn (Intern)
Main Supervisor:
Bastrup, Jan (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Sektorministerium, Stip-SU
Project: PhD

Udvikling af beregningsmodel for dannelse af luftforurening og spredning ved turbulent luftstrømning i arbejdslokaler
Department of Mechanical Engineering
Period: 01/01/1995 → 03/06/1998
Number of participants: 4
Phd Student:
Lennert, Anne Spandet (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
**Financing sources**

**Source:** Internal funding (public)
**Name of research programme:** Forskerakademiets Samfinansier
**Project:** PhD

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**Sammenhængen mellem aluminiums mikrostruktur, styrkeegenskaber og plastiske formgivning**

Department of Mechanical Engineering  
Period: 01/12/1994 → 15/11/1996  
Number of participants: 4  
Phd Student:  
Falk, Jørgen (Intern)  
Supervisor:  
Bay, Bent (Intern)  
Richelsen, Ann Bettina (Intern)  
Main Supervisor:  
Tvergaard, Viggo (Intern)

**Financing sources**

**Source:** Internal funding (public)
**Name of research programme:** Forskningsrådsstip.-SU, Eksp
**Project:** PhD

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**Strukturudvikling og mekanismer for udmattelse af polykrystallinsk messing**

Department of Mechanical Engineering  
Number of participants: 3  
Phd Student:  
Carstensen, Jesper Vejlø (Intern)  
Main Supervisor:  
Tvergaard, Viggo (Intern)  
Examiner:  
Maahn, Ernst Emanuel (Intern)

**Financing sources**

**Source:** Internal funding (public)
**Name of research programme:** Risø (Løn)
**Project:** PhD

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**Ultimate and post-ultimate strength of ship hulls under bending, shear and torsional loading**

Department of Mechanical Engineering  
Period: 01/10/1994 → 11/01/1999  
Number of participants: 3  
Phd Student:  
Nielsen, Lars Peter (Intern)  
Supervisor:  
Jensen, Jørgen Juncher (Intern)  
Main Supervisor:  
Pedersen, Preben Terndrup (Intern)

**Financing sources**

**Source:** Internal funding (public)
**Name of research programme:** Forskningsrådsstip.-SU, Eksp
**Project:** PhD
Analysis and Optimization of the progressive damage in fiber-reinforced materials
A Ph.D. Study. The cumulative damage and failure of composite materials is modelled by a continuum damage mechanics approach. The sensitivities of the nonlinear and transient system are determined analytically and used in the subsequent optimization problem of finding the optimal fiber-orientation, ply-thicknesses and stacking sequence yielding the strongest lay-up design of the laminate for a given load-situation.

Department of Solid Mechanics
Department of Mathematics
Department of Mechanical Engineering
Period: 01/09/1994 → 31/01/1997
Number of participants: 3
Project participant:
Hammer, Velaja B. (Intern)
Bendsøe, Martin P. (Intern)
Project Manager, organisational:
Pedersen, Pauli (Intern)
Project

Parametrization in Laminate Design for Optimal Compliance
The design problem is analyzed by performing a reformulation to an equivalent problem which is local in character and it is shown how this, together with an enlargement of the design space to allow for out of plane chattering designs, leads to a significant simplification of the problem. Thus the number of variables is reduced to only four for the stiffness problem at hand, even in the general case with coupling stiffnesses and multiple loads. Moreover, in the special case of in-plane loads, the optimal solution for each design element of the plate can be realized as a single rotated ply of material or in special strain situations by two plies. A computational solution procedure for the simplified problem is described and several numerical examples illustrate basic features of the design approach.

Department of Solid Mechanics
Department of Mathematics
Department of Mechanical Engineering
R. Lipton
Period: 01/09/1994 → 31/01/1997
Number of participants: 3
Project participant:
Hammer, Velaja B. (Intern)
Bendsøe, Martin P. (Intern)
Project Manager, organisational:
Pedersen, Pauli (Intern)
Project

Probabilistisk udmattelsesanalyse af typiske samlinger mellem stivere og webramer
Department of Mechanical Engineering
Number of participants: 4
PhD Student:
Andersen, Michael Rye (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD
Identifikation af modelleringsfejl ved dynamiske analyser

Department of Mechanical Engineering
Period: 01/08/1994 → 18/07/1997
Number of participants: 3
Phd Student:
Hansen, Hans Henrik (Intern)
Main Supervisor:
Pedersen, Pauli (Intern)
Examiner:
Olhoff, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Smøreoliefilmmodel for forbrændingsmotorer

Department of Mechanical Engineering
Number of participants: 6
Phd Student:
Frølund, Kent (Intern)
Supervisor:
Schramm, Jesper (Intern)
Main Supervisor:
Sorensen, Spencer C (Intern)
Examiner:
Carlsen, Henrik (Intern)
Denbratt, Ingemar (Ekstern)
Henningsen, Svend (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

MUP2 - Resistance projection welding of complex welding of complex metal combinations and geometries

The aim of the present framework programme is through some basic, systematic process analyses to improve the basis for industrial optimization and development of the resistance projection welding for assembly of complex metal combinations and geometries. Objectives are: * to establish of a profound basis of experience, making possible an evaluation and prediction of the weldability and weld quality when resistance projection welding complex metal combinations and geometries * to analyze the importance of statistical variations in composition of alloy and in surface contamination when projection welding stainless steel * to establish rules for selection of electrode material and to find substitute material for beryllium alloyed copper and to establish guidelines for electrode design and electrode cooling * to develop procedures for characterization of the electrical and mechanical properties of resistance projection welding machines as regards selection of machine and welding parameters for a specific welding job and to facilitate maintenance of the machines * to develop a numerical model for the analysis of resistance projection welding

Department of Management Engineering

Department of Mechanical Engineering

Danfoss A/S

Grundfos A/S

FORCE Institute
Period: 01/07/1994 → 31/12/1997
Number of participants: 3
Project participant:
Malberg, Michael Peter (Intern)
Zhang, Wenqi (Intern)
A Conditional Mean Second Order Wave Theory

In a stationary stochastic sea state the mean wave profile and associated wave kinematics conditioned on a given wave elevation at a specified point in space or time are derived. The results are based on the second-order, unidirectional, deep water Stokes’ wave theory, but can easily be extended to other moderate non-linear wave formulations. The application of the proposed wave theory as a design wave is discussed together with methods to overcome convergence problems associated with wideband wave spectra.

Department of Naval Architecture and Offshore Engineering
Department of Mechanical Engineering
University of California at Berkeley
Period: 01/06/1994 → 31/12/1999
Number of participants: 4
Project participant:
Kristensen, Mette Kramer (Intern)
Baatrup, Jan (Intern)
Mansour, Alaa E. (Ekstern)

Project Manager, organisational:
Jensen, Jørgen Juncher (Intern)

Impact of Temperature and Humidity on Perceived Indoor Air Quality

Department of Mechanical Engineering
Period: 01/06/1994 → 10/07/1998
Number of participants: 2
Phd Student:
Fang, Lei (Intern)

Main Supervisor:
Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Friplads_SU
Project: PhD
Mekanisk interaktion imellem katalysator og reaktor for kemiske reaktorer

Department of Mechanical Engineering
Period: 01/06/1994 → 07/01/1998
Number of participants: 5
Phd Student:
Vestergaard, Rune (Intern)
Supervisor:
Christoffersen, Jes (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)
Examiner:
Hansen, Bent Bruno (Intern)
Runnesson, Kenneth (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

MUP2 - Center for Structural Materials - MP2M - Materials processing, Properties and Modelling
The center has gathered the six most important Danish groups in a network within Manufacturing and Materials Science and Engineering with the aim of performing coordinated, basic research on, Materials Processing, Properties and Modelling, MP2M. The research refers to the integrated process of design - material - processing, adopting and developing the most advanced theoretical and experimental techniques for studies of materials manufacturing and processing. The coordinated research has been carried out within the following four basic areas: A. Numerical modelling and analysis of material properties B. Numerical modelling and analysis of process phenomena C. Experimental modelling and analysis of materials properties D. Experimental modelling and analysis of process phenomena All in all 36 projects have been carried out under the center programme engaging 118 researchers, who have contributed 466 publications in total among which more than 300 are international publications.

Department of Manufacturing Engineering
Manufacturing Engineering
Department of Mechanical Engineering
Solid Mechanics
Department of Management Engineering
Aalborg University
Rise National Laboratory
Grundfos A/S
Danfoss A/S
DISA A/S
DEMEX AB
B&W Shipyard
NKT Research & Innovation A/S
Period: 01/05/1994 → 28/02/1999
Number of participants: 25
Project participant:
Arentoft, Mogens (Intern)
Bjerregaard, Henrik (Intern)
Eriksen, Morten (Intern)
Gjørtsvang, Henrik Højborg (Intern)
Ravn, Bjarne Gottlieb (Intern)
Hansen, Søren Feldager (Intern)
Frandsen, Jens Ole (Intern)
Hansen, Jan Langkjær (Intern)
Hattel, Jesper Henri (Intern)
Henningsen, Poul (Intern)
Lassen, Søren (Intern)
Lindegren, Maria (Intern)
Malberg, Michael Peter (Intern)
Nielsen, Lars Søgaard (Intern)
Post-Pedersen, Bente (Intern)
Thorborg, Jesper (Intern)
Wanheim, Tarras (Intern)
Tan, Xincai (Intern)
Wanheim, Tarras (Intern)
Hattel, Jesper Henri (Intern)
Tvergaard, Viggo (Intern)
Danckert, Joachim (Ekstern)
Hansen, Niels (Ekstern)
Project Manager, organisational:
Bay, Niels Oluf (Intern)
Bay, Niels Oluf (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 17,000,000.00 Danish Kroner
Source: Unknown
Name of research programme: Ukendt
Amount: 4,800,000.00 Danish Kroner

Løsning af Navier-Stokes ligninger for viskos, turbulent strømning omkring skibsskrog
Department of Mechanical Engineering
Number of participants: 5
Phd Student:
Olesen, Niels Anker (Intern)
Supervisor:
Michelsen, Jess (Intern)
Main Supervisor:
Baatrup, Jan (Intern)
Examiner:
Jensen, Peter S. (Ekstern)
Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Rengøringsteknologi
Department of Mechanical Engineering
Period: 01/04/1994 → 15/01/1997
Number of participants: 2
Phd Student:
Pinholt, Peter (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Optimal design of laminater
Department of Mechanical Engineering
Period: 01/02/1994 → 16/04/1997
Number of participants: 4
Phd Student: Hammer, Velaja B. (Intern)
Main Supervisor: Pedersen, Pauli (Intern)
Examiner: Paetsch, Roland (Ekstern)
Stang, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Optimering af vingeprofil-form
Department of Mechanical Engineering
Period: 01/02/1994 → 07/05/1998
Number of participants: 3
Phd Student: Sørensen, Dan Nørtoft (Intern)
Main Supervisor: Sørensen, Jens Nørkær (Intern)
Examiner: Lind-Nielsen, Birger (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Analyse af pulserende højenergi vandstråle
Department of Mechanical Engineering
Period: 01/12/1993 → 27/10/1997
Number of participants: 4
Phd Student: Norman, Thomas (Intern)
Main Supervisor: Sorensen, Spencer C (Intern)
Examiner: Carlsen, Henrik (Intern)
Henningsen, Svend (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Responsberegning af dynamisk belastede komposit paneler.
Department of Mechanical Engineering
Mixing and Chemical Reactions in Turbulent Combustion.

Department of Mechanical Engineering
Period: 01/09/1993 → 31/07/1999
Number of participants: 3
Phd Student: Rasmussen, Anne (Intern)
Supervisor: Houbak, Niels (Intern)
Main Supervisor: Sorenson, Spencer C (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Rationelt design af skibskonstruktioner overfor ulykkeslast.

Department of Mechanical Engineering
Period: 01/09/1993 → 30/05/1997
Number of participants: 2
Phd Student: Cerup-Simonsen, Bo (Intern)
Main Supervisor: Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Strømning om vingeprofil

Department of Mechanical Engineering
Number of participants: 3
Phd Student: Nygreen, Per Jørgen (Intern)
Main Supervisor: Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
To-lignings turbulensmodeller for vægnære strømninger.
Department of Mechanical Engineering
Period: 01/09/1993 → 30/05/1997
Number of participants: 3
Phd Student: Schmidt, Jens Jørgen (Intern)
Main Supervisor: Larsen, Poul Scheel (Intern)
Examiner: Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Turbulens i kombineret bølge-strøm bevægelse.
Department of Mechanical Engineering
Period: 01/09/1993 → 11/03/1997
Number of participants: 3
Phd Student: Rønnow, Carsten Holm (Intern)
Supervisor: Fredsøe, Jørgen (Intern)
Main Supervisor: Sumer, B. Mutlu (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Department of Mechanical Engineering
Period: 01/08/1993 → 30/06/1997
Number of participants: 3
Phd Student: Rasmussen, Bjarne Dindler (Intern)
Main Supervisor: Danig, Per O (Intern)
Examiner: Sorenson, Spencer C (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Anden Sektorministeriel Fin-SU
Project: PhD

Genetisk modellering og intelligent styring af hydrauliske aktuatorer
Department of Mechanical Engineering
Period: 01/08/1993 → 01/10/1998
Number of participants: 4
Phd Student: Hansen, Poul Erik (Intern)
Main Supervisor: Conrad, Finn (Intern)
Examiner:
Christensen, Georg Kronborg (Intern)
Rasmussen, Henrik (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstip.-SU, Eksp
Project: PhD

Miljørigtig konstruktion (design for environment).
Department of Mechanical Engineering
Period: 01/08/1993 → 30/05/1997
Number of participants: 2
Phd Student:
Hansen, Troels Keldmann (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU Stipendium, Eksperiment
Project: PhD

Genbrugsrigtig konstruktion.
Department of Mechanical Engineering
Period: 01/05/1993 → 01/08/1996
Number of participants: 2
Phd Student:
Andersen, Erik (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Erhvervsforskerordningen
Project: PhD

Dynamisk stabilitet
Department of Mechanical Engineering
Period: 01/02/1993 → 18/04/1996
Number of participants: 3
Phd Student:
Langthjem, Mikael Andersen (Intern)
Main Supervisor:
Pedersen, Pauli (Intern)
Examiner:
Jensen, Jørgen Juncher (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU Stipendium, Eksperiment
Project: PhD

Intelligent Actuators and motion control of multivariable hydraulic systems
Department of Mechanical Engineering
Period: 01/02/1993 → 27/02/1997
Number of participants: 3
Phd Student:
Andersen, Torben Ole (Intern)
Main Supervisor:
Conrad, Finn (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Statistisk analyse af indeklimafaktorer
Department of Mechanical Engineering
Period: 01/02/1993 → 17/04/1996
Number of participants: 4
Phd Student:
Groes, Anne Lisbet (Intern)
Main Supervisor:
Langkilde, Gunnar (Intern)
Examiner:
Fanger, Povl Ole (Intern)
Windfeld, Kristian (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-Su Stipendium, Eksperiment
Project: PhD

Aeroakustisk/aerodynamisk støj fra vindmøller
Department of Mechanical Engineering
Period: 01/01/1993 → 21/01/1997
Number of participants: 3
Phd Student:
Dahl, Kristian Skriver (Intern)
Supervisor:
Aagaard Madsen , Helge (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Interoperability of Standards for robotics in CIME
The ESPRIT project 6457 (InterRob) has as its first goal the development of standardized interfaces and their software implementation for ISO-10303 (STEP) and DIN-66312 (IRL). The project is a natural continuation of previous ESPRIT projects in the same area, namely CAD*I and NIRO. The InterRob approach is based on standardized models for product geometry, kinematics, robotics, dynamics and control, hence, on a coherent neutral information model of the process chain from design to manufacturing. The second goal of the project is to increase the accuracy of off-line programmed robots. The results are demonstrated in industrial applications for ship building (robot welding) and airplane engine building (robot thermal coating of turbine blades).

Department of Control and Engineering Design
Department of Mechanical Engineering
Forschungs Zentrum Karlsruhe GmbH
BYG Systems Ltd.
Marine Structures
STVF funded Frame Programme. The purpose of the programme is to carry out technical and scientific research of fundamental importance for the analysis of ships and offshore structures.

Department of Naval Architecture and Offshore Engineering
Department of Mechanical Engineering
Danish Maritime Institute
Aalborg University
Period: 01/01/1993 → 31/12/1997
Number of participants: 16
Project participant:
Andersen, Michael Rye (Intern)
Andersen, Poul (Intern)
Baatrup, Jan (Intern)
Fris-Hansen, Peter (Intern)
Jensen, Jørgen Juncher (Intern)
Nielsen, Lars Peter (Intern)
Pedersen, Tommy (Intern)
Cerup-Simonsen, Bo (Intern)
Wang, Zhaohui (Intern)
Zhang, Shengming (Intern)
Branner, Kim (Intern)
Riber, Hans Jørgen (Intern)
Pawlowski, Maciej (Intern)
Verdier, Guillaume Henry C. (Intern)
Xia, Jinzhu (Intern)
Project Manager, organisational:
Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Unknown
Name of research programme: Ukendt
Amount: 14,000,000.00 Danish Kroner
Project

Optimering af elektromagnetiske volumenstrømsmetre.
Department of Mechanical Engineering
Period: 10/12/1992 → 18/04/1996
Number of participants: 4
Phd Student:
Jensen, Erik (Intern)
Supervisor:
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Lind, Leif (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

Automatic finite element mesh generation of regeneration
Department of Mechanical Engineering
Period: 09/12/1992 → 21/04/1999
Number of participants: 3
Phd Student:
Liu, Xiaoming (Intern)
Main Supervisor:
Jensen, Jarl F. (Intern)
Examiner:
Olhoff, Niels (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Optimal design af adaptive konstruktioner
Department of Mechanical Engineering
Period: 09/12/1992 → 20/03/1995
Number of participants: 3
Phd Student:
Sigmund, Ole (Intern)
Supervisor:
Bendsøe, Martin P. (Intern)
Main Supervisor:
Pedersen, Pauli (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Analysis of flow plast a rotating blade by viscous-inviscid interaction technique.
Department of Mechanical Engineering
Period: 01/12/1992 → 29/01/1996
Number of participants: 3
Phd Student:
Filippone, Antonino (Intern)
Supervisor:
Jensen, Johannes Tejlgaard (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)
Financing sources
Source: Internal funding (public)
Name of research programme: Ef-Finansieret, Stipen.-SU
Project: PhD

Menneske/maskin-samspil for mekatroniske produkter - betjeningskvalitet og udviklingsmetoder
Department of Mechanical Engineering
Period: 01/12/1992 → 29/05/1996
Number of participants: 2
Phd Student:
Markussen, Tom Hede (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådsstipendium
Project: PhD

Tubulensmodellering anvendt på morfologi i lille skala
Department of Mechanical Engineering
Period: 01/12/1992 → 22/04/1996
Number of participants: 2
Phd Student:
Tjerry, Søren (Intern)
Main Supervisor:
Fredsæ, Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
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)
Energiopptimering af kølesystemer

Department of Mechanical Engineering
Period: 01/09/1992 → 09/01/1996
Number of participants: 2
Phd Student:
Jakobsen, Arne (Intern)
Main Supervisor:
Danig, Per O (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Bestemmelse af svingninger i platforme som følge af ekstreme bølger

Department of Mechanical Engineering
Period: 01/08/1992 → 19/06/1995
Number of participants: 3
Phd Student:
Dal, Erik Gregersen (Intern)
Main Supervisor:
Fredøe, Jørgen (Intern)
Examiner:
Bjørnø, Irina (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Trækgener i det industrielle arbejdsmiljø

Department of Mechanical Engineering
Period: 01/08/1992 → 16/01/1994
Number of participants: 2
Phd Student:
Toftum, Jørn (Intern)
Main Supervisor:
Langkilde, Gunnar (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Acoustical properties of fibre materials for sound insulation

Propagation of sound waves in fibre materials at audible frequencies is studied. The purpose is to understand in detail the physical mechanisms that cause sound attenuation; and to be able to calculate the sound attenuation and velocity in the materials from fibre diameter, distribution and density. The work is experimental and theoretical.

Department of Applied Engineering Design and Production
Computarbaseret betjeningssimulering af mekatroniske produkter

Department of Mechanical Engineering
Period: 01/05/1992 → 01/01/1995
Number of participants: 3
PhD Student:
Hansen, Claus Sehested (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)
Examiner:
Molich, Rolf (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Sediment transport in the swash zone

Department of Mechanical Engineering
Period: 01/05/1992 → 08/02/1996
Number of participants: 4
PhD Student:
Elfrink, Berry (Intern)
Supervisor:
Sumer, B. Mutlu (Intern)
Main Supervisor:
Fredsoe, Jørgen (Intern)
Examiner:
Brøker, Ida (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: EF-finansieret
Project: PhD

Tre-dimensionele strømninger med seperation

Department of Mechanical Engineering
Period: 01/05/1992 → 02/11/1995
Number of participants: 3
PhD Student:
Hasbo, Peter Bent (Intern)
Supervisor:
Sumer, B. Mutlu (Intern)
Main Supervisor:
Fredsoe, Jørgen (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel Ordning - Blandet Finan
Project: PhD
**Afløsning bagved bakker.**
Department of Mechanical Engineering
Period: 01/04/1992 → 22/06/1995
Number of participants: 2
Phd Student:
Sørensen, Niels N. (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Forskerakademiets Samfinansier
Project: PhD

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**Genetisk produktmodellering og synteseværktøjer til konstruktionsstøtte system med aluminiumstekn. som anvendt område**
Department of Mechanical Engineering
Number of participants: 2
Phd Student:
Mortensen, Niels Henrik (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

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**Energy optimisation of domestic refrigerators.**
Design and testing of new hermetic compressor with variable speed drive for use in domestic refrigerators.
Department of Energy Engineering
Department of Mechanical Engineering
Cetec E/F
Danfoss A/S
Gram A/S
Aalborg University
Period: 01/03/1992 → 01/10/1996
Number of participants: 3
Project participant:
Rasmussen, Bjarne Dindler (Intern)
Jakobsen, Arne (Intern)
Project Manager, organisational:
Danig, Per O (Intern)

**Financing sources**
Source: Unknown
Name of research programme: Ukendt
Amount: 680,000.00 Danish Kroner
Project

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**Simulering af IGCC kraftværker**
Department of Mechanical Engineering
Period: 01/03/1992 → 17/04/1996
Number of participants: 2
Phd Student:
Lorentzen, Bent (Intern)
Main Supervisor:
Houbak, Niels (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

**Graphical Simulator**
Department of Mechanical Engineering
Period: 01/02/1992 → 12/10/1994
Number of participants: 3
Phd Student:
Hansen, Jes Birger (Intern)
Supervisor:
Boe, Christian (Intern)
Main Supervisor:
Dawids, Steen (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

**Kapacitet og levetid for højtbelastede maritime FRP-sandwich konstruktioner**
Department of Mechanical Engineering
Period: 01/02/1992 → 29/01/1996
Number of participants: 4
Phd Student:
Branner, Kim (Intern)
Supervisor:
Jensen, Jørgen Juncher (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)
Examiner:
Kildegaard, Arne (Ekstern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

**Viskoplastisk materialeopførsels indflydelse på skallers stabilitet og kollaps**
Department of Mechanical Engineering
Period: 01/02/1992 → 05/10/1995
Number of participants: 2
Phd Student:
Mikkelsen, Lars Pilgaard (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)

**Financing sources**
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD
Konceptuelt design af hurtigsejlende færger

Department of Mechanical Engineering
Period: 01/01/1992 → 08/09/1995
Number of participants: 2
Phd Student:
Schack, Christian (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Metoder til modellering og pålideligehedsanalyse af konstruktioner med komplicerede svigtbetingelser.

Department of Mechanical Engineering
Period: 01/01/1992 → 08/02/1996
Number of participants: 3
Phd Student:
Morsing Johannesen, Johannes (Intern)
Main Supervisor:
Ditlevsen, Ove Dalager (Intern)
Examiner:
Bierager, Peter (Ekstern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådene via projektbe
Project: PhD

Pålidelighedsmetoder til styrkedimensionering af skibe

Department of Mechanical Engineering
Period: 01/12/1991 → 08/08/1995
Number of participants: 2
Phd Student:
Hansen, Anders Melchior (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Stokastiske dynamiske virkninger i elastisk-plastiske konstruktioner

Department of Mechanical Engineering
Number of participants: 2
Phd Student:
Christensen, Claus (Intern)
Main Supervisor:
Ditlevsen, Ove Dalager (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD
Stokastiske effekтивительсфактор для пластических конструкций

Department of Mechanical Engineering
Number of participants: 3
Phd Student:
Randrup-Thomsen, Søren (Intern)
Supervisor:
Nielsen, Leif Otto (Intern)
Main Supervisor:
Ditlevsen, Ove Dalager (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Aerodynamiske strømninger med strukturinteraktion

Department of Mechanical Engineering
Period: 01/10/1991 → 16/01/1995
Number of participants: 5
Phd Student:
Walther, Jens Honore (Intern)
Supervisor:
Jensen, Johannes Tejlgaard (Intern)
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Massentransport og strømningsforhold i væske-gas blandinger omkring dyser og statiske mikser i en bioreaktor

Department of Mechanical Engineering
Period: 01/10/1991 → 29/08/1994
Number of participants: 4
Phd Student:
Nim, Erik (Intern)
Supervisor:
Villadsen, John (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Hassager, Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Instationær strømning ved lave Reynolds tal

Department of Mechanical Engineering
Number of participants: 3
Phd Student:
Mayer, Stefan (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)
Examiner:
Hansen, Erik Bent (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Optimering af sammensatte maskinsystemer
Department of Mechanical Engineering
Number of participants: 3
Phd Student:
Svendsen, Karl-Henrik (Intern)
Supervisor:
Hansen, Claus Thorp (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådene via projektbe
Project: PhD

Geometrisk og topologisk definition af maritime konstruktioner
Department of Mechanical Engineering
Period: 01/07/1991 → 07/11/1995
Number of participants: 3
Phd Student:
Michelsen, Jacob (Intern)
Main Supervisor:
Jensen, Jørgen Juncher (Intern)
Examiner:
Gravesen, Jens (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Forskningsrådene via projektbe
Project: PhD

Rotor-aerodynamik for vindmøller
Department of Mechanical Engineering
Period: 01/06/1991 → 17/02/1995
Number of participants: 4
Phd Student:
Hansen, Martin Otto Laver (Intern)
Supervisor:
Pedersen, Bjarne Maribo (Intern)
Sørensen, Jens Nørkær (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD
Identifikation/adaptiv regulering af systemer med ukendt modelstruktur og væsentlige ulineariteter
Department of Mechanical Engineering
Period: 01/04/1991 → 24/01/1994
Number of participants: 3
Phd Student:
Wagner, Christian Hedager (Intern)
Main Supervisor:
Conrad, Finn (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: ATV- Gammel ordning
Project: PhD

Modellering af indeluftkvalitet
Department of Mechanical Engineering
Period: 01/04/1991 → 14/09/1994
Number of participants: 2
Phd Student:
Knudsen, Henrik Nellemose (Intern)
Main Supervisor:
Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel Ordning - Blandet Finan
Project: PhD

Analyse af cykliske termodynamiske processer
Department of Mechanical Engineering
Period: 01/03/1991 → 16/01/1995
Number of participants: 2
Phd Student:
Commissio, Marcello Benito (Intern)
Main Supervisor:
Carlsen, Henrik (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Luftforureningskilder i ventilationsanlæg
Department of Mechanical Engineering
Period: 01/03/1991 → 02/06/1994
Number of participants: 2
Phd Student:
Pejtersen, Jan (Intern)
Main Supervisor:
Fanger, Povl Ole (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel Ordning - Blandet Finan
Project: PhD
Numerisk og eksperimentel undersøgelse af turbulent strømning og varmeoverførsel i industrielle procesanlæg

Department of Mechanical Engineering
Period: 01/02/1991 → 30/05/1994
Number of participants: 3
Phd Student:
Meyer, Knud Erik (Intern)
Supervisor:
Kristensen, Hans Sastrup (Intern)
Main Supervisor:
Larsen, Poul Scheel (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: DTU-stipendium
Project: PhD

Environmental planning and uncertainty

Department of Mechanical Engineering
Period: 01/10/1990 → 01/01/1994
Number of participants: 2
Phd Student:
Sørensen, Lene Tolstrup (Intern)
Main Supervisor:
Tvergaard, Viggo (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Tredimensionel, instationær aerodynamik for roterende vinge

Department of Mechanical Engineering
Period: 01/10/1990 → 15/09/1994
Number of participants: 4
Phd Student:
Christensen, Henrik Frans (Intern)
Supervisor:
Larsen, Poul Scheel (Intern)
Aagaard Madsen, Helge (Intern)
Main Supervisor:
Sørensen, Jens Nørkær (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Design for Quality

Department of Mechanical Engineering
Period: 01/08/1990 → 01/01/1994
Number of participants: 2
Phd Student:
Mørup, Mikkel (Intern)
Main Supervisor:
Andreasen, Mogens Myrup (Intern)

Financing sources
Erosion om lodrette pæle udsat for bølger

Department of Mechanical Engineering
Period: 01/08/1990 → 15/06/1994
Number of participants: 3
PhD Student:
Christiansen, Niels (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Pålidelighedsanalyse af maritime konstruktioner

Department of Mechanical Engineering
Period: 01/02/1990 → 17/06/1994
Number of participants: 2
PhD Student:
Friis-Hansen, Peter (Intern)
Main Supervisor:
Pedersen, Preben Terndrup (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Robotteknik

Department of Mechanical Engineering
Period: 01/02/1990 → 12/09/1997
Number of participants: 3
PhD Student:
Zhang, Muzhi (Intern)
Main Supervisor:
Conrad, Finn (Intern)
Examiner:
Poulsen, Niels Kjølstad (Intern)

Financing sources
Source: Internal funding (public)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

Integreret styring af kølemøbelfordampere til butiksølving

Department of Mechanical Engineering
Period: 01/01/1990 → 01/01/1993
Number of participants: 2
PhD Student:
Elefsen, Frank (Intern)
Main Supervisor:
Danig, Per O (Intern)
Stirling Engines for Wood chips

The Danish program for research and development within new decentralised co-generation plants using biomass as fuel includes an investigation of Stirling engines. They are very attractive for solid fuels as wood chip because Stirling engines have external combustion. The target is to develop Stirling engines in the output range from 35 kW to 600 kW electric. The development has been concentrating on the development of a Stirling engine with an electric power output of 35 kW engine, but a 150 kW engine has also been designed. The first 35 kW engine was ready for field test in July 1998. Since that time the plant has tested successfully for more than 1400 hours using wood chips as fuel. The plant is fully automated and it has most of the time been running unmanned. The power output of the first engine was less than expected, and the design has now been optimised in order to improve the performance. At present a new engine is tested in the laboratory, and the preliminary results show, that the target performance has been obtained.

Department of Energy Engineering
Department of Mechanical Engineering
Danstoker A/S
Period: 01/01/1990 → 01/01/9999
Number of participants: 3
Project participant:
Bovin, Jonas Kabell (Intern)
Bruun, I. B. (Eksterm)
Project Manager, organisational:
Carlsen, Henrik (Intern)

Optimering for akkumulering af elastisk energi i laminat konstruktioner

Department of Mechanical Engineering
Period: 01/11/1989 → 12/10/1994
Number of participants: 2
Phd Student:
Petersen, Thomas (Intern)
Main Supervisor:
Pedersen, Pauli (Intern)

Kyst- og brink beskyttelse

Department of Mechanical Engineering
Period: 01/09/1989 → 15/08/1995
Number of participants: 3
Phd Student:
Arnskov, Michael Macdonald (Intern)
Supervisor:
Fredsøe, Jørgen (Intern)
Main Supervisor:
Sumer, B. Mutlu (Intern)
Name of research programme: Gammel ordning u/skema-SU
Project: PhD

**Prospektiv medicinsk teknologivurdering**

Department of Mechanical Engineering  
Period: 01/08/1987 → 01/07/1994  
Number of participants: 3  
Phd Student:  
Andersen, Steen Lauritz (Intern)  
Main Supervisor:  
Dawids, Steen (Intern)  
Examiner:  
Jørgensen, Torben (Ekstern)  

**Financing sources**

Source: Internal funding (public)  
Name of research programme: DTU-stipendium  
Project: PhD

**Converging Technologies for Micro System Manufacturing : Large scale integration project**

Department of Mechanical Engineering  
FOTEC GmbH  
Period: 02/02/20036 → 30/03/2037  
Number of participants: 1  
Acronym: COTECH  
Project Manager, organisational:  
Islam, Aminul (Intern)  

**Financing sources**

Source: Forsk. EU - Rammeprogram  
Name of research programme: Forsk. EU - Rammeprogram  
Project

**Activities:**

**Ocean Dynamics (Journal)**  
Period: 2018  
David R. Fuhrman (Reviewer)  
Department of Mechanical Engineering  
Fluid Mechanics, Coastal and Maritime Engineering  

**Description**  
Guest Editor (Special Issue on Coastal Dynamics)  
Degree of recognition: International  

**Related Journal**

Ocean Dynamics  
1616-7341  
Central database  
Activity: Research › Journal editor

**On the prediction of thermophysical properties of innovative fluids**  
Period: 2018  
Maria E. Mondejar Montagud (Guest lecturer)
Fredrik Haglind (Other)
Department of Mechanical Engineering
Thermal Energy

Documents:
Poster_MSCA_Alumni_Meeting

Related event

5th Marie Curie Alumni Association Annual Meeting
02/02/2018 → 03/02/2018
Leuven, Belgium
Activity: Talks and presentations › Conference presentations

The 20th International Workshop on Configuration (Event)
Period: 27 Sep 2018 → 28 Sep 2018
Sara Shafiee (Reviewer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Program Committee

Related event

The 20th International Workshop on Configuration
27/09/2018 → 28/09/2018
Graz, Austria
Activity: Research › Peer review of manuscripts

2nd IEOM European Conference on Industrial Engineering and Operations Management (Event)
Period: 26 Jul 2018 → 27 Jul 2018
Sara Shafiee (Reviewer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Program Committee
Degree of recognition: International

Related event

2nd IEOM European Conference on Industrial Engineering and Operations Management
26/07/2018 → 27/07/2018
Paris, France
Activity: Research › Peer review of manuscripts

Piston Ring Lubrication - Model Validation, Lubricant Injection Position and Injection Volume
Period: 2 Mar 2018
Hannibal Toxværd Overgaard (Guest lecturer)
Department of Mechanical Engineering
Solid Mechanics

Related external organisation

MAN Diesel & Turbo
Denmark
Activity: Talks and presentations › Talks and presentations in private or public companies and organisations
Reproduction of multi-hierarchical structural surfaces by vat-photopolymerization
Period: 7 Feb 2018
Macarena Mendez Ribo (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
This study investigates the intersection of bio-inspired surfaces and additive manufacturing (AM), with the aim of determining the feasibility and viability of leveraging 3D printing technologies to replicate surfaces that mirror those found in nature. These surfaces, like metamaterials, are constituted by arrays of microstructures arranged at multiple hierarchical levels. The ability to rapidly and inexpensively reproduce microstructures using AM at micro scale would thus serve to enable the scientific community to conduct optimization of 3D surface model designs. This would allow for improved forecasting of surface properties and behaviors before investment in other micromanufacturing methods. The investigation was carried out using a state-of-the-art vat photopolymerization AM machine-tool suitable for precision manufacturing at the micro dimensional range developed, built and validated at the Technical University of Denmark. It was shown that it was possible to reproduce multihierarchical micro features inspired by the surface of the Tokay gecko toe. Ultimately, voxel resolution of 7.6 μm was visualized. Moreover, two more intricate designs were fabricated with the same parameters, yet showing higher hydrophobicity with a water contact angle of 124°±0.10°, due to their increased density and decreased feature size, not due to its material properties. These results indicate the possibility of using precision AM for a rapid, easy and reliable fabrication of working functional surfaces, which can also be applied to the design and fabrication of metamaterials.

Related event
Dedicated manufacturing and experimental techniques for acoustic metamaterials and acoustic treatments
06/02/2018 → 07/02/2018
Leuven, Belgium
Activity: Talks and presentations › Conference presentations

Coastal Engineering (Journal)
Period: 2017 → …
David R. Fuhrman (Reviewer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

Description
Advisory Editorial Board
Degree of recognition: International

Related journal
Coastal Engineering
0378-3839
Central database
Activity: Research › Journal editor

GREEN FIBER BOTTLE: TOWARDS A SUSTAINABLE PACKAGE
Period: 2017
Mattia Didone (Guest lecturer)
Department of Mechanical Engineering
Manufacturing Engineering
Documents:
GREEN FIBER BOTTLE TOWARDS A SUSTAINABLE PACKAGE_Didone
Related event

16th Fundamental Research Symposium: Advances in Pulp and Paper Research
03/09/2017 → 08/09/2017
Oxford, United Kingdom
Activity: Talks and presentations › Conference presentations

Green Fiber Bottle: Towards a Sustainable Package and a Manufacturing Process
Period: 2017
Mattia Didone (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering
Documents:
Green Fiber Bottle Towards a Sustainable Package and a Manufacturing Process_Didone

Related event

28th IAPRI World Symposium on Packaging
09/05/2017 → 12/05/2017
Lausanne, Switzerland
Activity: Talks and presentations › Conference presentations

Journal of Waterway, Port, Coastal, and Ocean Engineering (Journal)
Period: 2017 → …
David R. Fuhrman (Reviewer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Description
Associate Editor
Degree of recognition: International
Related journal
Journal of Waterway, Port, Coastal, and Ocean Engineering
0733-950X
BFI (2018): BFI-level 2, Scopus rating (2016): CiteScore 1.48 SJR 0.708 SNIP 1.139, ISI indexed (2013): ISI indexed yes,
Web of Science (2018): Indexed yes
Central database
Activity: Research › Journal editor

Robotics and Computer-Integrated Manufacturing (Journal)
Period: 2017
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering
Related journal
Robotics and Computer-Integrated Manufacturing
0736-5845
Web of Science (2018): Indexed yes
Central database
Activity: Research › Peer review of manuscripts
Characterization of additive manufacturing processes for polymer micro parts productions using direct light processing (DLP) method

Period: 12 Dec 2017
Ali Davoudinejad (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
The process capability of additive manufacturing (AM) for direct production of miniaturized polymer components with micro features is analyzed in this work. The consideration of the minimum printable feature size and obtainable tolerances of AM process is a critical step to establish a process chains for the production of parts with micro scale features. A specifically designed direct light processing (DLP) AM machine suitable for precision printing has been used. A test part is designed having features with different sizes and aspect ratios in order to evaluate the DLP AM machine capability to fabricate polymer micro scale features geometries. Four different factors are evaluated for the AM process analysis: printing layer thickness, exposure time, film thickness and geometry. The process optimization of the workpiece quality features is carried out to highlight potential and challenges of the micro AM process.

Degree of recognition: International

Related event
33rd Annual Meeting of the Polymer Processing Society (PPS33)
10/12/2017 → 14/12/2017
Cancun, Mexico
Activity: Talks and presentations › Conference presentations

Dimensional accuracy of Acrylonitrile Butadiene Styrene injection molded parts produced in a pilot production with an additively manufactured insert

Period: 12 Dec 2017
Ali Davoudinejad (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Injection molding inserts manufactured additively by vat photopolymerization have become a serious option for significantly faster and more economical prototyping and pilot production due to technological progress and advancements in photopolymer materials in the recent years. 10 000 parts of a geometry including micro-features have been injection-molded in Acrylonitrile Butadiene Styrene (ABS) with a single 20x20x2.5 mm³ injection molding insert manufactured in a photopolymer composite material. This research investigates the dimensional accuracy of the injection molded parts as a function of inserts wearing and deformation with increasing shot number.

Degree of recognition: International

Related event
33rd Annual Meeting of the Polymer Processing Society (PPS33)
10/12/2017 → 14/12/2017
Cancun, Mexico
Activity: Talks and presentations › Conference presentations

Reversible Operation using Carbonaceous Gasses of a 30-cell Solid Oxide Cell Stack

Period: 12 Dec 2017 → 15 Dec 2017
Søren Højgaard Jensen (Guest lecturer)
Hendrik Langnickel (Guest lecturer)
Nils Hintzen (Other)
Ming Chen (Guest lecturer)
Xiufu Sun (Guest lecturer)
Anne Hauch (Guest lecturer)
Recent theoretical studies show that reversible electrochemical conversion of H2O and CO2 to CH4 inside novel pressurized solid oxide cells (SOCs) combined with subsurface storage of the produced gasses can facilitate seasonal electricity storage with a round-trip efficiency 70-80% and a storage cost below 3 ¢/kWh. Here we show test results from a 30-cell SOC stack operated with carbonaceous gasses at 18.7 bar at 700 °C in both electrolysis and fuel cell mode. The GC data from the electrolysis test results show 18% methane in the dry outlet gas, i.e. substantial methane formation inside the SOC stack. Further we observed degradation rates comparable to that of ambient pressure operation with H2/H2O gas mixtures.

**Links:**

**Related event**

7th European Fuel Cell Piero Lunghi Conference
12/12/2017 → 16/12/2017
Naples, Italy
Activity: Talks and presentations › Conference presentations

**Response prediction of vessel motions and sea state estimation from ships**

Period: 17 Nov 2017
Ulrik Dam Nielsen (Guest lecturer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

**Description**
Seminar at University of California - Berkeley @ Ocean Engineering.

**Documents:**
Response prediction and SSE (UCB Nov. 2017)

**Related external organisation**

University of California at Berkeley
United States
Activity: Talks and presentations › Conference presentations

**Biological features produced by additive manufacturing processes using vat photopolymerization method**

Period: 8 Nov 2017
Ali Davoudinejad (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Bio inspired surfaces have attracted great interest due to their potential applications in different industries by using a variety of structures. The fabrication of microstructures having complex shapes have been developed within the recent
decades. This work realizes the direct fabrication of micro biological features by Additive Manufacturing (AM) processes. The study characterizes the additive manufacturing processes for polymeric micro part productions using the vat photopolymerization method. A specifically designed vat photopolymerization AM machine suitable for precision printing at the micro dimensional scale has been developed, built and validated. In order to evaluate the AM machine capability a Tokay gecko test part that contains microscale pillars with widened tips was used as benchmark sample. Two main printing parameters were selected for the study: exposure time and layer thickness. In order to select the optimal range of printing parameters, a sensitivity analysis was carried out prior to the final experiment. The print quality was assessed in terms of features heights, tip heights and tip diameters.

Degree of recognition: International

Related event

euspen Special Interest Group Meeting: Micro/Nano Manufacturing
08/11/2017 → 09/11/2017
Glasgow, United Kingdom
Activity: Talks and presentations › Conference presentations

Multi-scale testing of composite steel interfaces for blade root bushing connections

Period: 8 Nov 2017 → 9 Nov 2017
Mohsen Rezaei (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
On November 8th 2017, CASMaT held the second annual symposium on Multi-Scale Experimental Mechanics. The symposium will be held every year and focus on relevant research and technology in the field of experimental mechanics.
Degree of recognition: International
Documents:
Abstract-CASMAT_MR2017

Related event

2nd International Symposium on Multiscale Experimental Mechanics was Multiscale Fatigue.
08/11/2017 → 09/11/2017
Kongens Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Comparison of measured lattice rotations of individual grains with crystal plasticity simulations

Period: 5 Nov 2017 → 11 Nov 2017
Nicolai Ytterdal Juul (Speaker)
Jette Oddershede (Other)
Grethe Winther (Guest lecturer)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
Oral presentation
Degree of recognition: International
Documents:
Abstract_Nicolai_Ytterdal_Juul_v2

Related event

18th International Conference on Textures of Materials (ICOTOM 18)
05/11/2017 → 11/12/2017
St. George, Utah, United States
Activity: Talks and presentations › Conference presentations

Measured resolved shear stresses and active slip systems in austenitic steel

Period: 5 Nov 2017 → 11 Nov 2017
Efficient use of low temperature heat sources: High performance heat pump cycles with zeotropic mixtures

Period: 24 Oct 2017
Benjamin Zühlsdorf (Guest lecturer)
Department of Mechanical Engineering
Thermal Energy

Description
The intended phase out of fossil fuels and the according, inevitable shift to renewable energy sources increased the potential for heat supply with heat pumps. Despite these increasingly attractive conditions for heat pumps and the availability of efficient heat pumps for different applications, there are different hurdles, which hinder heat pumps being implemented more frequently. One of these hurdles is a limited integration of the heat pump into the boundary conditions of the system and the resulting decreased effectiveness, especially for applications with a large temperature glide in sink and source. Therefore, the project focused on the development of a procedure, which analyses the irreversibilities of the heat pump cycle, accounts the inefficiencies to the components and the working fluid and derives based on that recommendations for improvements. One approach to optimize the cycle and enable an improved integration into the boundary conditions is the consideration of zeotropic mixtures as working fluids. By matching the temperature glide in sink and source with the temperature glide of the working fluid during phase change, the exergy destruction due to heat transfer is decreased and the overall efficiency increased. Nevertheless, the identification of a beneficial working fluid mixture requires a comprehensive screening. Finally, it could be shown, that a good choice can improve heat pump cycles dependent on the boundary conditions by more than 10 % to 30 % without adding additional equipment. The presentation will give an overview of the procedure and expectable improvements in thermodynamic and economic performance resulting from the use of mixed working fluids. It will be demonstrated by applications to different industrial case studies. Furthermore, it will be discussed which possible additional benefits and difficulties result from the use of mixtures as working fluids.

Degree of recognition: International
Documents:
2017_10_24_EHPS_Zuehlsdorf_16_9

Related event
European Heat Pump Summit: Powered by Chillventa
24/10/2017 → 25/10/2017
Nürnberg, Germany
Activity: Talks and presentations › Conference presentations
**Description**
Statistical modelling, surfaces generation and traceability for 3D Micro/Nano Optical Metrology at the Center for Precision Metrology

**Activity:** Visiting an external institution › Visiting another research institution

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**Micro 3D Additive Manufacturing and metrological methods**

**Period:** Sep 2017 → Dec 2017  
**Ali Davoudinejad (Supervisor)**

Department of Mechanical Engineering

**Description**
visiting PhD student researcher at the Technical University of Denmark (DTU)
Degree of recognition: International

**Activity:** Examinations and supervision › Supervisor activities

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**Shipboard sea state estimation based on wave-induced response measurements**

**Period:** 26 Sep 2017  
**Ulrik Dam Nielsen (Guest lecturer)**

Department of Mechanical Engineering

**Fluid Mechanics, Coastal and Maritime Engineering**

Degree of recognition: International

Documents:
- WaveEstim and DSS (MIT Sep. 2017)

**Related external organisation**

**Massachusetts Institute of Technology**
Cambridge, United States

Activity: Talks and presentations › Conference presentations

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**Complex Motion In Fluids Summer School**

**Period:** 24 Sep 2017 → 29 Sep 2017  
**Seyed Saeed Asadzadeh (Participant)**  
**Jens Honore Walther (Participant)**  
**Lasse Tor Nielsen (Participant)**  
**Julia Dölger (Participant)**  
**Thomas Kjærboe (Participant)**  
**Anders Peter Andersen (Participant)**

Department of Mechanical Engineering

**Fluid Mechanics, Coastal and Maritime Engineering**

**National Institute of Aquatic Resources**
Centre for Ocean Life

**Department of Physics**

**Biophysics and Fluids**

**Description**
The school will consist of 16 lectures in total, given by 8 speakers (90'+60' each), contributed talks, poster sessions and other activities.
Degree of recognition: International

Documents:
- Asadzadeh

**Related event**
Parallel evolution of deformation textures and dislocation boundaries
Period: 20 Sep 2017 → 22 Sep 2017
Grethe Winther (Guest lecturer)

Department of Mechanical Engineering
Materials and Surface Engineering
Degree of recognition: International

Documents:
Parallel evolution of deformation textures and dislocation boundaries

Related organisation

Parallel evolution of deformation textures and dislocation boundaries
Winther, G. (Guest lecturer)
20 Sep 2017 → 22 Sep 2017
Activity: Talks and presentations › Conference presentations

Influence of tool texture on friction and lubrication in strip reduction
Period: 17 Sep 2017 → 22 Sep 2017
Mohd Hafis Bin Sulaiman (Guest lecturer)
Peter Christiansen (Guest lecturer)
Niels Oluf Bay (Guest lecturer)

Department of Mechanical Engineering
Manufacturing Engineering

Description
International Conference on the Technology of Plasticity, ICTP 2017, 17-22 September 2017, Cambridge, United Kingdom

Abstract:
Tool texturing is studied as a method to enhance lubrication and prevent the occurrence of galling. Strip reduction test tools manufactured with longitudinal, shallow pocket geometries oriented perpendicular to the sliding direction are tested. The pockets have small angles to the workpiece surface and varying distance. The experiments show an optimum distance between the pockets to exist that creates table mountain topography with flat plateaus and narrow pockets in between. If the flat plateaus are too narrow, an increase in drawing load and pick-up on the tool plateaus is observed. The same occurs for too wide plateaus. A theoretical friction model supports the experimental findings of an optimum distance between the pockets, where the contribution to friction by mechanical interlocking of the strip in the pockets is limited and lubrication of the plateaus is enhanced by micro-plasto-hydrodynamic lubrication.

Degree of recognition: International

Related external organisation

Universiti Malaysia Perlis
Malaysia
Activity: Talks and presentations › Conference presentations

19th International Configuration Workshop (Event)
Period: 14 Sep 2017 → 15 Sep 2017
Sara Shafiee (Reviewer)

Department of Mechanical Engineering
Engineering Design and Product Development

Description
Program Committee
Degree of recognition: International
Design considerations for integration of two 5 MW vapour compression heat pumps in the Greater Copenhagen district heating system
Period: 13 Sep 2017
Torben Schmidt Ommen (Speaker)
Department of Mechanical Engineering
Thermal Energy
Degree of recognition: International
Documents:
SVAF_4DH_1

Booster heat pump with zeotropic mixtures
Period: 12 Sep 2017
Benjamin Zühlsdorf (Guest lecturer)
Department of Mechanical Engineering
Thermal Energy
Description
This study analysed a booster heat pump, which was designed for district heating networks operating at 40 °C to elevate the temperature of the forward stream to 60 °C, by using part of the stream as heat source while cooling it down to the return temperature of 25 °C. The proposed optimization approach demonstrated an increase in the thermodynamic performance, which was achieved by using mixed refrigerants.
The screening of working fluids considered 18 pure working fluids and all possible binary mixtures of these fluids. The most promising solutions were analysed with respect to their performance under conditions deviating from design conditions and their economic potential.
The best-performing mixture showed a COP of 9.01 and thereby outperformed R134a by 47 %. Although the mixed working fluids resulted in higher investment cost, the economic performance was comparable to the pure fluids. The mixtures showed similar behaviour as the pure fluids for varying operating conditions.
It was concluded that the mixtures 50 % Propylene / 50 % Butane or 50 % R1234yf / 50 % R1233zdE could considerably improve the thermodynamic performance of the overall heat supply system while being sustainable and economically competitive under the assumed economic boundary conditions.
Degree of recognition: International
Documents:
2017_09_12_4DH_BoosterHP_Zuehlsdorf_publication

Performance analysis of heat pumps utilizing different low temperature heat sources to supply district heating
Period: 12 Sep 2017
Henrik Pieper (Speaker)
Department of Mechanical Engineering
Performance analysis of heat pumps utilizing different low temperature heat sources to supply district heating

Related event

3rd International Conference on Smart Energy Systems and 4th Generation District Heating
12/09/2017 → 13/09/2017
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

International Workshop on High Temperature Heat Pumps
Period: 11 Sep 2017
Brian Elmegaard (Organizer)
Benjamin Zühlsdorf (Organizer)
Reinholdt Lars Ove (Organizer)
Michael Bantle (Organizer)
Department of Mechanical Engineering

Hierarchical microstructures in metals due to dislocation-mediated plasticity
Period: 29 Aug 2017 → 31 Aug 2017
Grethe Winther (Invited speaker)
Department of Mechanical Engineering

International Symposium on Multiscale Computational Analysis of Complex Materials
29/08/2017 → 31/08/2017
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Digital Manufacturing in the Extrusion Process Chain by Additively Manufacturing Soft Tooling for Extrusion Dies
Period: 15 Aug 2017 → 30 Jan 2018
Ali Davoudinejad (Supervisor)
Department of Mechanical Engineering

Abstract Grethe Winther
Experimental Validation of Vibro-Impact Force Models using Numeric Simulation and Perturbation Methods

Geraldo Francisco de Souza Reboucas (Guest lecturer)

Department of Mechanical Engineering

Description
The frequency response of a single-degree of freedom vibro-impact oscillator is analysed using Harmonic Linearization, Averaging and Numeric Simulations considering two different impact force models, one given by a piecewise-linear function and other by a high-order polynomial. Experimental validation is carried out using control-based continuation to obtain the experimental frequency response, including its unstable branch.

Degree of recognition: International

Documents:
Geraldo-ENOC2017
Links:
http://congressline.hu/enoc2017/abstracts/227.pdf (Link to the extended abstract on the conference site)

Related event

9th European Nonlinear Dynamics Conference (ENOC 2017)
25/06/2017 → 30/06/2017
Budapest, Hungary
Activity: Talks and presentations › Conference presentations

Coastal Dynamics 2017

Period: 12 Jun 2017 → 16 Jun 2017

David R. Fuhrman (Organizer)

Department of Mechanical Engineering

Fluid Mechanics, Coastal and Maritime Engineering

Description
Local Organizing Committee

Degree of recognition: International

Related event

Coastal Dynamics 2017
12/06/2017 → 16/06/2017
Helsingør, Denmark

Activity: Attending an event › Participating in or organising a conference

Numerical studies and experimental validation of topology-optimised aluminium heat sinks manufactured by additive manufacturing

Period: 8 Jun 2017

Joe Alexandersen (Speaker)

Department of Mechanical Engineering

Solid Mechanics

Description
Session presentation at the 12th World Congress of Structural and Multidisciplinary Optimization.

Related event

12th World Congress of Structural and Multidisciplinary Optimisation
05/06/2017 → 09/06/2017
Braunschweig, Germany

Activity: Talks and presentations › Conference presentations

Topology optimisation of passive coolers for light-emitting diode lamps

Period: 6 Jun 2017

Joe Alexandersen (Invited speaker)

Period: 1 Jun 2017
Ali Davoudinejad (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
This study investigates the micro end-milling process by using a 3D finite element modeling (3D FEM) approach. The FE model is developed for contouring up-milling operation to predict chip flow, burr formation and cutting forces. Different cutting conditions were simulated in order to investigate the influence of process variables that might be difficult or even impossible to follow in the physical experiments, particularly at this scale. 3D simulations of chip flow and temperature distribution are compared in various cutting conditions. The results of the burr formation and cutting forces predictions are compared against the experiments. The correlations were observed in terms of burr dimension trends and force profile shapes and magnitude.

Degree of recognition: International

Related event
12th World Congress of Structural and Multidisciplinary Optimisation
05/06/2017 → 09/06/2017
Braunschweig, Germany
Activity: Talks and presentations › Conference presentations

3D Printing of Bio-inspired Surfaces

Period: May 2017
Ali Davoudinejad (Supervisor)
Department of Mechanical Engineering
Manufacturing Engineering

Description
In this thesis report, the intersection of bio-inspired surfaces and additive manufacturing is investigated, with the aim of determining the feasibility and viability of leveraging 3D printing technologies to rapidly prototype surfaces that mirror those found in nature. While both of these areas are heavily researched, the overlap of the two is an area filled with endless potential, ranging from the medical industry to product design and much more. The ability to rapidly and inexpensively reproduce bio-inspired surfaces using conventional 3D printing at microscale would thus serve to enable the scientific community to conduct optimisation of 3D surface model designs and printing process parameters. This would allow for improved forecasting of surface properties before investment in nano-fabrication takes place. However, as biological surfaces display divergent and numerous features, this report utilises the gecko toes, known for their dry adhesion properties, as a case study and a basis for investigation. As a point of departure, a literature geometry based on the gecko toe is used as a benchmark.

With reference to the research consulted in the duration of this project, this report identifies multi-hierarchical structures, feature geometry, feature density, and manufacturing methods used as the key determinants of how well 3D printing can emulate the intricate features of the gecko’s toes. In this regard, Stereolithography (SLA) and Direct Light Processing (DLP) are characterised via experiments involving translating a simplification of the gecko toes features derived from the literature (literature sample) into a CAD model, and thereafter printing the model while manipulating different process parameters. In this particular case, DLP was found to outperform SLA in relation to features sizes, tolerances and other qualitative and quantitative criteria. As such, this thesis focuses on DLP as the most promising manufacturing method for the purpose of this project’s aim. Based on conducting a wettability test (water drop angle measurement), it was
determined that smaller and more intricate designs showed better wettability properties compared with the simplified literature geometry. This is indicative of that the simplification of bio-inspired surfaces is likely detrimental to the emergent properties of the replicated geometry. Hence, the capabilities of 3D printing geometries to print smaller, denser and more complex surface features should enable a closer match between synthetic bio-surfaces and real ones.

Degree of recognition: International
Links:
Activity: Examinations and supervision › Supervisor activities

Feasibility study on integrated process/product quality assurance framework for precision injection moulding based on vibration monitoring
Period: 29 May 2017 → 31 May 2017
Nikolaos Giannekas (Other)
Rene Gammelby (Other)
Guido Tosello (Other)
Dmitri Tcherniak (Other)
Yang Zhang (Other)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Feasibility study on integrated process/product quality assurance framework for precision injection moulding based on vibration monitoring
Degree of recognition: International
Documents:
EUSPEN2017_Poster_nikgia

Related organisation
Feasibility study on integrated process/product quality assurance framework for precision injection moulding based on vibration monitoring
Giannekas, N. (Other), Rene Gammelby (Other), Tosello, G. (Other), Dmitri Tcherniak (Other), Zhang, Y. (Other)
29 May 2017 → 31 May 2017
Activity: Talks and presentations › Conference presentations

Oral presentation
Period: 17 May 2017
Malene Hovgaard Vested (Guest lecturer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Degree of recognition: National
Documents:
AbstractDANSIS2017

Related event
Dansis Research Seminar 2017
17/05/2017 → …
Kgs Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Replication and analysis of polymer micro structured functional surfaces for contrast generation
Period: 9 May 2017
Francesco Regi (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering
A preliminary study on replication and quality correlation of on-part and on-runner polymer injection moulded micro features

Period: 7 May 2017 → 9 May 2017

Nikolaos Giannekas (Guest lecturer)
Guido Tosello (Other)
Yang Zhang (Other)

Department of Mechanical Engineering
Manufacturing Engineering

Description

A preliminary study on replication and quality correlation of on-part and on-runner polymer injection moulded micro features

PRN 2017- Polymer replication on Nanoscale Conference

Degree of recognition: International

Documents:

PRN2017_Poster_nikgia

Related event

Polymer Replication on Nanoscale 2017
08/05/2017 → 09/05/2017
Aachen, Germany
Activity: Talks and presentations › Conference presentations

University of North Carolina at Charlotte
Period: 1 May 2017 → 31 Jul 2017

Danilo Quagliotti (Visiting researcher)

Department of Mechanical Engineering
Manufacturing Engineering

Description

Statistical modelling, surfaces generation and traceability for 3D Micro/Nano Optical Metrology at the Center for Precision Metrology

Activity: Visiting an external institution › Visiting another research institution

Oral presentation

Period: 24 Apr 2017 → 28 Apr 2017

Malene Hovgaard Vested (Guest lecturer)

Department of Mechanical Engineering

Fluid Mechanics, Coastal and Maritime Engineering

Degree of recognition: International

Documents:

EGU2017-7837

Related event

EGU General Assembly 2017: European GEosciences Union 2017
24/04/2017 → 28/04/2017
Vienna, Austria
Activity: Talks and presentations › Conference presentations
Harmonic Polynomial Cell method with Immersed Boundaries
Period: 3 Apr 2017 → 7 Apr 2017
Yanlin Shao (Speaker)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Degree of recognition: International
Documents:
HYWEC2017_Shao
Links:

Related event

BCAM WORKSHOP HYDRODYNAMICS OF WAVE ENERGY CONVERTERS
03/04/2017 → 07/04/2017
Basque, Spain
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Factors affecting the thermophysical properties of nanofluids
Period: Mar 2017
Maria E. Mondejar Montagud (Other)
Fredrik Haglind (Other)
Department of Mechanical Engineering
Thermal Energy
Degree of recognition: International
Documents:
mcaa_book_of_abstracts17_MEMondejar

Related event

4th Marie Curie Alumni Association Annual Meeting
24/03/2017 → …
Salamanca, Spain
Activity: Talks and presentations › Conference presentations

Biomedical Microdevices (Journal)
Period: 30 Mar 2017 → 31 Dec 2017
Govindan Puthumana (Reviewer)
Department of Mechanical Engineering

Description
Biomedical Microdevices
Degree of recognition: International
Links:
https://link.springer.com/journal/10544

Related journal

Biomedical Microdevices
1387-2176
Central database
Activity: Research › Journal editor

DCAMM 16th Internal Symposium
Period: 13 Mar 2017 → 15 Mar 2017
Lubricant transport across the piston ring with flat and triangular lubrication injection profiles on the liner in large two-stroke marine diesel engines
Period: 3 Feb 2017
Hannibal Toxvaerd Overgaard (Guest lecturer)
Department of Mechanical Engineering
Solid Mechanics

Metrology for additively manufactured medical implants
Period: 3 Feb 2017 → 30 Apr 2017
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

The Danish Society of Engineers, IDA (External organisation)
Period: 1 Feb 2017 → …
Govindan Puthumana (Participant)
Department of Mechanical Engineering

International Symposium on Multiscale Computational Analysis of Complex Materials (Event)
Period: 1 Jan 2017 → 31 Aug 2017
Grethe Winther (Member)
Department of Mechanical Engineering
Materials and Surface Engineering

International Symposium on Multiscale Computational Analysis of Complex Materials
EBSD 2016 Dresden
Period: 2016
Annika Martina Diederichs (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
study of microstructure heterogenization in rolling contact fatigue of 100Cr6 bearings

Related event
EBSD 2016 Dresden
30/03/2016 → …
Activity: Talks and presentations › Conference presentations

Precision Engineering (Journal)
Period: 2016 → …
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering
Degree of recognition: International

Related journal
Precision Engineering
0141-6359
Central database
Activity: Research › Peer review of manuscripts

Sensors (Journal)
Period: 2016 → …
Alessandro Stolfi (Reviewer)
Department of Applied Mathematics and Computer Science
Department of Mechanical Engineering
Manufacturing Engineering

Related journal
Sensors
1424-8220
Central database
Activity: Research › Peer review of manuscripts

Mechanics of Advanced Materials and Modern Processes (Journal)
Period: 1 Dec 2016 → …
Govindan Puthumana (Reviewer)
Department of Mechanical Engineering
Manufacturing Engineering

**Related journal**

**Mechanics of Advanced Materials and Modern Processes**
2198-7874
Indexed in DOAJ
Local database
Activity: Research › Peer review of manuscripts

**ATV Sustain conference**
Period: 30 Nov 2016
Govindan Puthumana (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
ATV Sustain conference

**Related event**

**ATV Sustain conference**
30/11/2016 → 30/11/2016
Activity: Talks and presentations › Conference presentations

**How to Get Published in an International Journal**
Period: 29 Nov 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
How to Get Published in an International Journal

**Related event**

**How to Get Published in an International Journal**
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Oral examinations, including group examination**
Period: 28 Nov 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Oral examinations, including group examination

**Related event**

**Oral examinations, including group examination**
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**How to prepare a successful proposal for Horizon 2020**
Period: 24 Nov 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
How to prepare a successful proposal for Horizon 2020

Related event

How to prepare a successful proposal for Horizon 2020
24/11/2016 → 24/11/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU's 5. undervisningsbiennale: God undervisningspraksis i ingeniøruddannelserne
Period: 17 Nov 2016
Govindan Puthumana (Participant)
LearningLab DTU
Department of Mechanical Engineering

Description
DTU's 5. undervisningsbiennale: God undervisningspraksis i ingeniøruddannelserne

Related event

DTU's 5. undervisningsbiennale: God undervisningspraksis i ingeniøruddannelserne
17/11/2016 → 17/11/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Supervision of PhD students at DTU
Period: 14 Nov 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
LearningLab DTU

Description
Supervision of PhD students at DTU

Related event

Supervision of PhD students at DTU
14/11/2016 → 14/11/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

TECNICHE INNOVATIVE DI INDURIMENTO SUPERFICIALE E TRATTAMENTO CRIOGENICO DEGLI ACCIAI
Period: 10 Nov 2016
Matteo Villa (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering
Degree of recognition: National
Documents:
Dispense GdS Trento 10 Nov 2016 - Matteo Villa
Links:
http://www.metallurgia-italiana.net/manifestazione.php?id=409&idc=1

Related event

Tecniche Innovative di Indurimento Superficiale e Trattamento Criogenico Degli Acciai
Euspen Special Interest Group Meeting: Structured & Freeform Surfaces
Period: 9 Nov 2016 → 11 Nov 2016
Prateek Saxena (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Poster presentation
Computed Tomography characterization of the Green Fiber Bottle
Documents:
Poster_Saxena and Bissacco

Related event
Euspen Special Interest Group Meeting: Structured & Freeform Surfaces
09/11/2016 → 10/11/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Euspen Special Interest Group Meeting: Structured & Freeform Surfaces
Period: 9 Nov 2016
Mattia Didone (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Related event
Euspen Special Interest Group Meeting: Structured & Freeform Surfaces
09/11/2016 → 10/11/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK
Period: 9 Nov 2016 → 10 Nov 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK

Related event
Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK
09/11/2016 → 10/11/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK
Period: 9 Nov 2016
Danilo Quagliotti (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Objectives comparison in a confocal microscope using pseuso-random roughness artefacts

Oral session: Surfaces for nano manufacturing and their metrology
Documents:
LWD Bento B_Quagliotti DID # SFS121

Related event
Special Interest Group Meeting: Structured & Freeform Surfaces 9th – 10th November 2016 - Technical University of Denmark (DTU) Copenhagen, DK
09/11/2016 → 10/11/2016
Activity: Talks and presentations › Conference presentations

E-LASS European network for lightweight applications at sea
Period: 8 Nov 2016 → 9 Nov 2016
Vasileios Karatzas (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Related event
E-LASS European network for lightweight applications at sea
08/11/2016 → 09/11/2016
Finspång, Sweden
Activity: Talks and presentations › Conference presentations

University of Nottingham
Danilo Quagliotti (Visiting researcher)
Department of Mechanical Engineering
Manufacturing Engineering

Description
ISO 25178 part 600 metrological characteristics for a point autofocus instrument: Measurement noise of a point autofocus instrument
Activity: Visiting an external institution › Visiting another research institution

University of Copenhagen Innovation Day 2016
Period: 13 Oct 2016
Govindan Puthumana (Participant)
Manufacturing Engineering
Department of Mechanical Engineering

Description
Innovation Day 2016 - Workshop: Innovation course design - themes, tools and methods

Innovation Day - University of Copenhagen

Related event
University of Copenhagen Innovation Day 2016: Innovation course design - themes, tools and methods
13/10/2016 → 13/10/2016
Copenhagen, Denmark
Analysis of grain-scale experimental data in a crystal plasticity framework
Grethe Winther (Invited speaker)
Department of Mechanical Engineering
Materials and Surface Engineering
Documents:
Abstract

Related event
8th International Conference on Multiscale Materials Modeling
09/10/2016 → 14/10/2016
Dijon, France
Activity: Talks and presentations › Conference presentations

Making your research visible II
Period: 6 Oct 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Making your research visible - II

Related event
Making your research visible II
06/10/2016 → 06/10/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

1st International Symposium on Multi-Scale Experimental Mechanics
Period: 5 Oct 2016
Vasileios Karatzas (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Related event
1st International Symposium on Multi-Scale Experimental Mechanics
05/10/2016 → 05/10/2016
Roskilde, Denmark
Activity: Talks and presentations › Conference presentations

Determination of mechanical properties of Glass-Epoxy composites and sandwich structures at elevated temperatures
Period: 5 Oct 2016
Mohsen Rezaei (Guest lecturer)
Department of Mechanical Engineering
Solid Mechanics

Description
On October 5th 2016, CASMaT held the first annual symposium on Multi-Scale Experimental Mechanics. The symposium will be held every year and focus on relevant research and technology in the field of experimental mechanics. The symposium consisted of keynote presentations, scientific and technical presentations and a visit to the testing facilities at DTU Risø Campus in Roskilde.
Degree of recognition: International
Related external organisation

Annual symposium on Multi-Scale Experimental Mechanics
Denmark
Activity: Talks and presentations › Conference presentations

Danish course 872
Period: 3 Oct 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Danish course 872

Related event

Danish course 872
03/10/2016 → …
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Developing the Green Fiber Bottle
Period: 3 Oct 2016
Ellen Brilhuis Meijer (Lecturer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Guest lecture at the course ‘Product Life and Environmental Issues’

Related organisation

Developing the Green Fiber Bottle
Meijer, E. B. (Lecturer)
3 Oct 2016
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Introduction to SimaPro
Period: 3 Oct 2016
Ellen Brilhuis Meijer (Lecturer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Lecture at the Masters course ‘Life Cycle Assessment of Products and Systems’

Related organisation

Introduction to SimaPro
Meijer, E. B. (Lecturer)
3 Oct 2016
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities
Modeling and analyzing solar heating plants to predict thermal performance
Period: 27 Sep 2016
Henrik Pieper (Speaker)
Department of Mechanical Engineering
Thermal Energy
Degree of recognition: International
Documents:
Modeling and analyzing solar heating plants to predict thermal performance
Links:
http://www.4dh.eu/conferences/conference-2016/slides-presentations

Related event
2nd International Conference on Smart Energy Systems and 4th Generation District Heating
27/09/2016 → 28/09/2016
Aalborg, Denmark
Activity: Talks and presentations › Conference presentations

7th international conference on mass customization and personalization in Central Europe (Event)
Period: 21 Sep 2016 → 23 Sep 2016
Sara Shafiee (Reviewer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Program Committee
Degree of recognition: International

Related event
7th international conference on mass customization and personalization in Central Europe
21/09/2016 → 23/09/2016
Novi Sad, Serbia
Activity: Research › Peer review of manuscripts

Characterization of the micrometric structure of molded pulp using X-ray microtomography
Period: 21 Sep 2016 → 22 Dec 2016
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Meeting with SIRI and DIS

Related event
Meeting with SIRI and DIS
20/09/2016 → 20/09/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.
**Life Cycle Assessment for Product Designers**  
Period: 19 Sep 2016  
Ellen Brilhuis Meijer (Lecturer)  
Department of Mechanical Engineering  
Engineering Design and Product Development

**Description**  
Lecture at the course 'Product Life and Environmental Issues'  
(Course lecturer)

**Related event**

**Product Life and Environmental Issues**  
19/09/2016 → 19/09/2016  
Denmark  
Activity: Other

**Prediction of dislocation boundary characteristics**  
Period: 19 Sep 2016 → 23 Sep 2016  
Grethe Winther (Invited speaker)  
Department of Mechanical Engineering  
Materials and Surface Engineering

**Documents:**  
Winther_abstract

**Related event**

**Dislocations 2016**  
19/09/2016 → 23/09/2016  
West Lafayette, United States  
Activity: Talks and presentations › Conference presentations

**Metrology for additive manufacturing of medical implants**  
Period: 13 Sep 2016 → 31 Dec 2016  
Alessandro Stolfi (Participant)  
Department of Mechanical Engineering  
Manufacturing Engineering  
Activity: Other

**Demonstration - Course 41742**  
Period: 8 Sep 2016  
Govindan Puthumana (Participant)  
Department of Mechanical Engineering  
Manufacturing Engineering

**Description**  
Demonstration - Course 41742  
Introduction to micro-mechanical system design and manufacture

**Related event**

**Demonstration - Course 41742**  
08/09/2016 → 08/09/2016  
Activity: Attending an event › Participating in or organising a conference
Technological signature in precision injection compression moulding of polymer Fresnel lenses
Period: 1 Sep 2016 → 31 Jan 2017
Danilo Quagliotti (Supervisor)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Examinations and supervision › Supervisor activities

EuroTech Postdoc workshop
Period: 31 Aug 2016 → 2 Sep 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Technical University of Munich
EuroTech Postdoc workshop
Related event

Rheology of High-Melt-Strength Polypropylene for Additive Manufacturing
Period: 24 Aug 2016
Thomas Hofstätter (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Oral Contribution at EAMC
Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Crack Tip Flipping Under Mode I/III Tearing
Christian Lotz Felter (Lecturer)
Department of Mechanical Engineering
Solid Mechanics
Documents:
felter_jensen_nielsen_2016
Related event

24th International Congress of Theoretical and Applied Mechanics
21/08/2016 → 26/08/2016
Montreal, Canada
Activity: Talks and presentations › Conference presentations

DTU Mekanik Sommerseminar 2016
Period: 18 Aug 2016
Govindan Puthumana (Participant)
15th International Symposium on Magnetic Bearings
Period: 3 Aug 2016
Jonas Skjedt Lauridsen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Co-author

Related event
15th International Symposium on Magnetic Bearings
03/08/2016 → …
Kitakyushu, Japan
Activity: Attending an event › Participating in or organising a conference

Measured Resolved Shear Stresses on Slip Systems in Austenitic Steel Grains
Period: 10 Jul 2016 → 13 Jul 2016
Grethe Winther (Other)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
Co-author

Related event
3rd International Congress on Materials Science
10/07/2016 → 13/07/2016
St. Charles, United States
Activity: Talks and presentations › Conference presentations

Danish summer school 880
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Danish summer school 880

Related event
Danish summer school 880
04/07/2016 → 15/07/2016
Traceability investigation in Computed Tomography using industry-inspired workpieces
Period: 1 Jul 2016 → 30 Sep 2017
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

University of Padova
Period: Jun 2016 → Jul 2018
Sara Shafiee (Visiting researcher)
Department of Mechanical Engineering
Engineering Design and Product Development
Activity: Visiting an external institution → Visiting another research institution

18th Summer School on Engineering Design Research
Ellen Brilhuis Meijer (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development
Description
Summer School for PhD students, with two course weeks over the summer.
Degree of recognition: International

Related event
18th Summer School on Engineering Design Research
27/06/2016 → 30/07/2016
Activity: Attending an event → Participating in or organising workshops, courses, seminars etc.

Prediction of Solar Heating Plant Performance
Period: 24 Jun 2016
Henrik Pieper (Speaker)
Department of Mechanical Engineering
Thermal Energy
Degree of recognition: Local
Documents:
Prediction of Solar Heating Plant Performance

Related event
Grøn dyst 2016
24/06/2016 → 24/06/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations → Conference presentations

Motivation and Learning
Period: 22 Jun 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Motivation and Learning

Related event

Motivation and Learning
22/06/2016 → 22/06/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Advanced LCA PhD Course 2016
Ellen Brilhuis Meijer (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

Related event

Advanced LCA PhD Course 2016
20/06/2016 → 24/06/2016
Aalborg, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Accurate Manufacture-DLM
Period: 16 Jun 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Accurate Manufacture-DLM

Related event

Accurate Manufacture-DLM
16/06/2016 → 16/06/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Integrating Product and Technology Development: A Proposed Reference Model for Dual Innovation
Period: 15 Jun 2016
Ellen Brilhuis Meijer (Speaker)
Department of Mechanical Engineering
Engineering Design and Product Development
Degree of recognition: International

Related event

26th CIRP Design Conference
15/06/2016 → 17/06/2016
Stockholm, Sweden
Activity: Talks and presentations › Conference presentations

The 17th Nordic Symposium on Tribology
Hannibal Toxværd Overgaard (Participant)
Department of Mechanical Engineering
Solid Mechanics
Talk in "Tribology of Machine Elements' with the title 'Investigation of Different Piston Ring Curvatures on Lubricant Transport along Cylinder Liner in Large Two-Stroke Marine Diesel Engines'.

NordTrib2016 - The 17th Nordic Symposium on Tribology

Related event

The 17th Nordic Symposium on Tribology
14/06/2016 → 17/06/2016
Hämeenlinna, Finland
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Økonomioversigter
Period: 13 Jun 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Økonomioversigter

Related event

Økonomioversigter
13/06/2016 → 13/06/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Novo Nordisk AS
Period: 10 Jun 2016 → 30 Aug 2016
Alessandro Stolfi (Visiting researcher)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Harmonization of uncertainty budget for CT scanner at Novo Nordisk
Activity: Visiting an external institution › Visiting another research institution

Performance Verication of the Moulding Method for Production of Paper Bottles
Period: 3 Jun 2016 → 23 Jun 2016
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

Best Presentation Award
Period: 2 Jun 2016
Thomas Hofstätter (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Degree of recognition: International

Related event

16th euspen International Conference & Exhibition
30/05/2016 → 03/06/2016
Nottingham, United Kingdom
Successful management of externally financed project at DTU - from Grant to project closing
Period: 26 May 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Successful management of externally financed project at DTU - from Grant to project closing

Related event
Successful management of externally financed project at DTU - from Grant to project closing
26/05/2016 → 26/05/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Marie Skłodowska-Curie Individual Fellowships 2016
Period: 24 May 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Marie Skłodowska-Curie Individual Fellowships 2016

Related event
Marie Skłodowska-Curie Individual Fellowships 2016
24/05/2016 → 24/05/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Intern handel
Period: 18 May 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Intern handel

Related event
Intern handel
18/05/2016 → 18/05/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

HTCPM 2016 - 9th International Symposium on High-Temperature Corrosion and Protection of Materials
Period: 15 May 2016 → 20 May 2016
Duoli Wu (Participant)
Department of Mechanical Engineering
Materials and Surface Engineering
Description
HTCPM 2016 - 9th International Symposium on High-Temperature Corrosion and Protection of Materials
Related event

**HTCPM 2016 - 9th International Symposium on High-Temperature Corrosion and Protection of Materials**
15/05/2016 → 20/05/2016
Les Embiez Island, France
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Learning by Failing/Learning by Succeeding**
Period: 3 May 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Learning by Failing/Learning by Succeeding

**Related event**

**Learning by Failing/Learning by Succeeding**
03/05/2016 → 03/05/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Precision Metrology Workshop - Optical Metrology**
Period: 19 Apr 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Precision Metrology Workshop - Optical Metrology

**Related event**

**Precision Metrology Workshop - Optical Metrology**
19/04/2016 → 19/04/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Introduction to Pulp and paper Technology 2016**
Period: 13 Apr 2016 → 15 Apr 2016
Ellen Brilhuis Meijer (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development
Degree of recognition: National

**Related event**

**Introduction to Pulp and paper Technology 2016**
13/04/2016 → 15/04/2016
Vancouver, Canada
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Principle for achieving metrological traceability with CMM’s**
Period: 12 Apr 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Principle for achieving metrological traceability with CMM's

Related event
Principle for achieving metrological traceability with CMM's
12/04/2016 → 12/04/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Search, cite, publish - information competences for PhD students and newly employed researchers
Period: 12 Apr 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering

Description
Search, cite, publish - information competences for PhD students and newly employed researchers

Related event
Search, cite, publish - information competences for PhD students and newly employed researchers
12/04/2016 → 12/04/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

University of British Columbia
Period: 11 Apr 2016 → 14 May 2016
Ellen Brilhuis Meijer (Visiting researcher)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Research visit to the Faculty of Forestry and the Pulp and Paper Centre.
Activity: Visiting an external institution › Visiting another research institution

PhD supervision
Period: 4 Apr 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering

Description
PhD supervision

Related event
PhD supervision
04/04/2016 → 04/04/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Fracture Toughness Characterization of Honeycomb Core Sandwich Composites in Mode - I: A Comparative Study
Vishnu Saseendran (Speaker)
Christian Berggreen (Lecturer)
Leif A. Carlsson (Lecturer)
Department of Mechanical Engineering
Solid Mechanics
Centre for oil and gas – DTU

Description
The aim of this paper is to experimentally investigate face/core fracture toughness and disbond propagation in a honeycomb core sandwich using two contemporary test methods - single cantilever beam (SCB) and double cantilever beam uneven bending moments (DCB-UBM). These test methods will be performed in mode-I conditions to allow comparison.
Degree of recognition: International

Related event
11th International Conference on Sandwich Structures (ICSS-11)
20/03/2016 → 22/03/2016
Fort Lauderdale, FL., United States
Activity: Talks and presentations › Conference presentations

HTC/KME Symposium 2016
Duoli Wu (Participant)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
The annual HTC/KME symposium was held in March 15-16 Where: AF-Borgen, Sandgatan 2, Lund, Sweden
The symposium is intended for employees at member companies and others taking part in the HTC and KME programmes in the current programme periods 2014-2017/8.
Links:
hhttp://www.energiforsk.se/konferenser/kmehtc-research-symposium-2016/

Related event
HTC/KME Symposium 2016
15/03/2016 → 16/03/2016
Lund , Sweden
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Physikalisch-Technische Bundesanstalt,
Period: 15 Mar 2016 → 1 May 2016
Alessandro Stolfi (Visiting researcher)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Creating a Multi-material Probing Error Test for the Acceptance Testing of Dimensional Computed Tomography Systems
Activity: Visiting an external institution › Visiting another research institution

Making your research visible
Period: 8 Mar 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
Making your research visible

Related event
Making your research visible
08/03/2016 → 08/03/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

New Concepts for Shipboard Sea State Estimation
Period: 1 Mar 2016
Ulrik Dam Nielsen (Speaker)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Description
Seminar talk/presentation given at University of California, Santa Barbara, USA.
Documents:
SeaStateEstimation_UCSB

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

H.C. Ørsted COFUND Postdoc Programme Network Group Meeting
Period: 26 Feb 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Description
H.C. Ørsted COFUND Postdoc Programme Network Group Meeting

Related event
H.C. Ørsted COFUND Postdoc Programme Network Group Meeting
26/02/2016 → 26/02/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Intragranular orientation spread induced by grain interaction
Period: 14 Feb 2016 → 18 Feb 2016
Grethe Winther (Invited speaker)
Department of Mechanical Engineering
Materials and Surface Engineering
Documents:
Intragranular orientation spread induced by grain interaction

Related event
TMS 2016 145th ANNUAL MEETING & EXHIBITION
14/02/2016 → 18/02/2016
Nashville, United States
Activity: Talks and presentations › Conference presentations

Danish course 874
Period: 2 Feb 2016 → 2 Jun 2016
Govindan Puthumana (Participant)
Design and Optimization of High Precision Positioning Fixture
Period: 1 Feb 2016 → 23 Jun 2016
Danilo Quagliotti (Supervisor)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Co-supervision of Bachelor thesis. Students: Martin Kain and Michael Gani
Activity: Examinations and supervision › Supervisor activities

17th Workshop of Nordic Maritime Universities and DNV-GL
Period: 21 Jan 2016 → 22 Jan 2016
Vasileios Karatzas (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Presentation of Structural component testing under thermomechanical loading

Application of Digital Image Correlation for Material Testing
Period: 19 Jan 2016 → 21 Jan 2016
Andrei Costache (Lecturer)
Department of Civil Engineering
Department of Mechanical Engineering

Description
(Course lecturer)
Links:

Eksperimental strukturel mekanik
04/01/2016 → 22/01/2016
Kgs. Lyngby, Denmark
Activity: Other
Experimental Solid Mechanics (41811)
Period: 12 Jan 2016 → 18 Jan 2016
Andrei Costache (Lecturer)
Department of Mechanical Engineering

Description
Application of Digital Image Correlation for Material Testing
Links:

Related event

Experimental Solid Mechanics (41811)
04/01/2016 → 25/02/2016
Kgs. Lyngby, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

H. C. Ørsted COFUND postdoc Fellow day
Period: 7 Jan 2016
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
H. C. Ørsted COFUND postdoc Fellow day
H. C. Ørsted COFUND postdoc Fellow day

Related event

H. C. Ørsted COFUND postdoc Fellow day
07/01/2016 → 07/01/2016
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Applied Ocean Research (Journal)
Period: 2015 → …
David R. Fuhrman (Reviewer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

Description
Editorial Board
Degree of recognition: International

Related journal

Applied Ocean Research
0141-1187
Central database
Activity: Research › Journal editor

Global Cleaner Production & Sustainable Consumption Conference
Period: 2015
Vinicius Picanco Rodrigues (Speaker)
Department of Mechanical Engineering

Related event
Global Cleaner Production & Sustainable Consumption Conference: Accelerating the Transition to Equitable Post Fossil-Carbon Societies
01/11/2015 → 04/11/2015
Sitges, Barcelona, Spain
Activity: Talks and presentations › Conference presentations

Journal of Cleaner Production (Journal)
Period: 2015 → ...
Vinicius Picano Rodrigues (Reviewer)
Department of Mechanical Engineering
Engineering Design and Product Development
Degree of recognition: International
Related journal
Journal of Cleaner Production
0959-6526
Central database
Activity: Research › Peer review of manuscripts

Journal of Offshore Mechanics and Arctic Engineering (Journal)
Period: 2015 → ...
David R. Fuhrman (Reviewer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
Description
Associate Editor
Degree of recognition: International
Related journal
Journal of Offshore Mechanics and Arctic Engineering
0892-7219
BFI (2018): BFI-level 1, Scopus rating (2016): CiteScore 0.89 SJR 0.668 SNIP 0.749, ISI indexed (2013): ISI indexed yes, Web of Science (2018): Indexed yes
Central database
Activity: Research › Journal editor

Waste Heat Recovery in a Cruise Vessel in the Baltic Sea by Using an Organic Rankine Cycle: A Case Study
Period: 2015
Fredrik Ahlgren (Speaker)
Maria E. Mondejar Montagud (Other)
Marcus Thern (Other)
Magnus Genrup (Other)
Department of Mechanical Engineering
Thermal Energy
Links:
Related event
ASME Turbo Expo 2015
15/06/2015 → ...
Canada
Activity: Talks and presentations › Conference presentations
DTU Sustain conference 2015
Period: 17 Dec 2015
Govindan Puthumana (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
DTU Sustain conference 2015

Related event

DTU Sustain Conference 2015
17/12/2015 → 17/12/2015
Lyngby, Denmark
Activity: Talks and presentations › Conference presentations

Why sustainability is still not integrated into product development?
Period: 16 Dec 2015
Daniela Cristina Antelmi Pigossi (Keynote speaker)
Department of Mechanical Engineering
Engineering Design and Product Development

Related event

8th Plenary Meeting Collaborative Research Center 1026 – Sustainable Manufacturing
16/12/2015 → 17/12/2015
Berlin, Germany
Activity: Talks and presentations › Conference presentations

DTU Seminar: Educating Engineers for the Future - Solving Engineering Dilemmas with Innovation as a Context for Teaching
Period: 8 Dec 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
DTU Seminar: Educating Engineers for the Future - Solving Engineering Dilemmas with Innovation as a Context for Teaching

Related event

DTU Seminar: Educating Engineers for the Future - Solving Engineering Dilemmas with Innovation as a Context for Teaching
08/12/2015 → 08/12/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DTU Modeling day 2015
Period: 7 Dec 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
**Description**
DTU Modeling day 2015

**Related event**
DTU Modeling day 2015
07/12/2015 → 07/12/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**EUSPEN Micro/Nano Manufacturing Workshop**
Period: 25 Nov 2015
Danilo Quagliotti (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Metrological investigation of nanostructured polymer surfaces replication using atomic force microscopy

**Documents:**
AdvIMReplication_ID # MN-136_v1_revised

**Related event**
EUSPEN Micro/Nano Manufacturing Workshop
24/11/2015 → 26/11/2015
Teddington, United Kingdom
Activity: Talks and presentations › Conference presentations

**Language Learning Event**
Period: 2 Nov 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Language Learning Event

**Related event**
Language Learning Event
02/11/2015 → 02/11/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Global Cleaner Production & Sustainable Consumption Conference**
Period: 1 Nov 2015 → 4 Nov 2015
Daniela Cristina Antelmi Pigosso (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

**Description**
1.RODRIGUES, V.P.; PIGOSSO, D.C.A.; MCALOONE, T.C. KPIs for measuring the sustainability performance of ecodesign implementation into product development and related processes: a systematic literature review. Global Cleaner Production & Sustainable Consumption Conference. 2015, Barcelona, Spain.

**Related event**
Global Cleaner Production & Sustainable Consumption Conference: Accelerating the Transition to Equitable Post Fossil-Carbon Societies
01/11/2015 → 04/11/2015
Sitges, Barcelona, Spain
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Modeling Void-by-void Growth vs. Void Interaction in Thin Sheet Metal**
Christian Lotz Felter (Lecturer)
Department of Mechanical Engineering
Solid Mechanics
Documents:
2015_SES_Felter_Nielsen

**Related event**

52nd Annual Technical Meeting of the Society of Engineering Science
26/10/2015 → 28/10/2015
Texas, United States
Activity: Talks and presentations › Conference presentations

**Introduction to research councils and foundations 20th October 2015**
Period: 20 Oct 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

**Description**
Introduction to research councils and foundations 20th October 2015

Introduction to research councils and foundations 20th October 2015

**Related event**

Introduction to research councils and foundations 20th October 2015
20/10/2015 → 20/10/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Developing the Green Fiber Bottle**
Period: 19 Oct 2015
Ellen Brilhuis Meijer (Lecturer)
Department of Mechanical Engineering
Engineering Design and Product Development

**Description**
Lecture at the course 'Product Life and Environmental Issues'

**Related organisation**

Developing the Green Fiber Bottle
Meijer, E. B. (Lecturer)
19 Oct 2015
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

**training courses for Thermo-cal and DICTRA**
Duoli Wu (Participant)
Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
Training courses for Thermo-cal and DICTRA

**Links:**
http://www.thermocalc.com/training/training-courses/

**Related event**

training courses for Thermo-cal and DICTRA
13/10/2015 → 16/10/2015
Stockholm, Sweden
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Maritime Engineering Education (at DTU): What are the challenges?**
Period: 9 Oct 2015
Ulrik Dam Nielsen (Lecturer)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering
**Documents:**
Maritime education - What are the challenges

**Related event**

Danish Maritime Days: ATV Seminar
05/10/2015 → 09/10/2015
Denmark
Activity: Talks and presentations › Conference presentations

**The Nordic Flame Days 2015**
Period: 6 Oct 2015
Sunday Chukwudi Okoro (Speaker)
Materials and Surface Engineering
Department of Mechanical Engineering
CHEC Research Centre

**Description**
Alkali chloride induced corrosion of superheaters under biomass firing conditions: Improved insights from laboratory scale studies

**Related event**

The Nordic Flame Days 2015
06/10/2015 → 07/10/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

**Observation of deformation induced redistribution of chromium and carbon in bearing steel**
Period: Sep 2015
Annika Martina Diederichs (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
Microscopy Conference 2015, Georg-August-Universität Göttingen, Germany

**Related external organisation**
**SimaPro Exercise**  
*Period:* 24 Sep 2015  
Ellen Brilhuis Meijer (Lecturer)  
Department of Mechanical Engineering  
Engineering Design and Product Development  

**Description**  
Lecture at the Masters course 'Life Cycle Assessment of Products and Systems'  

**Related organisation**  
**SimaPro Exercise**  
Meijer, E. B. (Lecturer)  
24 Sep 2015  
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities  

**11621 How to write a scientific paper**  
*Period:* 17 Sep 2015 → 9 Dec 2015  
Govindan Puthumana (Participant)  
Department of Mechanical Engineering  
Manufacturing Engineering  

**Description**  
11621 How to write a scientific paper  

**Related event**  
**11621 How to write a scientific paper**  
17/09/2015 → 09/12/2015  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

**Danish course 888**  
*Period:* 15 Sep 2015 → 3 Dec 2015  
Govindan Puthumana (Participant)  
Department of Mechanical Engineering  
Manufacturing Engineering  

**Description**  
Danish course 888  

**Related event**  
**Danish course 888**  
15/09/2015 → 03/12/2015  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

**Dimensional and Surface Micro/Nano Metrology for Precision Moulding Technology**  
*Period:* 7 Sep 2015 → 15 Jan 2016  
Danilo Quagliotti (Supervisor)  
Department of Mechanical Engineering  
Manufacturing Engineering
**Optical Metrology and Precision Milled Metal Surfaces for Process Validation and Product Quality Assurance**

**Period:** 1 Sep 2015 → 1 Feb 2016

Danilo Quagliotti (Supervisor)

Department of Mechanical Engineering

**Description**

Master project supervisor

Danish title: Optisk metrologi af præcision fræsede metaloverflader til procesvalidering og kvalitetssikring af produktet

English title: Optical Metrology and Precision Milled Metal Surfaces for Process Validation and Product Quality Assurance

ECTS Credits: 30

Cooperation Companies: LEGO Systems A / S

The forms of cooperation: The project conducted partly at DTU and partly in company

Project conducted in: Denmark

Supervisor (s): Guido Tosello (guto@mek.dtu.dk) - Danilo Quagliotti (danqua@mek.dtu.dk)

Supervisor (s) (external): Stefania Gasparin (stefania.gasparin@lego.com)

Students: 151883 (Federico Baruffi)

Activity: Examinations and supervision › Supervisor activities

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**A methodology for designing flexible multi-generation systems**

**Period:** 25 Aug 2015

Christoffer Ernst Lythcke-Jørgensen (Invited speaker)

Department of Mechanical Engineering

**Thermal Energy**

**Systems Analysis**

**Description**

Presentation at 'International Conference on Smart Energy Systems and 4th Generation District Heating', Copenhagen, 25-26 August 2015

Documents:

Smart Energy Systems presentation - celjo@mek.dtu.dk

**Related external organisation**

**Unknown external organisation**

Activity: Talks and presentations › Conference presentations

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**Expert panel for Research Council of Norway (External organisation)**

**Period:** 11 Aug 2015 → 12 Aug 2015

Grethe Winther (Participant)

Department of Mechanical Engineering

Materials and Surface Engineering

Degree of recognition: International

**Related external organisation**

**Expert panel for Research Council of Norway**

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar
**Dislocations 2016**
Period: 1 Aug 2015 → 1 Aug 2017
Grethe Winther (Organizer)
Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
Member of International Executive Committee

**Related event**

**Dislocations 2016**
19/09/2016 → 23/09/2016
West Lafayette, United States
Activity: Attending an event › Participating in or organising a conference

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**Gordon Research Conference on High Temperature Corrosion**
Sunday Chukwudi Okoro (Participant)
Materials and Surface Engineering
Department of Mechanical Engineering
CHEC Research Centre
Department of Chemical and Biochemical Engineering

**Related event**

**Gordon Research Conference on High Temperature Corrosion**
26/07/2015 → 31/07/2015
New London, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

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**20th International Conference on Composite Materials**
Period: 19 Jul 2015 → 24 Jul 2015
Konstantinos Poulilos (Speaker)
Department of Mechanical Engineering
Solid Mechanics

**Description**
Presentation with title ACCOUNTING FOR FIBER BENDING EFFECTS IN HOMOGENIZATION OF LONG FIBER REINFORCED COMPOSITES

Participation in the 20th International Conference on Composite Materials
Links:
http://iccm20.org

**Related event**

**20th International Conference on Composite Materials**
19/07/2015 → 24/07/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

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**Connect! European Moldflow User Meeting 2015**
Period: 23 Jun 2015
David Maximilian Marhöfer (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Title: Implementation and application of material models in injection molding simulations using powder feedstocks
Abstract: Extensive material characterization was conducted for metallic and ceramic powder feedstocks which can be used for precision powder injection molding. The collected data was used as a basis for the implementation of material models of feedstocks in the database of the Autodesk Moldflow® simulation software. The necessary data and its acquisition such as rheological and pVT measurements as well as steps of the implementation process (i.e. data fitting in order to create material models for new materials) are presented. The resulting material models can be directly imported to Autodesk Moldflow and they are applied to the simulation of a spiral test part. Simulations with the newly created material models were successfully completed and the applicability of process simulations on parts produced by powder injection molding is demonstrated. The simulations comprise furthermore differently advanced models in order to investigate the influence of the model complexity on the simulation results accuracy. Finally, simulation predictions in terms of flow front pattern and process outputs parameters are compared with experimental results from short shots studies and process monitoring by cavity sensors.

Related event
Connect! European Moldflow User Meeting 2015
23/06/2015 → 24/06/2015
Frankfurt am Main, Germany
Activity: Talks and presentations › Conference presentations

Micro Mechanical Systems Design and Manufacturing Course 41790
Period: 22 Jun 2015 → 3 Jul 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Micro Mechanical Systems Design and Manufacturing Course 41790

Micro Mechanical Systems Design and Manufacturing Course 41790

Related event
Micro Mechanical Systems Design and Manufacturing Course 41790
22/06/2015 → 03/07/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Polymer tribology: The polymer against polymer wear puzzle
Period: 22 Jun 2015 → 26 Jun 2015
Ion Marius Sivebæk (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description
The International Conference on Understanding and Controlling Nano and Mesoscale Friction: June 22-26 2015, Istanbul, Turkey.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

The International Conference on Understanding and Controlling Nano and Mesoscale Friction
Period: 22 Jun 2015 → 26 Jun 2015
Ion Marius Sivebæk (Organizer)
Department of Mechanical Engineering
Manufacturing Engineering

Related event

The International Conference on Understanding and Controlling Nano and Mesoscale Friction
22/06/2015 → 26/06/2015
Istanbul, Turkey
Activity: Attending an event › Participating in or organising a conference

Period: 18 Jun 2015
David Maximilian Marhöfer (Speaker)
Department of Mechanical Engineering

Description
Title: Micro product development and micro tool design by means of micro injection molding process simulations
Abstract: Similar to conventional injection molding, process simulations are an effective tool in micro injection molding for the optimization and simulation-aided design of micro components as well as the mold and the molding process. Although the demand for simulations in micro injection molding rises, their application must be conducted carefully, because available software packages are actually made for macroscopic injection molding. In the presented work, the proper implementation, meshing, and modeling strategy for micro components is reported. Process simulations are applied to two microfluidic devices (micro distributor and micro mixer) fabricated in plastic and exhibiting feature sizes down to about 100 μm and aspect ratios of up to three. The goal of the simulations is the investigation of the general filling of each part and the influence of different gate configurations. The simulation results are used to evaluate the gate designs and find the most suitable one with regard to the process window, the filling behavior, and possible part quality criteria such as part flatness. An outlook on limitations and possible improvements rounds up the talk.


Related event

18/06/2015 → …
Odense, Denmark
Activity: Talks and presentations › Conference presentations

Poster Session - DTU (on 15th International Conference of the European Society for Precision Engineering)
Period: 12 Jun 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering

Description
Poster Session - DTU (on 15th International Conference of the European Society for Precision Engineering)

Poster Session - DTU (on 15th International Conference of the European Society for Precision Engineering)

Related event

Poster Session - DTU (on 15th International Conference of the European Society for Precision Engineering)
12/06/2015 → 12/06/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

29th International Conference on Surface Modification Technologies
Period: 11 Jun 2015
Sunday Chukwudi Okoro (Speaker)
Materials and Surface Engineering
Description
Improving the high-temperature corrosion resistance of alumina forming alloys under biomass-firing conditions by pre-oxidizing the surface

Related event
29th International Conference on Surface Modification Technologies
10/06/2015 → 12/06/2015
Copenhagen, Denmark
Activity: Talks and presentations › Conference presentations

11th World Congress of Structural and Multidisciplinary Optimization
Period: 7 Jun 2015 → 12 Jun 2015
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics
Description
Participation in the 11th World Congress of Structural and Multidisciplinary Optimisation (WCSMO-11)

Related event
11th World Congress of Structural and Multidisciplinary Optimization
07/06/2015 → 12/06/2015
Sydney , Australia
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

11th World Congress of Structural and Multidisciplinary Optimization
Period: 7 Jun 2015 → 12 Jun 2015
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event
11th World Congress of Structural and Multidisciplinary Optimization
07/06/2015 → 12/06/2015
Sydney , Australia
Activity: Attending an event › Participating in or organising a conference

Tolerance verification of a hearing aid component using Computed Tomography
Period: 1 Jun 2015 → 31 Jul 2015
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

NMI Tribology Meeting
Period: May 2015
Annika Martina Diederichs (Participant)
Department of Mechanical Engineering
Materials and Surface Engineering

Related event

NMI Tribology Meeting
20/05/2015 → …
Haigerloch, Germany
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Transition from wet to dry friction
Period: 22 May 2015
Ion Marius Sivebæk (Invited speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Description

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

VI International Conference on Coupled Problems in Science and Engineering
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Participation in the VI International Conference on Coupled Problems in Science and Engineering

Related event

VI International Conference on Coupled Problems in Science and Engineering
18/05/2015 → 20/05/2015
San Servolo, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Acoustical technological facilities visit - DTU Elektro
Period: 13 May 2015
Govindan Puthumana (Participant)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Acoustical technological facilities visit - DTU Elektro

Acoustical technological facilities visit - DTU Elektro

Related event

Acoustical technological facilities visit - DTU Elektro
13/05/2015 → 13/05/2015
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

7th International Conference on Composite Testing and Model Identification
Period: 8 Apr 2015 → 10 Apr 2015
Andrei Costache (Participant)
Department of Mechanical Engineering

**Description**
Conference Participation and oral Poster Presentation

**Documents:**
Experimental Investigation of a Basalt Fiber Reinforced Composite to Metal Joint

**Related event**
7th International Conference on Composite Testing and Model Identification
08/04/2015 → 10/10/2015
Madrid, Denmark
Activity: Attending an event › Participating in or organising a conference

Annika Martina Diederichs (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
Royal Microscopy Society RMS EBSD Conference 2015, Glasgow, Scotland

**Documents:**
09_example conference abstract_RMS

**Related external organisation**
Unknown external organisation
Activity: Talks and presentations › Conference presentations

**2015 Electron Backscatter Diffraction Meeting**
Period: 31 Mar 2015
Hossein Alimadadi (Speaker)
Center for Electron Nanoscopy
DTU Danchip
Department of Mechanical Engineering

**Description**
Oral presentation: "An electron microscopy study of spontaneous and FIB-induced martensite formation in metastable stainless steel"

**Documents:**
Hossein Alimadadi EBSD 2015
Hossein Alimadadi EBSD 2015

**Related event**
2015 Electron Backscatter Diffraction Meeting
30/03/2015 → 31/03/2015
Glasgow, United Kingdom
Activity: Talks and presentations › Conference presentations

Vasileios Karatzas (Invited speaker)
Department of Mechanical Engineering

**ATV-SEMAPP konferencen 'Plast i offshoreindustrien**
Period: 18 Mar 2015
Vasileios Karatzas (Invited speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Overview of the COMPASS project - composite in marine applications

Related event

ATV-SEMAPP konferencen 'Plast i offshoreindustrien
18/03/2015 → …
Vejen, Denmark
Activity: Talks and presentations › Conference presentations

DCAMM 15th Internal Symposium
Christian Kim Christiansen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk in 'Fluid & CFD' session: Improvement in journal bearing design with application of computational fluid dynamics

Related event

DCAMM 15th Internal Symposium
16/03/2015 → 18/03/2015
Horsens, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DCAMM 15th Internal Symposium
Fabián Gonzalo Pierart Vásquez (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

DCAMM 15th Internal Symposium
16/03/2015 → 18/03/2015
Horsens, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DCAMM 15th Internal Symposium
Jonas Skjedt Lauridsen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

DCAMM 15th Internal Symposium
16/03/2015 → 18/03/2015
Horsens, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DCAMM 15th Internal Symposium
Jorge Andrés González Salazar (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Experimental Identification of Dynamic Coefficients in Actively-Lubricated Bearings (ALB)

Related event

DCAMM 15th Internal Symposium
16/03/2015 → 18/03/2015
Horsens, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

DCAMM 15th Internal Symposium
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

Analysis of Ingot Forging Damage Evolution Using Different Simulation Methods
Period: 9 Mar 2015
Peter Christiansen (Invited speaker)
Department of Mechanical Engineering
Manufacturing Engineering
Documents:
Christiansen_Bay_Martins_Hattel_Analysis_of_ingot_forging_damage_evolution_using_different_simulation_methods

Related event

7th International Seminar on Precision Forging
09/03/2015 → 12/03/2015
Nagoya, Japan
Activity: Talks and presentations › Conference presentations

11th International Conference on Vibrations in Rotating Machines
Period: 23 Feb 2015 → 25 Feb 2015
Jorge Andrés González Salazar (Speaker)
Department of Mechanical Engineering
Solid Mechanics
Links:

Related event

11th International Conference on Vibrations in Rotating Machines
23/02/2015 → 25/02/2015
Magdeburg, Germany
Activity: Talks and presentations › Conference presentations
16th Workshop of Nordic Maritime Universities and DNV-GL  
Period: 22 Jan 2015  
Vasileios Karatzas (Speaker)  
Department of Mechanical Engineering  
Solid Mechanics  

Description  
Presentation of the COMPASS project at the workshop  

Related event  
16th Workshop of Nordic Maritime Universities and DNV-GL  
22/01/2015 → 23/01/2015  
Activity: Talks and presentations › Conference presentations  

DTU Patent Course  
Period: 12 Jan 2015 → 16 Jan 2015  
Andrei Costache (Participant)  
Department of Management Engineering  
Department of Mechanical Engineering  

Description  
1 week, 3 ECTS concentrated course on commercialization of technology and research based inventions, including intellectual property rights, patent law, licensing principles, rules & agreements in university-industry collaboration, entrepreneurship, business formation, cases and more.  

Related event  
DTU Patent Course  
12/01/2015 → 16/01/2015  
Kgs. Lyngby, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.  

Materialers fantastiske verden  
Period: 22 Nov 2014  
Grethe Winther (Lecturer)  
Department of Mechanical Engineering  
Materials and Surface Engineering  

Description  
Indledende foredrag, der introducerer forskellige typer af materialer (metal, keramer og plast), deres forskellige mekaniske opførsel i form af demonstrationsforsøg samt den underliggende forskel i mikrostruktur.  

Related event  
Børnenes Universitet 2014  
22/11/2014 → …  
Kgs. Lyngby, Denmark  
Activity: Talks and presentations › Conference presentations  

Euspen Special Interest Group Meeting - Structured and Freeform Surfaces  
Period: 19 Nov 2014 → 20 Nov 2014  
Matteo Calaon (Speaker)  
Department of Mechanical Engineering  
Manufacturing Engineering  
Documents:  
Structured and freeform surfaces Padova 2014-Calaon Matteo
Related event

Euspen Special Interest Group Meeting - Structured and Freeform Surfaces
19/11/2014 → 20/11/2014
Padova, Italy
Activity: Talks and presentations › Conference presentations

Microstructural investigations of White Etching Areas
Period: 18 Nov 2014
Annika Martina Diederichs (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
Workshop White Etching Areas/ White Etching Cracks, RWTH Aachen University, Germany

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Response-based sea state estimation for onboard DSS - Safe and Efficient Marine Operations
Period: 13 Nov 2014
Ulrik Dam Nielsen (Invited speaker)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

Description
Guest lecture given at NTNU, Trondheim, Norway, November, 2014.
Documents:
WaveEstim and DSS (AMOS Workshop)

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Karlsruhe Institute of Technology KIT
Period: Oct 2014 → Dec 2014
David Maximilian Marhöfer (Visiting researcher)
Department of Mechanical Engineering
Manufacturing Engineering

Description
Material characterization, process capability, and simulation accuracy assessment of precision powder injection molding

External stay as guest PhD
Activity: Visiting an external institution › Visiting another research institution

27th Nordic Seminar on Computational Mechanics
Christian Kim Christiansen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk in 'Fluid Mechanics II' session: Application of finite elements and computational fluid dynamics to predict and improve the filling ratio in journal bearings under dynamic loading
Related event

27th Nordic Seminar on Computational Mechanics
22/10/2014 → 24/10/2014
Stockholm, Sweden
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

13th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Participation in and oral presentation at conference.
Documents:
Conference abstract

Related event

13th International Symposium on Multiscale, Multifunctional and Functionally Graded Materials
19/10/2014 → 22/10/2014
São Paulo, Brazil
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Comparison of measurements using Computed Tomography and CMM
Period: 1 Oct 2014 → 9 Jan 2015
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

Electron-microscopical analysis of White etching Areas in 100Cr6 steel
Period: Sep 2014
Annika Martina Diederichs (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
International Microscopy Conference IMC 2014, Prag, Czech Republic

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

10th European Fluid Mechanics Conference (EUROMECH)
Period: 14 Sep 2014 → 18 Sep 2014
Christian Kim Christiansen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk in 'Industrial' session: Theoretical and experimental investigation of cavitation in bearings for large two-stroke marine diesel engines

Related event
European Corrosion Congress
Period: 8 Sep 2014 → 12 Sep 2014
Sunday Chukwudi Okoro (Speaker)
Materials and Surface Engineering
Department of Mechanical Engineering
CHEC Research Centre
Department of Chemical and Biochemical Engineering

Description
Oral presentation

Links:
http://eurocorr2014.org/

Related event
European Corrosion Congress
08/09/2014 → 12/09/2014
Pisa, Italy
Activity: Talks and presentations › Conference presentations

Bygningsmekanik II
Period: 31 Aug 2014 → 4 Dec 2014
Andrei Costache (Participant)
Department of Mechanical Engineering

Description
Ansys Finite Element Analysis
Teaching assistant

Links:

Related event
Bygningsmekanik II
01/10/2013 → 31/10/2013
Kgs. Lyngby, Denmark
Activity: Other

Analysis of deformation-induced intragranular orientation spread in IF-steel by a combination of 3DXRD and crystal plasticity
Grethe Winther (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Documents:
Abstract

Related event
17th International Conference on Textures of Materials
24/08/2014 → 29/08/2014
Dresden, Germany
Activity: Talks and presentations › Conference presentations
Nanotribology: Theory and Applications
Andrei Costache (Participant)
Department of Mechanical Engineering

Description
Course Participation

Related event

Nanotribology: Theory and Applications
18/08/2014 → 29/08/2014
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Material and geometry characterization of FDM parts
Period: 15 Aug 2014 → 15 Nov 2015
Alessandro Stolfi (Participant)
Department of Mechanical Engineering
Manufacturing Engineering
Activity: Other

8th European Nonlinear Dynamics Conference
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
ENOC2014

Related event

8th European Nonlinear Dynamics Conference
06/07/2014 → 11/07/2014
Vienna, Austria
Activity: Attending an event › Participating in or organising a conference

17th U.S. National Congress on Theoretical and Applied Mechanics
Period: 16 Jun 2014 → 21 Jun 2014
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

17th U.S. National Congress on Theoretical and Applied Mechanics
15/06/2014 → 20/06/2014
East Lansing, Michigan, United States
Activity: Attending an event › Participating in or organising a conference

Investigations on PVD Al/Ni electrocatalysts for alkaline water electrolysis
Period: 15 Jun 2014 → 20 Jun 2014
Michael Caspersen (Speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Description
Poster presentation
Documents:
WHEC2014_poster
WHEC2014_poster

Related event

20th World Hydrogen Energy Conference 2014
15/06/2014 → 20/06/2014
Gwangju Metropolitan City, Korea, Republic of
Activity: Talks and presentations › Conference presentations

16th Nordic Symposium on Tribology
Period: 12 Jun 2014
Jorge Andrés González Salazar (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Feedback-Controlled Lubrication for Reducing the Lateral Vibration of Flexible Rotors supported by Tilting-Pad Journal Bearings.
Links:
http://www.nordtrib.dti.dk/

Related event

16th Nordic Symposium on Tribology
10/06/2014 → 13/06/2014
Aarhus, Denmark
Activity: Talks and presentations › Conference presentations

16th Nordic Symposium on Tribology
Period: 10 Jun 2014 → 13 Jun 2014
Christian Kim Christiansen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk in 'Test methods 3' session: Presentation of a Cavitation Test Rig

Related event

16th Nordic Symposium on Tribology
10/06/2014 → 13/06/2014
Aarhus, Denmark
Activity: Attending an event › Participating in or organising a conference

Hilton Head Workshop 2014
Period: 8 Jun 2014 → 12 Jun 2014
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics
description
poster presentation

related event

hilton head workshop 2014: a solid-state sensors, actuators and microsystems workshop
08/06/2014 → 12/06/2014
hilton head island, united states
activity: attending an event › participating in or organising a conference

2nd international symposium on anodizing science and technology
period: 5 jun 2014
villads egede johansen (speaker)
department of mechanical engineering
solid mechanics
description
20 minutters præsentation med titlen mapping of properties for optical appearance of anodized aluminium.
documents:
joehansen_villads_egede

related event

2nd international symposium on anodizing science and technology
04/06/2014 → 06/06/2014
sapporo, japan
activity: talks and presentations › conference presentations

international conference on engineering and applied sciences optimization (opt-i)
period: 4 jun 2014 → 6 jun 2014
joe alexandersen (participant)
department of mechanical engineering
solid mechanics
description
presenting author of the presentation: topology optimised design of robust material microstructures without length scale separation
presenting author at the opt-i 2014 conference on kos island, greece.
documents:
topology optimised design of robust material microstructures without length scale separation

related event

1st international conference on engineering and applied sciences optimization
04/06/2014 → 06/06/2014
kos island, greece
activity: attending an event › participating in or organising workshops, courses, seminars etc.

norwegian university of science and technology (external organisation)
period: 2 jun 2014
grethe winther (participant)
department of mechanical engineering
materials and surface engineering
description
phd bedømmelsesudvalg
degree of recognition: international
Related external organisation

Norwegian University of Science and Technology
Trondheim, Norway
Activity: Membership › Membership in review committee

European Maritime Day
Period: 19 May 2014 → 20 May 2014
Erik Damgaard Christensen (Speaker)
Department of Mechanical Engineering
Fluid Mechanics, Coastal and Maritime Engineering

Description
Koordinator for MERMAID.

Documents:
EMD Workshop Flyer

Links:

Related event

European Maritime Day : Innovation driving Blue Growth
19/05/2014 → 20/05/2014
Bremen, Germany
Activity: Talks and presentations › Conference presentations

Robust Discretisation and Fast Solvers for Computable Multi-physics Models
Period: 12 May 2014 → 16 May 2014
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Participant and poster presenter

Related event

Robust Discretisation and Fast Solvers for Computable Multi-physics Models: ICERM advanced workshop
12/05/2014 → 16/05/2014
Providence, RI, United States
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Carnegie Mellon University
Period: 19 Apr 2014 → 14 Jun 2014
Leonardo Pierobon (Visiting researcher)
Department of Mechanical Engineering
Thermal Energy

Description
Model predictive control for efficient and safe operation of offshore power systems

Activity: Visiting an external institution › Visiting another research institution

Microscopy of Oxidation
Period: 14 Apr 2014 → 16 Apr 2014
Sunday Chukwudi Okoro (Participant)
Department of Chemical and Biochemical Engineering
CHEC Research Centre
Department of Mechanical Engineering
Materials and Surface Engineering

Description
Poster Presentation

Related event

Microscopy of Oxidation
14/04/2014 → 16/04/2014
Nottingham, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Combining crystal plasticity and dislocation theory to model dislocation boundary characteristics
Period: 24 Feb 2014 → 28 Feb 2014
Grethe Winther (Invited speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

Related event

Dislocation-based plasticity
24/02/2014 → 28/02/2014
Schöntal, Germany
Activity: Talks and presentations › Conference presentations

Michigan State University
Period: 3 Feb 2014 → 27 Jun 2014
Suguang Dou (Visiting researcher)
Solid Mechanics
Department of Mechanical Engineering

Description
Research scholar in Michigan State University
Activity: Visiting an external institution › Visiting another research institution

Bygningsmekanik II
Period: 2013
Andrei Costache (Lecturer)
Department of Mechanical Engineering

Description
Teaching Assistant

Related event

Bygningsmekanik II
01/10/2013 → 31/10/2013
Kgs. Lyngby, Denmark
Activity: Other

Feasibility Study of Process Optimisation and Biomass Utilisation in the Asphalt Industry
Period: 2013
Brian Elmegaard (Supervisor)
Department of Mechanical Engineering
Thermal Energy

Activities:

**Membership in the European Society for Precision Manufacturing and Nanotechnology (euspen) (External organisation)**

**Period:** 2013 → …

**David Maximilian Marhöfer (Participant)**

Department of Mechanical Engineering

Manufacturing Engineering

Degree of recognition: International

**Related external organisation**

**Membership in the European Society for Precision Manufacturing and Nanotechnology (euspen)**

Activity: Membership › Membership of research networks or expert groups

**EUSPEN Micro/Nano Manufacturing Workshop**

**Period:** 27 Nov 2013 → 28 Nov 2013

**Rasoul Mahshid (Speaker)**

Department of Mechanical Engineering

**Description**

European Society for Precision Engineering & Nanotechnology (EUSPEN).

Micro/Nano Manufacturing Workshop.

**Related event**

**EUSPEN Micro/Nano Manufacturing Workshop**

27/11/2013 → 28/11/2013

Karlsruhe, Germany

Activity: Talks and presentations › Conference presentations

**Atv-semapp micro-nano moulding: technologies and applications**

**Period:** 13 Nov 2013

**David Maximilian Marhöfer (Speaker)**

Department of Mechanical Engineering

Manufacturing Engineering

**Description**

Title: Advancements on the simulation of the micro injection moulding process

Abstract: Process simulations are applied in micro injection moulding with the same purpose as in conventional injection moulding: optimization and support of the design of mould, inserts, parts, and process. Commercial software is however not well suited for micro injection moulding. The software is developed for macro plastic parts and it is therefore limited in the capability of modelling the polymer flow in micro cavities properly. Nonetheless, current developments of the simulation technology brought up new opportunities for improved accuracy. In this speech, new strategies and aspects for comprehensive simulation models which provide more precise results for micro injection moulding are discussed. Modelling and meshing recommendations are presented, leading to a multi-scale mesh of all relevant process and system units of micro injection moulding. The implementation and influence of process boundary conditions (e.g. venting, machine behaviour) on simulations results are described. Ultimately, the importance of cooling simulations settings is addressed.

ATV-SEMAPP micro-nano moulding: technologies and applications. 3rd MicroNano Moulding ATV-SEMAPP Seminar.

**Related event**

**Atv-semapp micro-nano moulding: technologies and applications: 3rd MicroNano Moulding ATV-SEMAPP Seminar**

13/11/2012 → 13/11/2013

Kgs. Lyngby, Denmark
12th EDF - PPRIME
Period: 17 Sep 2013 → 18 Sep 2013
Jorge Andrés González Salazar (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Adjustable ETHD lubrication applied to the improvement of dynamic performance of flexible rotors supported by active TPJB

Links:
http://edf-pprime-2013.sciencesconf.org/

Related event

12th EDF - PPRIME: Solutions for performance improvement and friction reduction of journal and thrust bearings
17/09/2013 → 18/09/2013
Poitiers, France
Activity: Talks and presentations › Conference presentations

Dansk Teknologihistorisk Selskabs Årsmøde
Period: 14 Sep 2013
Laila Zwisler (Organizer)
Department of Physics
Office for Study Programmes and Student Affairs
Department of Mechanical Engineering

Links:
http://www.teknologihistorie.dk/

Related event

Dansk Teknologihistorisk Selskabs Årsmøde: Den danske ingeniørs historiske konstruktion
14/09/2013 → 14/09/2013
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

19th International Conference on Composite Materials
Period: 28 Jul 2013 → 2 Aug 2013
Andrei Costache (Participant)
Department of Mechanical Engineering

Description
Conference participation and oral Poster Presentation
Documents:
On the Analysis of a Contact Friction Composite-to-Metal Joint

Related event

19th International Conference on Composite Materials
28/07/2013 → 02/08/2013
Montréal, Canada
Activity: Attending an event › Participating in or organising a conference

Separated Representations and PGD-based Model Reduction: Fundamentals and Applications
Period: 8 Jul 2013 → 12 Jul 2013
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Participation in the advanced school on 'Separated Representations and PGD-based Model Reduction'.

Related event

Separated Representations and PGD-based Model Reduction: Fundamentals and Applications: CISM Advanced School
08/07/2013 → 12/07/2013
Udine, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Topology Optimization – Theory and Applications
Period: 19 Jun 2013 → 25 Jun 2013
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

Topology Optimization – Theory and Applications
19/06/2013 → 25/06/2013
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

PRACE Summer School 2013
Period: 17 Jun 2013 → 21 Jun 2013
Joe Alexandersen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
- Attended the 2013 PRACE summer school on 'Frameworks for Scientific Computing on Supercomputers'. - Presented poster on the TopOpt research groups activities within large scale computation and optimisation

Related event

PRACE Summer School 2013: Frameworks for Scientific Computing on Supercomputers
17/06/2013 → 21/06/2013
Ostrava, Czech Republic
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
10th World Congress on Structural and Multidisciplinary Optimization
Period: 22 May 2013
Joe Alexandersen (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Gave presentation titled 'Topology Optimisation for Coupled Convection Problems'

Presentation at the 10th World Congress on Structural and Multidisciplinary Optimization (WCSMO10)
Documents:
Alexandersen_ID5103_FinalAbstract

Related event

10th World Congress on Structural and Multidisciplinary Optimization
19/05/2013 → 24/05/2013
Orlando, FL, United States
Activity: Talks and presentations › Conference presentations

10th World Congress on Structural and Multidisciplinary Optimization
Period: 19 May 2013 → 24 May 2013
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

10th World Congress on Structural and Multidisciplinary Optimization
19/05/2013 → 24/05/2013
Orlando, FL, United States
Activity: Attending an event › Participating in or organising a conference

Delft University of Technology
Period: 30 Apr 2013 → 10 Sep 2013
Leonardo Pierobon (Visiting researcher)
Department of Mechanical Engineering
Thermal Energy

Description
Design methodology for flexible energy conversion systems accounting for dynamic performance

Activity: Visiting an external institution › Visiting another research institution

3rd International Tribology Symposium of IFToMM
Period: 19 Mar 2013 → 21 Mar 2013
Konstantinos Poulos (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Presentation with title "Real Contact Area Study Using a Micro-Contact FEM Model"

Participation in 3rd International Tribology Symposium of IFToMM
Links:
http://www.ltu.se/research/subjects/Maskinelement/Konferenser/IFTOMM-ITS-2013
Related event

3rd International Tribology Symposium of IFToMM
19/03/2013 → 21/03/2013
Luleå, Sweden
Activity: Attending an event › Participating in or organising a conference

DCAMM 14th Internal Symposium
Period: 13 Mar 2013 → 15 Mar 2013
Christian Kim Christiansen (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Participation in poster session with the poster 'Diesel engine tribology'.

Related event

DCAMM 14th Internal Symposium
Period: 13 Mar 2013 → 15 Mar 2013
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

Related event

DCAMM 14th Internal Symposium
Period: 13 Mar 2013 → 15 Mar 2013
Nyborg, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Business Course for Industrial PhD Students
Period: 4 Feb 2013 → 8 Feb 2013
Andrei Costache (Participant)
Department of Mechanical Engineering

Description
Course Participation

Related event

Business Course for Industrial PhD Students
Period: 4 Feb 2013 → 8 Feb 2013
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Journal of Intelligent Manufacturing (Journal)
Period: 1 Jan 2013 → …
Govindan Puthumana (Reviewer)
Department of Mechanical Engineering
Manufacturing Engineering
1st Symposium on Advances in Refrigeration and Heat Pump Technology
Period: 2012 → …
Jorrit Wronschi (Organizer)
Department of Mechanical Engineering

Description
Technical University of Denmark – Department of Mechanical Engineering, Danish Technological Institute, and the Danish Energy Association in collaboration hosted a two-day symposium covering advances in refrigeration and heat pump technology on the 15th and 16th of May 2012.

Documents:
Proceedings of the 1st Symposium on Advances in Refrigeration and Heat Pump Technology 2012

Related event
1st Symposium on Advances in Refrigeration and Heat Pump Technology
15/05/2012 → 16/05/2012
Kgs. Lyngby, Denmark
Activity: Attending an event › Participating in or organising a conference

Experimental determination of (p, ρ, T) data for mixtures of carbon dioxide with methane for indirect calorific value determination of non-conventional energy gases
Period: 2012
Maria E. Mondejar Montagud (Guest lecturer)
César R. Chamorro (Guest lecturer)
José J. Segovia (Guest lecturer)
Miguel A. Villamanan (Guest lecturer)
Teresa Fernandez (Other)
Frederique Haloua (Guest lecturer)
Department of Mechanical Engineering

Degree of recognition: International
Links:

Related event
18th Symposium on Thermophysical Properties
24/06/2012 → 29/06/2012
**Sustainability-Driven Innovation through Product-Service Systems (External organisation)**

**Period:** 20 Dec 2012  
Tim C. McAloone (External examiner)
Department of Mechanical Engineering  
Engineering Design and Product Development

**Description**  
PhD Examination Committee

**Body type:** PhD Committee  
**Degree of recognition:** International  
**Activity:** Examinations and supervision › External examination

**Fracture Mechanics for Laminated Composite Structures**

**Period:** 15 Oct 2012 → 18 Oct 2012  
Andrei Costache (Participant)
Department of Mechanical Engineering

**Description**  
Course Participation

**Related event**

**Ph.D. Course 2012: Fracture Mechanics for Laminated Composite Structures**  
15/10/2012 → 18/10/2012  
Aalborg, Denmark  
**Activity:** Attending an event › Participating in or organising workshops, courses, seminars etc.

**Characterisation of best practices in eco-design for the training of engineering designers: Summary of dimensions, methods, tools and activities (External organisation)**

**Period:** 11 Oct 2012  
Tim C. McAloone (Participant)
Department of Mechanical Engineering  
Engineering Design and Product Development

**Description**  
PhD Examination Committee

**Body type:** PhD Committee  
**Degree of recognition:** International

**Related external organisation**

**Characterisation of best practices in eco-design for the training of engineering designers: Summary of dimensions, methods, tools and activities**  
**Activity:** Membership › Membership in review committee

**Ecodesign implementation for complex industrial systems: From scenario-based LCA to the definition of an eco-innovative R&D projects portfolio (External organisation)**

**Period:** 28 Sep 2012  
Tim C. McAloone (External examiner)
Department of Mechanical Engineering  
Engineering Design and Product and Product Development
Description
PhD Examination Committee, Ecole Centrale Paris

Body type: PhD Committee
Degree of recognition: International
Activity: Examinations and supervision › External examination

Charting of ecodesign experiences, needs and perspectives
Period: 20 Sep 2012
Tim C. McAloone (Keynote speaker)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
DI Network for ecodesign, B&O, Struer, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Product/Service-Systems Design from an Engineering Perspective
Period: 19 Sep 2012
Tim C. McAloone (Keynote speaker)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Guest lecture to Taiwanese delegation at CIID, Denmark

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Strain and defect structure in individual subgrains: Summer School Scattering methods for the analysis of the structure of matter, International Max Planck Research School, Stuttgart, Germany
Period: 17 Sep 2012 → 20 Sep 2012
Wolfgang Pantleon (Invited speaker)
Department of Mechanical Engineering

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

NeuroDesign - Second workshop (held at CBS)
Period: 10 Sep 2012
Anja Maier (Participant)
Department of Management Engineering
Production and Service Management
Engineering Design and Product Development

Related event
NeuroDesign - Second workshop (held at CBS)
10/09/2012 → 10/09/2012
Copenhagen, Denmark  
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Product/Service-System Strategies, Design and Markets**  
**Period:** 9 Sep 2012  
Tim C. McAloone (Speaker)  
Department of Mechanical Engineering  
Engineering Design and Product Development  

**Description**  
Lecture in seminar series: "Seminars across Design, Production and Service Systems"  
Links:  
http://podcast.llab.dtu.dk/feeds/seminars-across-design-production-and-service-systems/ (Video of lecture)

**Related event**  
**Seminars across Design, Production and Service systems**  
09/10/2012 → …  
Kongens Lyngby, Denmark  
Activity: Talks and presentations › Conference presentations

**10th International Conference on Sandwich Structures**  
**Period:** 29 Aug 2012  
Andrei Costache (Speaker)  
Department of Mechanical Engineering  

**Description**  
Oral Presentation  
Fracture Characterization of Debond Damaged Balsa-Sandwich Composites Using the Modified TSD Method

**Related event**  
**10th International Conference on Sandwich Structures**  
27/08/2012 → 29/08/2012  
Nantes, France  
Activity: Talks and presentations › Conference presentations

**Open innovation practices in a cluster context: A Medicon Valley case study**  
**Period:** 29 Aug 2012  
Tim C. McAloone (Keynote speaker)  
Department of Mechanical Engineering  
Engineering Design and Product Development  

**Description**  
Guest Lecture for "Network for Point of Care: from Idea to Market"

**Related event**  
**Network for Point of Care: From Idea to Market**  
29/08/2012 → …  
Hørsholm, Denmark  
Activity: Talks and presentations › Conference presentations

**NordDesign 2012**  
**Period:** 22 Aug 2012 → 24 Aug 2012  
Tim C. McAloone (Participant)  
Department of Mechanical Engineering
Beyond x-ray line profiles: perceiving dislocation structures from high resolution reciprocal space mapping


Wolfgang Pantleon (Invited speaker)

Department of Mechanical Engineering

Description
For deformed materials, an asymmetry of x-ray line profiles is attributed by the classical composite model to a weighted superposition of contributions from two different constituents of a dislocation cell structure: dislocation walls and dislocation-depleted cell interiors strained elastically in opposite direction. By high resolution reciprocal space mapping, new insight in the contribution of the dislocation-poor regions is gained and simultaneously earlier criticism concerning the dislocation content relieved. With high angular resolution 3D X-ray Diffraction established at the Advance Photon Source, reciprocal space mapping of selected reflections of individual grains in the bulk of a specimen is performed in-situ during tensile loading. For deformed grains with dislocation cell structures, the intensity distribution in reciprocal space consists of bright sharp peaks superposed on a cloud of enhanced intensity. The high-intensity peaks are identified as diffraction signal from (almost) dislocation-free subgrains, whereas the cloud of lower intensity originates from the dislocation walls of the dislocation structure. Both, the azimuthal and radial positions of individual high-intensity peaks differ from each other indicating not only small orientation differences, but also a significant variation of their elastic strain state. The dislocation-free subgrains experience quite different elastic strains - in average opposing the elastic strains caused by the tensile load. Based on this finding modification of the classical composite model is suggested in the sense that the dislocation-poor regions do not contribute collectively with a common profile broadened by the dislocation density in these regions, but rather each individual dislocation-free subgrain contributes with an own sharp profile at a slightly different backward strain.

Related event
61st Annual Conference on Applications of X-ray Analysis
06/08/2012 → 10/08/2012
Denver, CO, United States
Activity: Talks and presentations › Conference presentations

European Fuel Cell Forum 2012
Period: 26 Jun 2012 → 29 Jun 2012
Anders Harthøj (Participant)

Department of Mechanical Engineering

Description
Participant in tutorial in fuel cell technology, oral presentation and paper for proceeding

Related event
European Fuel Cell Forum 2012
27/06/2012 → 29/06/2012
Luzern, Switzerland
Activity: Attending an event › Participating in or organising a conference

Ecodesign workshop
Tim C. McAloone (Organizer)

Department of Mechanical Engineering

Engineering Design and Product Development
Related event

**Ecodesign workshop: Natura**
Period: 25/06/2012 → 29/06/2012
São Paulo, Brazil
Activity: Attending an event › Participating in or organising a conference

**Modal Analysis of Nonlinear Mechanical Systems**
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

**Modal Analysis of Nonlinear Mechanical Systems**
25/06/2012 → 29/12/2014
Udine, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Topology Optimization in Structural and Continuum Mechanics**
Period: 18 Jun 2012 → 22 Jun 2012
Suguang Dou (Participant)
Department of Mechanical Engineering
Solid Mechanics

**Topology Optimization in Structural and Continuum Mechanics**
18/06/2012 → 22/07/2012
Udine, Italy
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**SUR/FIN Manufacturing and Technology Conference 2012**
Period: 11 Jun 2012 → 13 Jun 2012
Anders Harthøj (Participant)
Department of Mechanical Engineering
Description
Oral presentation

**SUR/FIN Manufacturing and Technology Conference 2012**
11/06/2012 → 13/06/2012
Las Vegas, NV, United States
Activity: Attending an event › Participating in or organising a conference

**Danish Metallurgical Society symposium 2012**
Period: 6 Jun 2012
Anders Harthøj (Participant)
Department of Mechanical Engineering
Description
Oral presentation

**Danish Metallurgical Society symposium 2012**
Strategic approaches to product/service-systems: Strategy, design and practice
Period: 5 Jun 2012 → 6 Jun 2012
Tim C. McAloone (Lecturer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Guest lecture, Ruhr-Universität Bochum, Germany

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

NeuroDesign - First workshop (held at DTU)
Period: 4 Jun 2012
Anja Maier (Organizer)
Department of Management Engineering
Production and Service Management
Engineering Design and Product Development

Related event
NeuroDesign - First workshop (held at DTU)
04/06/2012 → 04/06/2012
Lyngby, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Teaching, learning and creativity (UDTU): Examples from the lecture theatre – and the design studio
Period: 27 May 2012
Tim C. McAloone (Speaker)
Department of Mechanical Engineering
Engineering Design and Product Development

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

12th International design conference
Period: 21 May 2012 → 24 May 2012
Tim C. McAloone (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Speaker, chairman, keynote speaker, member of scientific committee

DESIGN 2012

Related event
12th International design conference
21/05/2012 → 24/05/2012
Dubrovnik, Croatia
Activity: Attending an event › Participating in or organising a conference

**Analysis and Design Optimisation of Laminated Composite Structures**
*Period: 21 May 2012 → 25 May 2012*
Andrei Costache (Participant)
Department of Mechanical Engineering

**Description**
Course Participation

**Related event**

**Analysis and Design Optimisation of Laminated Composite Structures**
21/05/2012 → 25/05/2012
Ålborg, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

**Ecodesign Maturity Model: a framework to support companies in the selection and implementation of ecodesign practices (External organisation)**
*Period: 14 May 2012*
Tim C. McAloone (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

**Description**
PhD examination committee, University of São Paulo, Brazil

Body type: PhD Committee
Degree of recognition: International

**Related external organisation**

**Ecodesign Maturity Model: a framework to support companies in the selection and implementation of ecodesign practices**
Activity: Membership › Membership in review committee

**PSS Workshop Series**
*Period: 11 May 2012*
Tim C. McAloone (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

**Related event**

**PSS Workshop Series: BTH, Sweden**
10/05/2012 → 11/05/2012
Karlskrona, Sweden
Activity: Attending an event › Participating in or organising a conference

**Tour of Elplatek A/S 2012**
*Period: 10 Apr 2012*
Anders Harthøj (Other)
Department of Mechanical Engineering

**Description**
Guide on a tour in Elplatek's factory for the students in course 41655, Advanced surface technology

**Related external organisation**
**PROTEUS-Workshops**
Period: 20 Mar 2012
Tim C. McAloone (Organizer)
Department of Mechanical Engineering
Engineering Design and Product Development

**Description**
PROTEUS Stormøde

**Related event**

**Environmentally conscious design of medical devices (External organisation)**
Period: 13 Mar 2012
Tim C. McAloone (Chairman)
Department of Mechanical Engineering
Engineering Design and Product Development

**Description**
PhD examination committee, Cambridge University, UK

Body type: PhD Committee
Degree of recognition: International

**Related external organisation**

**Environmentally conscious design of medical devices**
Activity: Membership › Membership in review committee

**Monitoring strain path changes by high resolution reciprocal space mapping**
Wolfgang Pantleon (Invited speaker)
Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
The evolution of deformation structures in polycrystalline copper during strain path changes is observed in situ by high resolution reciprocal space mapping with high energy synchrotron radiation. The resolved behavior of a large number of resolved individual subgrains (complemented by conventional x-ray peak profile analysis) allows a distinction between two different regimes during the mechanically transient behavior following the strain path change: below about 0.3% strain, number and orientation of the resolved subgrains changes only slightly while their elastic stresses are significantly altered indicating a microplastic regime during which only the subgrains deform plastically and no yielding occurs in dislocation walls. After reloading to about 0.3% strain, the elastic stresses of the individual subgrains (having reached the corresponding values of unidirectionally deformed reference specimens) increase only slightly further on, accompanied by occasional appearances of new subgrains, abundant orientation changes and removal of individual existing subgrains.

**Related event**
Creating a business plan

Period: 6 Mar 2012
Tim C. McAloone (Lecturer)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Guest lecture to course on Innovation in product development

Related external organisation

European Robotics Forum 2012

Period: 5 Mar 2012
Ali Gürcan Özkil (Organizer)
Department of Mechanical Engineering

Description
Organizer, Robots in Healthcare and Welfare Workshop, EU Robotics Forum 2012, Odense

Related event

European Robotics Forum 2012
05/03/2012 → 07/03/2012
Odense, Denmark
Activity: Attending an event › Participating in or organising a conference

Cranfield IMRC PSS Dissemination Day

Period: 22 Feb 2012
Tim C. McAloone (Participant)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
Cranfield’s Innovative Manufacturing Centre’s Product-Service Systems (PSS) Dissemination Day

Related event

Cranfield IMRC PSS Dissemination Day
22/02/2012 → 22/02/2012
Cranfield, United Kingdom
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Lektion 4 i 41982, korrosion og materialevalg

Period: 22 Feb 2012
Anders Harthøj (Lecturer)
Department of Mechanical Engineering

Description
Underviser i Per Møllers kursus 41982, korrosion og materialevalg

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

A Value-centric Decision Making Framework for Maintenance Services Outsourcing (External organisation)
Period: 21 Feb 2012
Tim C. McAloone (Chairman)
Department of Mechanical Engineering
Engineering Design and Product Development

Description
PhD thesis examination, Cranfield University

Body type: PhD Committee
Degree of recognition: International

Related external organisation
A Value-centric Decision Making Framework for Maintenance Services Outsourcing
Activity: Membership › Membership in review committee

The Future of Eco-Innovation
Period: 19 Jan 2012 → 20 Jan 2012
Tim C. McAloone (Participant)

Department of Mechanical Engineering
Engineering Design and Product Development

Description
The Future of Eco-Innovation: The Role of Business Models in Green Transformation
OECD/European Commission/Nordic Innovation Joint Workshop

Links:
http://www.oecd.org/innovation/green

Related event
The Future of Eco-Innovation: The Role of Business Models in Green Transformation
19/01/2012 → 20/01/2012
Copenhagen, Denmark
Activity: Attending an event › Participating in or organising workshops, courses, seminars etc.

Sekretær i bestyrelse for Dansk Metallurgisk Selskab (External organisation)
Period: 2011 → 2015
Grethe Winther (Secretary)

Department of Mechanical Engineering
Materials and Surface Engineering

Links:
http://www.D-M-S.dk

Related external organisation
Sekretær i bestyrelse for Dansk Metallurgisk Selskab
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Danish Electrochemical Society annual meeting 2011
Period: 29 Sep 2011 → 30 Sep 2011
Anders Harthøj (Participant)

Department of Mechanical Engineering
Description
Oral presentation

Related event
Danish Electrochemical Society annual meeting 2011
29/09/2011 → 30/06/2012
Odense, Denmark
Activity: Attending an event › Participating in or organising a conference

Omega-3 food emulsions: Control and investigation of molecular structure in relation to lipid oxidation
Period: 26 Sep 2011
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
Tour of DTU Cen and presentation for Arla Strategic Innovation Centre, ARLA FOODS, Denmark.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

SUR/FIN Manufacturing and Technology Conference 2011
Period: 13 Jun 2011 → 15 Jun 2011
Anders Harthøj (Participant)
Department of Mechanical Engineering

Description
Oral presentation

Related event
SUR/FIN Manufacturing and Technology Conference 2011
13/06/2011 → 15/06/2011
Chicago, IL, United States
Activity: Attending an event › Participating in or organising a conference

Omega-3 food emulsions: Control and investigation of molecular structure in relation to lipid oxidation
Period: 9 Jun 2011
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
DMS Risø.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Danish Metallurgical Society symposium 2011
Period: 6 Jun 2011
Anders Harthøj (Participant)
Department of Mechanical Engineering
New Trends in Applied Geometry
Period: 20 Feb 2011 → 25 Feb 2011
Niels Leergaard Pedersen (Participant)
Department of Mechanical Engineering

Description
Isogeometric Shape Optimization for Fluids: Talk given at the workshop "New Trends in Applied Geometry"

The aim of this work is to use isogeometric analysis, a unification of finite element methods (FEM) and computer aided design (CAD), to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. The crux of isogeometric analysis is to approximate the fluid velocity and pressure fields by B-splines. The accurate geometry representation and high degree of continuity of the flow fields are some of the method’s advantages. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. The design variables in the isogeometric approach are the coordinates of control points that define the boundary of the domain. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The methodology is firstly presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of how to apply isogeometric analysis to the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrizations during optimization are discussed, and different design results for a range of Reynolds numbers are presented. Lastly, we present results for a simple airfoil optimization, in which an airfoil is designed to minimize the drag with a constraint on the lift and the size of the wing.
Place: Hurdalsjoen, Norway
design (CAD), to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. The crux of isogeometric analysis is to approximate the fluid velocity and pressure fields by B-splines. The accurate geometry representation and high degree of continuity of the flow fields are some of the method's advantages. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. The design variables in the isogeometric approach are the coordinates of control points that define the boundary of the domain. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The methodology is firstly presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of how to apply isogeometric analysis to the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrizations during optimization are discussed, and different design results for a range of Reynolds numbers are presented. Lastly, we present results for a simple airfoil optimization, in which an airfoil is designed to minimize the drag with a constraint on the lift and the size of the wing.

**Related event**

**New Trends in Applied Geometry**

20/02/2011 → 25/02/2011
Hurdalsjoen, Norway

Activity: Attending an event › Participating in or organising a conference

**Dansk Metallurgisk Selskab (External organisation)**

Period: 25 Jan 2011 → 25 Jan 2017
Grethe Winther (Secretary)

Department of Mechanical Engineering
Materials and Surface Engineering

**Description**
Sekretær i DMS bestyrelse

Body type: Fagligt netværk
Links:
http://www.D-M-S.dk

**Related external organisation**

**Dansk Metallurgisk Selskab**

Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

**New Trends in Applied Geometry**

Period: 14 Jan 2011
Allan Roulund Gersborg (Participant)

Department of Mechanical Engineering

**Description**
Isogeometric Shape Optimization for Fluids: Talk given at the workshop "Isogeometric Analysis 2011: Integrating Design and Analysis"

The aim of this work is to use the unification of finite element methods (FEM) and computer aided design (CAD) embedded in isogeometric analysis to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. These partial differential equations are solved for fluid velocity and pressure using B-spline based isogeometric analysis. The accurate geometry representation and high degree of continuity of the flow fields are some of the method's advantages. To ensure stable discretizations, though, care has to taken in the choice of polynomial degrees and knots vectors for the velocity and pressure approximations. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The design variables are the coordinates of control points that define the boundary of the domain. As the optimizer moves the control points around, though, control points are sometimes seen to coalesce and the control net might even fold over severely, causing an improper design and the analysis to break down. Regularization methods to ensure a good boundary representation are therefore often needed. The methodology is presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of the
The aim of this work is to use the unification of finite element methods (FEM) and computer aided design (CAD) embedded in isogeometric analysis to solve shape optimization problems within fluid mechanics. The flow problems considered are governed by the 2-dimensional steady-state, incompressible Navier-Stokes equations. These partial differential equations are solved for fluid velocity and pressure using B-spline based isogeometric analysis. The accurate geometry representation and high degree of continuity of the flow fields are some of the method's advantages. To ensure stable discretizations, though, care has to taken in the choice of polynomial degrees and knots vectors for the velocity and pressure approximations. In shape optimization for fluids we search for an optimal design of the flow domain that minimizes a prescribed objective, while satisfying suitable constraints. With the ability to represent complex shapes in few design variables, and the unification of the analysis and geometry models, isogeometric analysis is highly suited for shape optimization purposes. The design variables are the coordinates of control points that define the boundary of the domain. As the optimizer moves the control points around, though, control points are sometimes seen to coalesce and the control net might even fold over severely, causing an improper design and the analysis to break down. Regularization methods to ensure a good boundary representation are therefore often needed. The methodology is presented through a simple example in which a pipe bend is designed to minimize the drag with a constraint on the area of the pipe. The basics of the analysis of the Navier-Stokes equations are briefly covered, some regularization methods to ensure good boundary parametrisations during optimization are discussed, and different design results for a range of Reynolds numbers are presented.

Related event

New Trends in Applied Geometry
20/02/2011 → 25/02/2011
Hurdalsjoen, Norway
Activity: Attending an event › Participating in or organising a conference
Improvement and automation of a single sinker densimeter for the determination of \((p, \frac{581}{252c}+T\% 2529+properties+of+mixtures+of+gases+related+with+biogas\)

M.E. Mondéjar

Related event

23rd International Conference on Efficiency, Cost, Optimization, Simulation and Environmental Impact of Energy Systems
14/06/2010 → 17/06/2010
Lausanne, Switzerland
Activity: Talks and presentations › Conference presentations

Characterization of fish oil emulsions by electron microscopy
Period: 13 Oct 2010
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
Seminar. Lipid Research Cluster - DTU.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Characterization of fish oil emulsions by electron microscopy
Period: 5 Jun 2010
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
Arla Strategic Innovation Centre, ARLA FOODS, Brabrand Denmark.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

Electron microscopy of fully hydrated soft and liquid samples
Period: 3 Jun 2010
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
FIMIN workshop in Magnetic Methods in Biogeochemistry – from field to microscopy and Mössbauer spectroscopy, DTU Cen.

Related external organisation
Unknown external organisation
Activity: Talks and presentations › Conference presentations

International Workshop on Optical Waveguide Theory and Numerical Modelling (OWTNM); 19
Period: 9 Apr 2010 → 10 Apr 2010
Ole Sigmund (Speaker)
Department of Mechanical Engineering
Solid Mechanics

Description
Place: Cambridge, UK

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Electron microscopy of fully hydrated soft and liquid samples
Period: 11 Mar 2010
Louise Helene Søgaard Jensen (Lecturer)
Center for Electron Nanoscopy
Materials and Surface Engineering

Description
Seminar, DTU Systems Biology.

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Influence of New Sol-gel Refractory Coating on the Casting Properties of Cold Box and Furan Cores for Grey Cast iron: Presented at the 69. World Foundry Congress, Hangzhou 2010
Period: 1 Jan 2010 → …
Ugochukwu Chibuzih Nwaogu (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

Influence of New Sol-gel Refractory Coating on the Casting Properties of Cold Box and Furan Cores for Grey Cast iron:
Presented at the 69. World Foundry Congress, Hangzhou 2010
Period: 1 Jan 2010 → …
Niels Skat Tiedje (Speaker)
Department of Mechanical Engineering
Manufacturing Engineering

Related external organisation

Unknown external organisation
Activity: Talks and presentations › Conference presentations

3D simulations of self-propelled, video reconstructed jellyfish using vortex methods
Period: 22 Nov 2009 → 24 Nov 2009
Johannes Tophøj Rasmussen (Participant)
Department of Mechanical Engineering
Fluid Mechanics

Description
We present the simulation of the swimming medusa by capturing the outline of the motion from video taped experiments. A three dimensional body with constant mass distribution and divergence solid velocity field is ensured under the assumption of a rotationally symmetric medusa. The simulations are carried out using the vortex-in-cell algorithm in three dimensions with one-way coupling from the medusa motion. The boundaries of the deforming solid body are enforced using Brinkmann penalization. The flow is discretized by 67M vortex particles and the computations carried out on 256 cores with a 80% parallel efficiency. The simulation is visualized in a fluid dynamics video. To different strokes, A and B, are captured, simulated and studied. Stroke A produces a starting vortex ring as fluid is being expelled from the bell and produces yet a vortex ring of opposite sign when the bell opens and recovers its shape. Stroke B is more brisk and differs from A by producing two vortex rings during the recovery stroke. Both strokes propel the medusa but stroke B produces a higher velocity. The cruising velocity scales with the square root of the Reynolds number.

Related event

3D simulations of self-propelled, video reconstructed jellyfish using vortex methods
American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics
Activity: Attending an event › Participating in or organising a conference

3D simulations of self-propelled, video reconstructed jellyfish using vortex methods
Period: 22 Nov 2009 → 24 Nov 2009
Francesca Storti (Participant)
Department of Mechanical Engineering

Description
We present the simulation of the swimming medusa by capturing the outline of the motion from video taped experiments. A three dimensional body with constant mass distribution and divergence solid velocity field is ensured under the assumption of a rotationally symmetric medusa. The simulations are carried out using the vortex-in-cell algorithm in three dimensions with one-way coupling from the medusa motion. The boundaries of the deforming solid body are enforced using Brinkmann penalization. The flow is discretized by 67M vortex particles and the computations carried out on 256 cores with a 80% parallel efficiency. The simulation is visualized in a fluid dynamics video. To different strokes, A and B, are captured, simulated and studied. Stroke A produces a starting vortex ring as fluid is being expelled from the bell and produces yet a vortex ring of opposite sign when the bell opens and recovers its shape. Stroke B is more brisk and differs from A by producing two vortex rings during the recovery stroke. Both strokes propel the medusa but stroke B produces a higher velocity. The cruising velocity scales with the square root of the Reynolds number.

Related event

3D simulations of self-propelled, video reconstructed jellyfish using vortex methods
American Physical Society, 62nd Annual Meeting of the Division of Fluid Dynamics
Activity: Attending an event › Participating in or organising a conference

Comsol Conference 2008
Period: 4 Nov 2008 → 6 Nov 2008
Ole Sigmund (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk about "Simulation of Toology Optimized Microgrippers"

Place: Hannover, Germany

Related event

Comsol Conference 2008
04/11/2008 → 06/11/2008
Hannover, Germany
Activity: Attending an event › Participating in or organising a conference

Laser operatør kursus
Period: 2 Oct 2008
Flemming Ove Olsen (Other)
Manufacturing Engineering
Department of Mechanical Engineering

Description
Laser-ERFA-Gruppen afholder torsdag d. 2. oktober 2008, kl. 08:30-16:30 et 1-dags laseroperatør kursus. Kurset er et rent teorikursus, hvor Professor Flemming Olsen, DTU fortæller om laserskæring. Formålet er at give operatører af laserskæremaskiner en teoretisk ballast for deres arbejde. Kurset koncentrerer sig om en række teorilektioner, men der vil være rig lejlighed til at stille spørgsmål og bringe egne problemstillinger op i diskussionen. Kurset indeholder lektioner om:
• Laserskæringens udvikling
• Laseres virkemåde og gennemgang af de lasertyper, der anvendes til laserskæring
• Fokusering af laserstråler
• Indkobling af lys i emnet
• Skæreprocessens øvrige parametre
• Metoder til at vurdere kvaliteten af de laserskårne emner
• Procesoptimeringsmetodik
• Maskinjustering.

Head: Flemming Ove Olsen

Related external organisation

Laser-ERFA-Gruppen
Fredericia, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

ASME 2008 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference
Ole Sigmund (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk about "Topology Optimized Microgrippers for Nanomanipulation of Carbon Nanotubes" Presented at IDETC/CIE

Place: Brooklyn, New York, USA

Related event

ASME 2008 International Design Engineering Technical Conferences and Computers and Information in Engineering Conference
03/08/2008 → 06/08/2008
Brooklyn, NY, United States
Activity: Attending an event › Participating in or organising a conference

2008 MRS Spring Meeting & Exhibit
Ole Sigmund (Participant)
Department of Mechanical Engineering
Solid Mechanics

Description
Talk about "3D Pick-and-Place of Carbon Nanotubes Using Shape-optimized Grippers" Presented at MRS Spring Meeting

Place: San Francisco, USA
Degree of recognition: International

Related event

2008 MRS Spring Meeting & Exhibit
24/03/2008 → 28/03/2008
San Francisco, United States
Activity: Attending an event › Participating in or organising a conference
Laser Operatør Kursus
Period: 14 Feb 2008
Flemming Ove Olsen (Other)

Manufacturing Engineering

Department of Mechanical Engineering

Description

• Laserkæringens udvikling
• Laseres virkemåde og gennemgang af de lasertyper, der anvendes til laserkæring
• Fokusering af laserstråler
• Indkobling af lys i emnet
• Skæreprocessens øvrige parametre
• Metoder til at vurdere kvaliteten af de laserkærne emner
• Procesoptimeringsmetodik
• Maskinjustering.

Head: Flemming Ove Olsen

Related external organisation

Laser-ERFA-Gruppen
Fredericia, Denmark
Activity: Talks and presentations › Guest lectures, external teaching and course activities at other universities

Design Society Advisory Board (External organisation)
Period: Aug 2007 → …
Tim C. McAloone (Participant)

Department of Mechanical Engineering
Engineering Design and Product Development

Description
The Design Society is an international non-governmental, non-profit making organisation whose members share a common interest in design. It strives to contribute to a broad and established understanding of all aspects of development and design, and to promote the use of results and knowledge for the good of humanity.

The Advisory Board advises, guides and supports the Board of Management in developing and furthering the aim and objectives of the Society. It does this by bringing forward for consideration by the Board of Management any item of business or topic pertinent to the Society. Recommendations made by the Advisory Board are not binding on the Board of Management.

The Advisory Board consists of the President or President’s nominee and up to twenty seven members of the Society. The members of the Advisory Board are elected democratically by the members of the Society at the General Meeting, which is called every two years during ICED conferences. The normal term of an Advisory Board member is six (6) years with opportunity for one further term.

The Advisory Board is managed by a Chair, who is responsible for organising the annual meeting of the Advisory Board. The Chair is elected by the members of the Advisory Board. The office of the Chair is limited to two terms of two years.

Body type: Research Association
Degree of recognition: International
Links:
http://www.designsociety.org

Related external organisation

Design Society Advisory Board
Activity: Membership › Membership of committees, commissions, boards, councils, associations, organisations, or similar

Selskabet for Maskinteknisk Proces- og Produktionssteknik ( ATV-SEMAPP) (External organisation)
Period: 30 Apr 1998 → 29 Apr 2010
Flemming Ove Olsen (Chairman)

Department of Mechanical Engineering
Prizes:

3rd prize winner at Grøn Dyst (Green Challenge) 2016 in the category "Master thesis idea"
Henrik Pieper (Recipient)
Department of Mechanical Engineering, Thermal Energy
Details
Awarded date: 24 Jun 2016
Degree of recognition: Local
Granting Organisations: Technical University of Denmark
Prize: Prizes, scholarships, distinctions

Alexander Foss MADE award
Sara Shafiee (Recipient)
Department of Mechanical Engineering, Engineering Design and Product Development, Operations Management
Description
Sara Shafiee, ph.d. fra DTU, er dette års vinder af Alexander Foss MADE Award. Hun har som erhvervsph.d. hos Haldor Topsøe forsket inden for hurtig produkt- og produktionsudvikling i MADE.
Details
Awarded date: 30 Nov 2017
Degree of recognition: National
Prize: Prizes, scholarships, distinctions

Civilingenøer Kristian Rasmussen og hustru Gunhild Katrine Rasmussens Fond
Danilo Quagliotti (Recipient)
Department of Mechanical Engineering, Manufacturing Engineering
Description
Awarded with a research grant to support Postdoc research "Statistical modelling, surfaces generation and traceability for 3D Micro/Nano Optical Metrology"
Details
Awarded date: Jan 2017
Prize: Prizes, scholarships, distinctions

DTU’s Young Researcher award
Matteo Villa (Recipient)
Department of Mechanical Engineering, Materials and Surface Engineering
Details
Awarded date: 31 Oct 2014
Granting Organisations: Technical University of Denmark
Prize: Prizes, scholarships, distinctions

DTU’s Young Researcher Award 2017
Joe Alexandersen (Recipient)
Department of Mechanical Engineering, Solid Mechanics
**Description**
For my Ph.D. research work, one of six awarded.

**Details**
Awarded date: 27 Oct 2017  
Degree of recognition: Local  
Granting Organisations: Technical University of Denmark  
Prize: Prizes, scholarships, distinctions

**Fabriksejer, Civilingeniør Louis Dreyer Myhrwold og hustru Janne Myhrwolds Fond**  
Danilo Quagliotti (Recipient)  
Department of Mechanical Engineering, Manufacturing Engineering

**Description**
Awarded with a research grant to support PhD research project "Multi Scale Micro Nano Metrology for Advanced Moulding Technologies"

**Details**
Awarded date: 30 Oct 2015  
Prize: Prizes, scholarships, distinctions

**Green Challenge 2014**  
Malene Hovgaard Vested (Recipient)  
Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering

**Description**
First prize

**Details**
Awarded date: 27 Jun 2014  
Degree of recognition: Local  
event: Green Challenge (Grøn Dyst) 2014  
Prize: Prizes, scholarships, distinctions

**Green Talents Award 2015**  
Maria E. Mondejar Montagud (Recipient)  
Department of Mechanical Engineering, Thermal Energy

**Description**
The German Federal Ministry of Education and Research (BMBF) hosts the prestigious Green Talents Award to promote the international exchange of innovative green ideas. The award honors young researchers from numerous countries and scientific disciplines who are selected by a high-ranking jury of German experts for their outstanding achievements in making our societies more sustainable.

**Details**
Awarded date: Oct 2015  
Degree of recognition: International  
Granting Organisations: German Federal Ministry of Education and Research (BMBF)  
Prize: Prizes, scholarships, distinctions

**Idella Foundation**  
Danilo Quagliotti (Recipient)  
Department of Mechanical Engineering, Manufacturing Engineering

**Description**
Awarded with a research grant to support external stay at The University of Nottingham

**Details**
Awarded date: 20 Jun 2016  
Prize: Prizes, scholarships, distinctions

**Innovationsfonden Prize 2018**  
Sara Shafiee (Recipient)
Erhvervsforsker Prisen Honors the most talented Business PhDs or Business Postdocs from the Innovation Fund's talent program, which has combined a high level of research, with strong business understanding and has created a business impact for a company.

**Details**
- Awarded date: 2018
- Degree of recognition: National
- Prize: Prizes, scholarships, distinctions

**ISSMO/Springer Prize for Young Scientist 2015**
Joe Alexandersen (Recipient)
Department of Mechanical Engineering, Solid Mechanics

**Description**
For the presentation and paper “Topology optimisation of passive coolers for light-emitting diode lamps” at the 11th World Congress of Structural and Multidisciplinary Optimization.

**Details**
- Awarded date: 2015
- Degree of recognition: International
- Granting Organisations: International Society of Structural and Multidisciplinary Optimization (ISSMO)
- Prize: Prizes, scholarships, distinctions

**Otto Mønsteds Fond**
Danilo Quagliotti (Recipient)
Department of Mechanical Engineering, Manufacturing Engineering

**Description**
Awarded with a research grant to support PhD research project "Multi Scale Micro Nano Metrology for Advanced Moulding Technologies"

**Details**
- Awarded date: 15 Mar 2016
- Prize: Prizes, scholarships, distinctions

**Outstanding Reviewer Award**
David R. Fuhrman (Recipient)
Department of Mechanical Engineering, Fluid Mechanics, Coastal and Maritime Engineering

**Description**
ASCE Journal of Waterway, Port, Coastal, and Ocean Engineering

**Details**
- Awarded date: 2015
- Degree of recognition: International
- Prize: Prizes, scholarships, distinctions

**Third Price EFC17 Best Paper Awards**
Søren Højgaard Jensen (Recipient), Hendrik Langnickel (Recipient), Nils Hintzen (Recipient), Ming Chen (Recipient), Xiufu Sun (Recipient), Anne Hauch (Recipient), Giacomo Butera (Recipient) & Lasse Røngaard Clausen (Recipient)
Department of Energy Conversion and Storage, Applied Electrochemistry, Mixed Conductors, Department of Mechanical Engineering, Thermal Energy

**Description**
Third price for the paper: "Reversible Operation using Carbonaceous Gasses of a 30-cell Solid Oxide Cell Stack"

The awards are given to the best papers submitted to the EFC17 conference and that report the most important insights and progress within the broad field of hydrogen and fuel cell technologies. The awards are sponsored by the EFC17 conference. All nominations are judged by an independent Best Paper Selection Committee.

**Details**
Awarded date: 13 Dec 2017
Degree of recognition: International
event: 7th European Fuel Cell Piero Lunghi Conference
Prize: Prizes, scholarships, distinctions

**Tom Bell Young Author Award**
Matteo Villa (Recipient)
Department of Mechanical Engineering, Materials and Surface Engineering

**Details**
Awarded date: 21 Apr 2016
Degree of recognition: International

Granting Organisations: International Federation for Heat Treatment and Surface Engineering
event: 23rd IFHTSE Congress
Prize: Prizes, scholarships, distinctions

**Young Scientist Award: 6th ACE-X Conference, Istanbul, Turkey 2012**
Michael Wenani Nielsen (Recipient)
Department of Mechanical Engineering, Manufacturing Engineering

**Description**
For his contribution:
Prediction of internal strains during curing, post-curing and demoulding of thick glass/epoxy composite – Analysis of different constitutive models

**Details**
Awarded date: 4 Jul 2012
Prize: Prizes, scholarships, distinctions

**Press clippings:**

*Conceptual Modelling for Product Configuration Systems - Defence*
Sara Shafiee
11/09/2017

**Description**
Ph.D. Defence
https://www.youtube.com/watch?v=XLebQfHXNSM&t

**Subject**
https://www.youtube.com/watch?v=XLebQfHXNSM&t
Department of Mechanical Engineering, Department of Management Engineering

**Media contribution (1)**

*Conceptual Modelling for Product Configuration Systems - Defence*
11/09/2017
Conceptual Modelling for Product Configuration Systems - Defence (International), Denmark, Web
DTU
38:12
https://www.youtube.com/watch?v=XLebQfHXNSM&t
PhD defence by Sara Shafiee
Sara Shafiee
Department of Mechanical Engineering, Department of Management Engineering
Press / Media

PhD, Sara Shafiee, DTU Management Engineering and Haldor Topsøe: PhD, Sara Shafiee, DTU Management Engineering and Haldor Topsøe
Sara Shafiee
28/10/2016
This film is produced for DTU’s celebration of the new PhD graduates 2016, and is about Sara Shafiee, how is doing an industrial PhD about: “Conceptual Modelling for Product Configuration Systems” in collaboration between DTU Management Engineering and Haldor Topsøe.

Subject
https://www.youtube.com/watch?v=jocaJRget9g
Department of Mechanical Engineering, Department of Management Engineering

Media contribution (1)
PhD, Sara Shafiee, DTU Management Engineering and Haldor Topsøe: PhD, Sara Shafiee, DTU Management Engineering and Haldor Topsøe
28/10/2016
DTU.dk, youtube (International), Denmark, Web
DTU
2
http://www.youtube.com/embed/jocaJRget9g?rel=0&wmode=transparent&autoplay=1
Sara Shafiee
Department of Mechanical Engineering, Department of Management Engineering
Press / Media

Smag på din fremtid: Ny teknologi kommer til at påvirke din hverdag - der forskes bredt. Også i fremtidens øl.
Joe Alexandersen
18/06/2014

Description
Article in the Danish newspaper BT about the future of technology - in relation to the ESOF House of Future Technologies.

Interviewed about the interaction of topology optimisation and 3D printing.
Department of Mechanical Engineering, Solid Mechanics

Media contribution (1)
Smag på din fremtid: Ny teknologi kommer til at påvirke din hverdag - der forskes bredt. Også i fremtidens øl.
18/06/2014
BT, Print
Mads Korsager Nielsen
Joe Alexandersen
Department of Mechanical Engineering, Solid Mechanics
Press / Media