Benchmarking and monitoring framework for interconnected file synchronization and sharing services

On-premise file synchronization and sharing services are increasingly used in research collaborations and academia. The main motivation for the on-premise deployment is connected with the requirements on the physical location of the data, data protection policies and integration with existing computing and storage infrastructure in the research labs. In this work we present a benchmarking and monitoring framework for file synchronization and sharing services. It allows service providers to monitor the operational status of their services, understand the service behavior under different load types and with different network locations of the synchronization clients. The framework is designed as a monitoring and benchmarking tool to provide performance and robustness metrics for interconnected file synchronization and sharing services such as Open Cloud Mesh.

General information
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Organisations: Department of Applied Mathematics and Computer Science, IT Service, CERN
Authors: Mrówczyński, P. (Intern), Mościcki, J. T. (Ekstern), Lamanna, M. (Ekstern), Orellana, F. (Intern)
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BFI (2014): BFI-level 1
Scopus rating (2014): SJR 1.088 SNIP 3.196 CiteScore 4.45
Four simple recommendations to encourage best practices in research software

Scientific research relies on computer software, yet software is not always developed following practices that ensure its quality and sustainability. This manuscript does not aim to propose new software development best practices, but rather to provide simple recommendations that encourage the adoption of existing best practices. Software development best practices promote better quality software, and better quality software improves the reproducibility and reusability of research. These recommendations are designed around Open Source values, and provide practical suggestions that contribute to making research software and its source code more discoverable, reusable and transparent. This manuscript is aimed at developers, but also at organisations, projects, journals and funders that can increase the quality and sustainability of research software by encouraging the adoption of these recommendations.
Sådan kan samarbejde mellem industrien, universiteterne og sundhedsvæsenet skabe gode løsninger til forebyggelse, diagnostik, patientbehandling og rehabilitering
PALSfit3: A software package for analysing positron lifetime spectra

The present report describes a Windows based computer program called PALSfit3. The purpose of the program is to carry out analyses of spectra that have been measured by positron annihilation lifetime spectroscopy (PALS). PALSfit3 is based on the well tested PATFIT and PALS fit programs, which have been used extensively by the positron annihilation community. The present document describes the mathematical foundation of the PALSfit3 model as well as a number of features of the program. The cornerstones of PALSfit3 are two least squares fitting modules: POSITRONFIT and RESOLUTIONFIT. In both modules a model function will be fitted to a measured lifetime spectrum. This model function consists of a function representing the physics of the positron decay which is convoluted with the experimental time resolution function, plus a constant background. The 'physics function' consists of a sum of decaying exponentials each of which may be broadened by convolution with a log-normal lifetime distribution. The time resolution function is described by a sum of Gaussians which may be displaced with respect to each other. Various types of constraints may be imposed on the fitting parameters. In the POSITRONFIT module, the fitting parameters to be extracted from a measured spectrum are for each lifetime component its mean lifetime and its broadening as well as its intensity. A correction for positrons annihilating outside the sample can be made as part of the analysis. In the RESOLUTIONFIT module, parameters determining the shape of the time resolution function can be fitted. The extracted resolution function may then be used in POSITRONFIT.

Graphics displays are provided to ease the selection of some of the input parameters and to display results of spectrum analysis. The results are also available in a text window.

PALSfit3 is verified on Windows XP and Windows 7, 8 and 10. The PALSfit3 software can be acquired from the Technical University of Denmark (http://PALSfit.dk)

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Organisations: Department of Energy Conversion and Storage, IT Service
Authors: Kirkegaard, P. (Intern), Olsen, J. V. (Intern), Eldrup, M. M. (Intern)
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Interactive Appearance Prediction for Cloudy Beverages

Juice appearance is important to consumers, so digital juice with a slider that varies a production parameter or changes juice content is useful. It is however challenging to render juice with scattering particles quickly and accurately. As a case study, we create an appearance model that provides the optical properties needed for rendering of unfiltered apple juice. This is a scattering medium that requires volume path tracing as the scattering is too much for single scattering techniques and too little for subsurface scattering techniques. We investigate techniques to provide a progressive interactive appearance prediction tool for this type of medium. Our renderings are validated by qualitative and quantitative comparison with photographs. Visual comparisons using our interactive tool enable us to estimate the apple particle concentration of a photographed apple juice.

General information
State: Published
Organisations: IT Service, Department of Applied Mathematics and Computer Science , Image Analysis & Computer Graphics, Alexandra Institute
Authors: Dal Corso, A. (Intern), Frisvad, J. R. (Intern), Kjeldsen, T. K. (Ekstern), Bærentzen, J. A. (Intern)
Number of pages: 4
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Publisher: Eurographics
Editors: Klein, R., Rushmeier, H.
ISBN (Print): 978-3-03868-007-9
Interactive directional subsurface scattering and transport of emergent light

Existing techniques for interactive rendering of deformable translucent objects can accurately compute diffuse but not directional subsurface scattering effects. It is currently a common practice to gain efficiency by storing maps of transmitted irradiance. This is, however, not efficient if we need to store elements of irradiance from specific directions. To include changes in subsurface scattering due to changes in the direction of the incident light, we instead sample incident radiance and store scattered radiosity. This enables us to accommodate not only the common distance-based analytical models for subsurface scattering but also directional models. In addition, our method enables easy extraction of virtual point lights for transporting emergent light to the rest of the scene. Our method requires neither preprocessing nor texture parameterization of the translucent objects. To build our maps of scattered radiosity, we progressively render the model from different directions using an importance sampling pattern based on the optical properties of the material. We obtain interactive frame rates, our subsurface scattering results are close to ground truth, and our technique is the first to include interactive transport of emergent light from deformable translucent objects.
Machine learning techniques applied to system characterization and equalization

Linear signal processing algorithms are effective in combating linear fibre channel impairments. We demonstrate the ability of machine learning algorithms to combat nonlinear fibre channel impairments and perform parameter extraction from directly detected signals.

General information

State: Published
Organisations: Department of Photonics Engineering, High-Speed Optical Communication, Centre of Excellence for Silicon Photonics for Optical Communications, IT Service, Technical University of Denmark, Helmut Schmidt Universität
Authors: Zibar, D. (Intern), Thrane, J. (Ekstern), Wass, J. (Ekstern), Jones, R. T. (Intern), Piels, M. (Intern), Schaeffer, C. (Ekstern)
Number of pages: 3
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Series: 2016 Optical Fiber Communications Conference and Exhibition (ofc)
Main Research Area: Technical/natural sciences
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Machine learning techniques in optical communication

Machine learning techniques relevant for nonlinearity mitigation, carrier recovery, and nanoscale device characterization are reviewed and employed. Markov Chain Monte Carlo in combination with Bayesian filtering is employed within the nonlinear state-space framework and demonstrated for parameter estimation. It is shown that the time-varying effects of cross-phase modulation (XPM) induced polarization scattering and phase noise can be formulated within the nonlinear state-space model (SSM). This allows for tracking and compensation of the XPM induced impairments by employing approximate stochastic filtering methods such as extended Kalman or particle filtering. The achievable gains are dependent on the autocorrelation (AC) function properties of the impairments under consideration which is strongly dependent on the transmissions scenario. The gain of the compensation method are therefore investigated by varying the parameters of the AC function describing XPM-induced polarization scattering and phase noise. It is shown that an increase in the nonlinear tolerance of more than 2 dB is achievable for 32 Gbaud QPSK and 16-quadratic-amplitude modulation (QAM). It is also reviewed how laser rate equations can be formulated within the nonlinear state-space framework which allows for tracking of nonLorentzian laser phase noise lineshapes. It is experimentally demonstrated for 28 Gbaud 16-QAM signals that if the laser phase noise shape strongly deviates from the Lorentzian, phase noise tracking algorithms employing rate equation-based SSM result in a significant performance improvement (>8 dB) compared to traditional approaches using digital phase-locked loop. Finally, Gaussian mixture model is reviewed and employed for nonlinear phase noise compensation and characterization of nanoscale devices structure variations.

General information

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Web of Science (2015): Indexed yes
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Scopus rating (2014): SJR 1.801 SNIP 2.423 CiteScore 4.23
Web of Science (2014): Indexed yes
BFI (2013): BFI-level 2
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Web of Science (2013): Indexed yes
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Scopus rating (2012): SJR 1.711 SNIP 2.335 CiteScore 3.21
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BFI (2011): BFI-level 2
Scopus rating (2011): SJR 1.605 SNIP 2.758 CiteScore 3.2
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Mobile network architecture of the long-range WindScanner system

In this report we have presented the network architecture of the long-range WindScanner system that allows utilization of mobile network connections without the use of static public IP addresses. The architecture mitigates the issues of additional fees and contractual obligations that are linked to the acquisition of the mobile network connections with static public IP addresses. The architecture consists of a hardware VPN solution based on the network appliances Z1 and MX60 from Cisco Meraki with additional 3G or 4G dongles. With the presented network architecture and appropriate configuration, we fulfill the requirements of running the long-range WindScanner system using a mobile network such as 3G. This architecture allows us to have the WindScanners and the master computer in different geographical locations, and in general facilitates deployments of the long-range WindScanner system.

General information
State: Published
Organisations: Department of Wind Energy, Meteorology & Remote Sensing, Test and Measurements, IT Service
Authors: Vasiljevic, N. (Intern), Lea, G. (Intern), Hansen, P. (Intern), Jensen, H. M. (Intern)
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**Simulator of GAleyxy Millimetre/submillimetre Emission (SiGAME): CO emission from massive z=2 main-sequence galaxies**

We present SiGAME (Simulator of GAleyxy Millimetre/submillimetre Emission), a new numerical code designed to simulate the $^{12}$CO rotational line spectrum of galaxies. Using sub-grid physics recipes to post-process the outputs of smoothed particle hydrodynamics (SPH) simulations, a molecular gas phase is condensed out of the hot and partly ionized SPH gas. The gas is subjected to far-UV radiation fields and cosmic ray ionization rates which are set to scale with the local star formation rate volume density. Level populations and radiative transport of the CO lines are solved with the 3D radiative transfer code lime. We have applied SiGAME to cosmological SPH simulations of three disc galaxies at $z = 2$ with stellar masses in the range $\sim 0.5$–$2 \times 10^{11} \, M_{\odot}$ and star formation rates $\sim 40$–140 $M_{\odot} \, yr^{-1}$. Global CO luminosities and line ratios are in agreement with observations of disc galaxies at $z \sim 2$ up to and including $J = 3$–4 observations. The central 5kpc regions of our galaxies have CO $3 - 2/1 - 0$ and $7 - 6/1 - 0$ brightness temperature ratios of $\sim 0.55$–0.65 and $\sim 0.02$–0.08, respectively, while further out in the disc the ratios drop to more quiescent values of $\sim 0.5$ and $<0.01$. Global CO-to-H$_2$ conversion ($\alpha_{CO}$) factors are $\sim 1.5 M_{\odot} pc^{-2} (K km s^{-1})^{-1}$, i.e. ~2–3 times below the typically adopted values for disc galaxies, and $\alpha_{CO}$ increases with radius, in agreement with observations of nearby galaxies. Adopting a top-heavy Giant Molecular Cloud (GMC) mass spectrum does not significantly change the results. Steepening the GMC density profiles leads to higher global line ratios for $J_{up} \geq 3$ and CO-to-H$_2$ conversion factors $\sim 3.6 M_{\odot} pc^{-2} (K km s^{-1})^{-1}$.
**Bibliographical note**
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**Big Data fra jord til bord**
Danske landmænd og virksomhederne i fødevaresektoren har gode forudsætninger for at drage nytte af den rivende udvikling inden for indsamling og bearbejdning af data:

- **Danmark** har en stærk fødevaresektor. Det skyldes bl.a., at alle dele af værdikæden arbejder tæt sammen. Fra primærproducenterne, over forarbejdningsindustrien, agroindustrien til videns- og forskningsmiljøerne. Effektiv ressourceudnyttelse og fokus på optimering i hele værdikæden gør sektoren i stand til at konkurrere på verdensmarkedet.

- **Danske fødevarevirksomheder** har altid været gode til at opdyrke nye forretningsmodeller og finde nye innovative veje til øget værdiskabelse. For eksempel gennem smartere måder at producere på, levere produkterne på eller at indarbejde større værdi i produkterne, så de kan sælges med større forøjelse.

- **Dansk landbrug og hele værdikæden i fødevaresektoren producerer store mængder af data.** Det skyldes bl.a. et højt automationsniveau og myndighedernes krav til dokumentation af fødevarekvaliteten, når de danske producenter leverer fødevarer til forbrugerne verden over. Der er imidlertid et stort spring fra at råde over store mængder af data til at bruge dem aktivt i forretningsudviklingen. Denne rapport viser, hvordan Big Data kan være ét af omdrejningspunkter

**General information**
State: Published

Organisations: Office for Innovation & Sector Services, Department of Applied Mathematics and Computer Science, Statistics and Data Analysis, National Food Institute, Division of Risk Assessment and Nutrition, Research Group for
Machine learning techniques in optical communication

Techniques from the machine learning community are reviewed and employed for laser characterization, signal detection in the presence of nonlinear phase noise, and nonlinearity mitigation. Bayesian filtering and expectation maximization are employed within nonlinear state-space framework for parameter tracking.

General information
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Organisations: Department of Photonics Engineering, High-Speed Optical Communication, IT Service, Helmut-Schmidt-University
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expectation-maximisation algorithm, lasers, learning (artificial intelligence), nonlinear optics, optical communication, optical filters, optical noise, optical signal detection, phase noise, Communication, Networking and Broadcast Technologies, Photonics and Electrooptics, Bayes methods, Bayesian filtering, expectation maximization, laser characterization, machine learning techniques, Nonlinear optics, nonlinear phase noise, nonlinear state-space framework, Optical noise, Optical polarization, Optical signal processing, Optical variables measurement, parameter tracking, Phase noise, signal detection
DOIs:
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Our 3D Vision Data-Sets in the Making

General information
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Organisations: Department of Applied Mathematics and Computer Science, Image Analysis & Computer Graphics, IT Service, National Space Institute, Istituto Italiano di Tecnologia, Aston University
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Main Research Area: Technical/natural sciences
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RobDS.pdf
Phosphorus in Denmark: national and regional anthropogenic flows

Substance flow analyses (SFA) of phosphorus (P) have been examined on a national or supra-national level in various recent studies. SFA studies of P on the country scale or larger can have limited informative value; large differences between P budgets exist within countries and are easily obscured by country-wide average values. To quantify and evaluate these imbalances we integrated a country-scale and regional-scale model of the Danish anthropogenic P flows and stocks. We examine three spatial regions with regard to agriculture, as the main driver for P use, and waste management, the crucial sector for P recovery. The regions are characterised by their differences in agricultural practice, population and industrial density. We show considerable variation in P flows within the country. First, these are driven by agriculture, with mineral fertiliser inputs varying between 3 and 5 kg ha\(^{-1}\) yr\(^{-1}\), and animal feedstuff inputs between 5 and 19 kg ha\(^{-1}\) yr\(^{-1}\). We identified surpluses especially in areas with a larger proportion of animal husbandry, owing to additional application of manure in excess of crop P demand. However, redistribution of the large amounts of P in manure is not feasible owing to transport limitations. Second, waste management, closely linked to population and industrial density is the driver behind differences in recoverable P flows. Current amounts of potentially recoverable P cannot change the reliance on primary P. The most immediate P re-use potential exists in the areas around the eastern urban agglomerations, from more complete recovery of sewage sludge (with unrecovered P amounts of up to 33% of P in current mineral fertiliser imports) and the biowaste fraction in municipal solid waste currently not collected separately (24% of P in current mineral fertiliser imports), since this region shows both the highest proportion of crop production and fertiliser use and lowest soil P budget.

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Organisations: Department of Environmental Engineering, Residual Resource Engineering, IT Service, University of Copenhagen, Vienna University of Technology
Authors: Klinglmair, M. (Intern), Lemming, C. (Ekstern), Jensen, L. S. (Ekstern), Rechberger, H. (Ekstern), Astrup, T. F. (Intern), Scheutz, C. (Intern)
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Scopus rating (2016): CiteScore 3.73 SJR 1.16 SNIP 1.709
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BFI (2015): BFI-level 1
Scopus rating (2015): SJR 1.275 SNIP 1.915 CiteScore 3.98
Web of Science (2015): Indexed yes
BFI (2014): BFI-level 1
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BFI (2013): BFI-level 1
Scopus rating (2013): SJR 1.432 SNIP 2.184 CiteScore 3.34
ISI indexed (2013): ISI indexed yes
Web of Science (2013): Indexed yes
BFI (2012): BFI-level 1
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Web of Science (2012): Indexed yes
VirtualTable: a projection augmented reality game

VirtualTable is a projection augmented reality installation where users are engaged in an interactive tower defense game. The installation runs continuously and is designed to attract people to a table, which the game is projected onto. Any number of players can join the game for an optional period of time. The goal is to prevent the virtual stylized soot balls, spawning on one side of the table, from reaching the cheese. To stop them, the players can place any kind of object on the table, that then will become part of the game. Depending on the object, it will become either a wall, an obstacle for the soot balls, or a tower, that eliminates them within a physical range. The number of enemies is dependent on the number of objects in the field, forcing the players to use strategy and collaboration and not the sheer number of objects to win the game.

General information

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Main Research Area: Technical/natural sciences
Global research collaborations today require reliable and secure dedicated network connections to facilitate data communications between collaborating partners. To deal with the deluge of data, dedicated connections are needed to transport data in a highly efficient manner. Managing such links, which often cross multiple administrative domains with heterogeneous infrastructure, poses many compelling research challenges, one of which is interdomain network monitoring. In this article, a multidomain circuit monitoring system, CMon, is introduced. Using some services of GÉANT perfSONAR MDM, CMon is able to provide end-to-end circuit monitoring services with great flexibility, extensibility, and vendor independence, regardless of the underlying circuit provisioning systems. The architecture of CMon, by using measurement federations, can adapt to either changes in the circuit provisioning system or expansion of network size.
Next-Practise in University Research Based Open Innovation - From Push to Pull: Case Studies from Denmark

How do we ensure knowledge transfer from universities in the most effective and efficient way? What is the right balance between a push and a pull approach? These issues have been discussed at length and various methods of intermediary facilitating and ways to organise the transfer have been tried in different contextual settings at universities all over the world. Lessons learned are mixed and naturally varies from country to country. This paper presents a recently completed development project concerning the transfer facility at the Technical University of Denmark (DTU). The project focused on the pull function and the capacity development of the SMEs as this was the main lessons learned during the initial phase of the project. The paper also presents four Danish innovation projects that illustrate the use of the pull-based concept. Last but not least, the paper presents a new post-graduate education at DTU in design and management of projects in network. It supports competence development within efficient knowledge transfer. Finally conclusions and recommendations will be presented and discussed based on the above six cases within university research based knowledge transfer. © Springer-Verlag Berlin Heidelberg 2013.

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Organisations: Department of Management Engineering, Office for Innovation & Sector Services, IT Service
Authors: Rønnow Lønholdt, J. (Intern), Wilken Bengtsson, M. (Ekstern), Karlby, L. T. (Ekstern), Skovgaard Lund, D. (Intern), Møller, C. (Ekstern), Nielsen, J. (Ekstern), Schwarz, A. W. (Intern), Ulbak, K. A. (Ekstern)
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CO2NSL (Datalogger)
The following report will describe the development of a computer system, and act as the final exams project for Sune Andersen prepared at Informatics Mathematical Modelling, the Technical University of Denmark acquiring the candidate degree in computer engineering. The project lasts 26 weeks, which must cover analyses, design, implementation and documentation of the project. Rise National Laboratory is getting more and more requests from the Danish government on how to save energy. One of the main issues is saving money on power, special when it comes to streetlight. Before the end of the year 2012, 1500 street lamps around Copenhagen will be changed for light sources with low power consumption. Technical and Environmental turn down the energy as a part of Copenhagen goal of reducing the city's CO2 emissions by 20 percent by the end of year 2015. But how much power will the new lamps consume? And can a street lamp produce sufficient power even in Denmark? Here will a low cost & low power Datalogger come handy. The data logger is an electronic device that records earthquakes (Sensor network), wind, daylight, power used/produced on the street lamp over time. Data will then be uploaded via a wireless radio MESH network (868 Mhz) to a database server for later analysis. The Prototype is developed on two microcontrollers (AVR and ARM Cortex-A8) with the low power and with fault tolerant in mind, equipped with extra storage for offline catching (like a uSD(16/32Gb)). The ARM CortexA8-board is running a full version of Ubuntu (OMAP), with Apache-webserver, PHP and MySQL-database for local catching of data, in case of the network is offline. Data will then be sync with the database server then there is connectivity. Controlling the Datalogger device can be done from the control centers webinterface or on the device itself (via Web or SSH). The device can even be used for other purposes like a (MESH) WIFI net, something like freifunk in Berlin & WNDW. In a catastrophe area the lamp-network will still be running (because it is off-grid), even when the infrastructure is destroyed or very heavy loaded.

General information
State: Published
Organisations: IT Service, Department of Applied Mathematics and Computer Science, Software Engineering
Authors: Andersen, S. S. (Intern), Gustafsson, F. (Intern)
Number of pages: 96
Publication date: 2012

Combustion aerosols from municipal waste incineration - Effect of fuel feedstock and plant operation
Combustion aerosols were measured in a 22MW (thermal energy) municipal waste incinerator. Different types of waste fractions were added to a base load waste and the effect on aerosol formation was measured. The waste fractions applied were: PVC plastic, pressure-impregnated wood, shoes, salt (NaCl), batteries, and automotive shredder waste. Also, runs with different changes in the operational conditions of the incinerator were made. Mass-based particle size distributions were measured using a cascade impactor and the number-based size distributions were measured using a Scanning Mobility Particle Sizer. The plant is equipped with flue gas cleaning and the penetration through this was determined. The particle morphology was investigated by Transmission Electron Microscopy (TEM) and chemical analysis of the aerosol particles was made by Energy Dispersive X-ray Spectroscopy (EDS). The mass-based particle size distribution was bimodal with a fine mode peak around 0.4 mm and a coarse mode peak around 100 mu m. The addition of NaCl, shredder waste, and impregnated wood increased the mass concentration of fine particles (aerodynamic diameter below 2.5 mu m). In general the mass concentration was stable and close to the reference PM2.5 value of 252 +/- 21 mg= m(3) (std. T, P). The total number concentration deviated during runs and between runs spanning from 43.10(6) to 87 . 10(6)#/cm(3) (std. T, P). The aerosols formed were mixtures of dense and aggregated particles in all tests. The fine particles are mainly composed by alkali salts, zinc, and lead. The heavy metals Cu, Cd, Hg, and Pb are significantly enriched in the fine particles.

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Organisations: CHEC Research Centre, Department of Chemical and Biochemical Engineering, Department of Environmental Engineering, IT Service
Authors: Zeuthen, J. (Ekstern), Pedersen, A. J. (Intern), Hansen, J. (Intern), Frandsen, F. (Intern), Livbjerg, H. (Intern), Riber, C. (Intern), Astrup, T. (Intern)
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Scopus rating (2012): SJR 0.47 SNIP 0.98 CiteScore 1.2
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EMMA - the electric and magnetic monitor of the aurora on Astrid-2

The Astrid-2 mission has dual primary objectives. First, it is an orbiting instrument platform for studying auroral electrodynamics. Second, it is a technology demonstration of the feasibility of using micro-satellites for innovative space plasma physics research. The EMMA instrument, which we discuss in the present paper, is designed to provide simultaneous sampling of two electric and three magnetic field components up to about 1 kHz. The spin plane components of the electric field are measured by two pairs of opposing probes extended by wire booms with a separation distance of 6.7 m. The probes have titanium nitride (TiN) surfaces, which has proved to be a material with excellent properties for providing good electrical contact between probe and plasma. The wire booms are of a new design in which the booms in the stowed position are wound around the exterior of the spacecraft body. The boom system was flown for the first time on this mission and worked flawlessly. The magnetic field is measured by a tri-axial fluxgate sensor located at the tip of a rigid, hinged boom extended along the spacecraft spin axis and facing away from the Sun. The new advanced-design fluxgate magnetometer uses digital signal processors for detection and feedback, thereby reducing the analogue circuitry to a minimum. The instrument characteristics as well as a brief review of the science accomplished and planned are presented.

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