Special invitation to clients and partners

MODELLING

SIMULATION

OPTIMIZATION

QUALITY

SEMINAR ON MODELING, SIMULATION AND OPTIMIZATION (MSO) IN AUTOMOTIVE AND VEHICLE INDUSTRY

DATE: 14 DECEMBER 2016
TIME: 10:00-16:15

Fraunhofer-Chalmers Centre *(FCC) is offering contract research, services, algorithms and software based on advanced mathematics within Modeling, Simulation and Optimization (MSO). MSO has proven to provide a significant leading edge in industrial innovation of products and production systems.*

We are now offering FCC clients and partners a seminar where we have invited our partner Fraunhofer ITWM to highlight technologies and examples from German Vehicle industry where MSO is supporting virtual product realization. The focus will be on already industrially implemented technologies where the capabilities and direct benefits are clear.

The seminar is free of charge and will be held at Chalmers Science Park, room Poseidon, Sven Hultins Gata 9, Gothenburg.

Welcome and please find registration information at the back of the folder,

Director Johan S Carlson

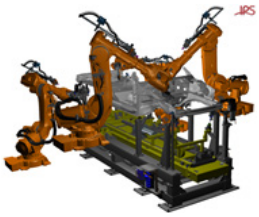
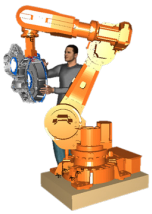
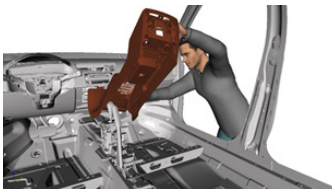
Fraunhofer CHALMERS Research Centre Industrial Mathematics

Fraunhofer ITWM

10.00-10.30

Introduction

In this talk, we will show how advanced mathematics and algorithms can be used to cut costs, improve quality and save time in product and production development as well as in running production. The focus will be on modelling, simulation, optimization and visualization of geometries and motions in manual and robotized assembly processes, joining processes and inspection processes. Geometry and motion planning algorithms can also contribute to and benefit from trends in digitalization and industry 4.0. Emerging applications are e.g. self-programming assembly lines, additive manufacturing, human robot cooperation, 3D scanning and point clouds.

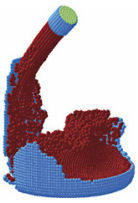
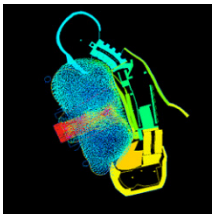




Dr Johan S. Carlson *is the Director of the Fraunhofer-Chalmers Research Centre for Industrial Mathematics, FCC, and is heading the department of Geometry and Motion Planning. He is one of the inventors and owners of the commercial software tool Industrial Path Solutions (IPS) used daily for virtual prototyping by engineers in Sweden, Europe, Asia and the US. He has published about 100 scientific articles in international conferences and journals.*

10.30-11.00

Finite Pointset Method (FPM) for Simulations in Car Industry

The Finite Pointset Method has been developed at Fraunhofer ITWM since 1996. It represents a purely meshfree numerical approach for applications in fluid flow and continuum mechanics. FPM does not require a mesh, thus being able to overcome the performance limits of the existing CFD methods (Finite Element Method FEM, Finite Differences Method FDM, Finite Volume Method FVM) with respect to grid generation and adaptation. The method is therefore superior to the classical methods in the case of those applications where the geometry of the flow field is rapidly changing with respect to time or where free surfaces and/or multiphase flows must be handled. Industrial applications of FPM in the car industry currently include numerical simulations of tank filling and tank sloshing, water crossing and aquaplaning, foaming processes, freezing processes and the interaction of vehicles with various ground materials (sand, gravel, snow) in appropriate crash scenarios.

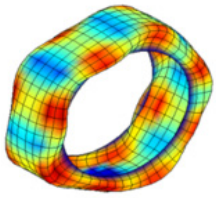



Dr. Almut Eisenträger *spent several years at the University of Oxford, where her research covered modeling and simulation of brain tissue as well as magnetic separation. As a member of the department of Transport Processes at Fraunhofer ITWM, she now works on further developments of the concepts and software tools within the framework of the Finite Pointset Method.*

11.15-11.45

Transient Structural Tire Simulation for Complex Vehicle Simulation Scenarios

CDTire/3D is a structural MBD tire model with dedicated descriptions of the main constructional elements (carcass, cap ply and belt layers), sidewall and tread pattern. The model has been extended in recent years to reproduce belt/sidewall and sidewall/rim contact and include thermodynamics. The authors will show how this tire model can be used in MBS-driven full-vehicle scenarios to simulate applications in different development areas that could not be covered before. These applications vary from the simulation of a sudden inflation pressure loss and its effect on vehicle stability, up to advanced handling applications

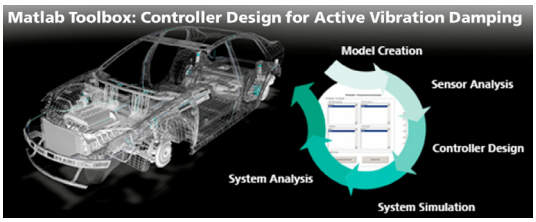



Dr. Klaus Dreßler *is since 2003 leading the department 'Dynamics and Durability' at Fraunhofer ITWM. He is also managing the Fraunhofer innovation cluster on 'vehicle-environment-human-interaction' where companies like Daimler, John Deere, Volvo and Liebherr cooperate with Fraunhofer on usage variability and virtual product development.*

11.45-12.15

Matlab Toolbox: Controller Design for Active Vibration Damping

Volkswagen AG and Fraunhofer ITWM initiated a project together aimed to increase comfort in cars by minimizing vibrations coming from the drivetrain and motor. The most important step in an active vibration damping system is the controller design. While other software tools are used for structure component modelling at Volkswagen AG, Matlab is used for the controller design. This is why a completely new Matlab Toolbox was developed: Controller Design for Active Vibration Damping. The toolbox automates time consuming steps for developers in the controller design phase.



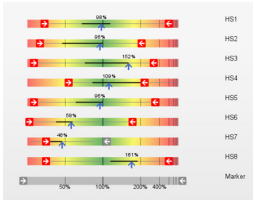
Dr. rer. nat Andreas Wirsen *is head of the department System Analysis, Prognosis and Control at Fraunhofer ITWM. Within the department he is responsible for model based control concepts covering methods from H2 to robust H∞-controller design up to model predictive control concepts.*

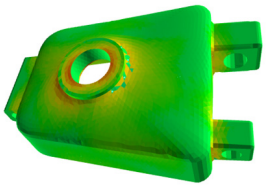
13.30-14.00

Multicriteria Optimization

In engineering processes, optimization is a crucial step to balance cost and quality measures. Common methods as extensive parameter studies or generic optimization based on the described weak coupling with simulation is often not ending in best possible outcomes. The department Optimization at Fraunhofer ITWM integrates simulation with optimization routines, providing an easy understandable process that allow decision makers either to interact with design parameters or key performance indicators in the same user interface.

Fraunhofer ITWM has a successful background in modelling of decision processes in various branches and has realized decision support software components for multicriteria processes and product design for companies like Siemens, Varian Medical Systems, BASF, Procter & Gamble, John Deere, Volvo, Accenture and others. Some general benefits of Multicriteria Optimizaton have been: Cost Savings in optimization processes, better quality figures and standardized modules allowing for rapid prototyping.





Dr. Volker Maag *studied mathematics at the University of Konstanz, at the York University in Toronto, and at the University of Kaiserslautern, where he did his PhD. He is a member of the department Optimization of the ITWM since 2004 and worked on tools for optimization and decision making support in the domains simplified test rigs, hybrid energy systems for buildings, gemstone cutting, chemical process engineering, injection molding and intensity modulated radiotherapy.*

14.00-14.30

Industrial Image Processing for the Automotive Industry

For many automotive products, the quality of a product depends on the quality of its surface. Due to the variety of possible surfaces it is difficult to find a fit-all image processing solution. This is why Fraunhofer ITWM has developed the modular system MASC - Modular Algorithms for Surface Inspection. The system offers a basis for almost every individual task concerning surface inspection. Some companies that have utilized the MASC system are Audi AG, MTU Aero Engines, Continental and Hübert Stuken. General benefits of the system have been: overall higher quality of the delivered products, cost reduction for quality control, fewer customer complaints and a stable, high product quality.

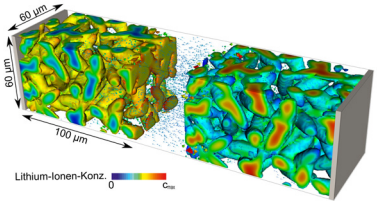
Dipl. Inf Markus Rauhut *is head of Department Image Processing at Fraunhofer ITWM. An extract of his work during his time at the department includes: developed concepts and designs for surface inspection systems in production lines, Shape-from-Shading methods for surface inspection and Probability of Detection (POD) analysis for optical image processing.*

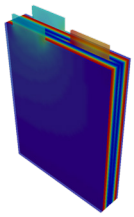
15.00-15.30

Physical simulations for battery design

The demand for hybrid and all-electric vehicles has been rising strongly in recent years. The demand on the electrochemical energy storage systems for these applications is very high with respect to energy and power density as well as life time and safety. While Lithium-Ion batteries are state-of-the-art there is the strong need to improve it in various aspects starting from production processes, cell composition and layout, pack design up to the battery management system. However, CAE-based approaches in this field are not as developed as in many other areas of the automotive development process due to the lack of predictive simulation tools that take are not only based on the physical processes occurring in batteries but also take three-dimensional geometric aspects into account.

In this contribution we will present the “Battery and Electrochemistry Simulation Tool” (BEST) as software for physics-based simulation of lithium-ion batteries. Application areas include computer-aided cell design, design of thermo- and electrical battery management as well as aging and degradation effects (eg by self-generated or external thermal or mechanical loads). BEST has been used in several industrial and public projects with participation of partners from Adam Opel AG, Volkswagen AG, Daimler AG and others.





BEST

Dr. Jochen Zausch *holds a doctoral degree in physics from the University of Mainz and works for the Fraunhofer ITWM since 2009 in the department for flow and material simulation. From the beginning he was involved in the battery activities, is in charge of the battery related projects and is responsible for the development of BEST. He is leading the battery simulation activities at Fraunhofer ITWM as well as in the Fraunhofer battery alliance.*

15.30-16.00

High Performance Data Analytics

At the Competence Center for HPC at the Fraunhofer ITWM we started our engagement in the big data world in 2006 inspired by a book from John Batelle about Google called “The Search”. Since then we have developed a new parallel file system, a new parallel programming approach and a software development and execution environment that enable us to quickly develop big data type applications. We have applied this technology in seismic data processing and interpretation, the renewable energy market and to accelerate deep learning.

In my talk I will give a quick overview about the toolchain, present some applications from the oil&gas market and will finally focus on today’s machine learning challenges and the transition to high performance data analytics. I will conclude with a view on performance topics related with Deep learning that include hardware consideration and algorithmic options and discuss our latest developments concerning the Caffe framework.

Dr. Franz-Josef Pfreundt *is head of department Competence Center High Performance Computing und Visualisierung at Fraunhofer ITWM. He is steering board member of European Technology Platform for High Performance Computing (ETP4HPC) and system architect for high performance data analytics (HPDA) solutions in research and industry.*
He has founded two Spin Offs that provide software solutions for the HPDA market.

How to Register

Register by sending an email with your company name and name/s of attendee/s to conference@fcc.chalmers.se.

We hope to see you on 14 December!

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Agenda

09.15-10.00	Registration + coffee
10.00-10.30	Dr. Johan S. Carlson – *Introduction*
10.30-11.00	Dr. Almut Eisenträger – *Finite Pointset Method (FPM) for Simulations in Car Industry*
11.00-11.15	Break
11.15-11.45	Dr. Klaus Dreβler – *Transient Structural Tire Simulation for Complex Vehicle Simulation Scenarios*
11.45-12.15	Dr. rer. nat Andreas Wirsen – *Matlab Toolbox: Controller Design for Active Vibration Damping*
12.15-13.30	Lunch
13.30-14.00	Dr. Volker Maag – *Multicriteria Optimization*
14.00-14.30	Dipl. Inf Markus Rauhut – *Industrial Image Processing for the Automotive Industry*
14.30-15.00	Coffee break
15.00-15.30	Dr. Jochen Zausch – *Physical simulations for battery design*
15.30-16.00	Dr. Franz-Josef Pfreundt – *High Performance Data Analytics*
16.00-16.15	Wrap-up
16.15-17.00	Mingle

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