PROGRAM OF THE

10th
INTERNATIONAL
MODELICA
CONFERENCE

March 10-12, 2014
Lund, Sweden
www.modelica.org

EDITORS: HUBERTUS TUMMESCHEIT AND KARL-ERIK ÅRZÉN

The Conference is organized by Modelon in collaboration with the Linnaeus center LCCC at Lund University in cooperation with the Modelica Association.
Program of the 10th International Modelica Conference
Lund, Sweden, March 10–12, 2014

EDITORS:
Dr. Hubertus Tummescheit and Prof. Karl-Erik Årzén

ORGANIZED BY:
Modelica Association  Modelon AB
C/o PELAB, Linköpings Univ.  IDEON Science Park
SE-581 83 Linköping  SE-223 70 Lund
Sweden  Sweden

CONFERENCE LOCATION:
Lund University
Matematikcentrum/Matteannexet
[Center for Mathematical Sciences]
Sölvegatan 20A, SE-223 62 LUND
SWEDEN

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The 10th International Modelica Conference is the main event for our community. Users, library developers, tool vendors and language designers will gather to share their knowledge and learn about the latest scientific and industrial progress related to Modelica and FMI (Functional Mockup Interface).

This 10th milestone conference returns to Lund, where the first event took place in 2000. Since then, Modelica has matured from an idea among a small number of dedicated enthusiasts to a widely accepted standard language for the modeling and simulation of cyber-physical systems. Modelica is now used in many industries including automotive, energy and process, aerospace, and industrial equipment. Modelica has even been tapped for one-of-a-kind systems engineering designs such as the ESS (European Spallation Source) which is currently being built nearby in Lund. Modelica is the language of choice for modeling and simulation of complex system interactions.

The addition of the FMI standard to the project portfolio under the stewardship of the Modelica Association has greatly strengthened Modelica. FMI provides a complementary standard that enables deployment of high quality models to a larger number of engineers working with system design and verification.

CONFERENCE HIGHLIGHTS:
- 2 Keynote speeches
- 114 papers in 5 parallel tracks
- 23 posters
- 6 tutorials
- 5 libraries for the Modelica Library Award
- 6 vendor sessions presenting the latest Modelica and FMI tools
- A fully booked exhibition area featuring 18 exhibitors
- Electronic proceedings including all papers and some associated Modelica libraries and models

The conference also presents new initiatives from the Modelica Association. Since the last conference, there has been a major effort to improve the standards compliance process for the Modelica language, the Modelica Libraries developed by the Modelica association and the FMI standard.

- The latest Modelica Standard Library release (MSL 3.2.1) has been enhanced and modified to be fully compliant with the Modelica Language Standards version 3.2 rev2, and is now solely based on open source code under the Modelica License version 2.0.

- MSL 3.2.1 has also been improved to significantly simplify comparisons of simulations of the same model across multiple Modelica environments. Tools to support such comparisons are now available through the Modelica Association.

- The Modelica language version 3.2rev 2 fixed many ambiguities in the specification.

- A Modelica Compliance Test Library has been carefully designed and implemented to verify that a Modelica tool is compliant to the Modelica specification. It has been tested with many tools, with agreed-upon reference results.

- A set of FMI Cross Check Rules was established in July 2013 and has been used by many vendors to verify tool quality and interoperability. All results are publically presented in a dynamic, online and tabular reference.

These combined efforts have helped to increase the industrial acceptance, commitment to, and use of Modelica and FMI as central standards for analytic model based systems engineering.

Finally, we want to acknowledge the support we received from the program board and program committee. Special thanks to this year’s organizers, the Modelica Association, Modelon AB, and Amelie Rönnård from Anagram. Last but not least, let us thank all authors for their contributions to this conference.

We wish all participants an enjoyable and successful conference.

West Hartford and Lund, February 10th 2014
Hubertus Tummescheit and Karl-Erik Årzén
The Modelica Association gratefully acknowledges the sponsoring of the Welcome Reception by the city of Lund.
Elmqvist’s Ph.D. thesis in 1978 from the Department of Automatic Control, Lund Institute of Technology contains the design of a novel object-oriented and equation based modelling language, Dymola, and algorithms for symbolic model manipulation.

Elmqvist spent one year in 1978–1979 at the Computer Science Department at Stanford University, California. His research continued in 1979-1984 on languages for implementation of control systems (LICS). Elmqvist was in 1984-1990 the principal designer and project manager at a subsidiary to Alfa-Laval called SattControl in Malmö for developing SattLine, a graphical, object-oriented and distributed control system. In 1990-1992, he worked for Alfa-Laval in Toronto.

In 1992, Elmqvist founded Dynasim AB (in 2006 acquired by Dassault Systèmes) and in 1996 he initiated the international effort to design the next generation object-oriented language for physical modelling, Modelica.

Elmqvist is Chief Technology Officer for Systems and the chief architect of the Multi-Engineering Modelling and Simulation software for Modelica used in the Dymola Product Line and 3DEXPERIENCE platform. He is also responsible for Technology within the board of Modelica Association.

Dr. Hilding Elmqvist
CTO Systems, Dassault Systèmes

Dr. Hilding Elmqvist is CTO Systems, Dassault Systèmes and Chief Technology Officer for Systems and the chief architect of the Multi-Engineering Modelling and Simulation software for Modelica used in the Dymola Product Line and 3DEXPERIENCE platform. He has been the principal designer and project manager at a subsidiary to Alfa-Laval called SattControl in Malmö for developing SattLine, a graphical, object-oriented and distributed control system. In 1990-1992, he worked for Alfa-Laval in Toronto.

Elmqvist founded Dynasim AB (in 2006 acquired by Dassault Systèmes) in 1992 and in 1996 he initiated the international effort to design the next generation object-oriented language for physical modelling, Modelica.

Dr. Clas A. Jacobson, Ph.D.
Chief Scientist, United Technologies Systems & Controls Engineering

Dr. Clas A. Jacobson is Chief Scientist for United Technologies Systems & Controls Engineering (UTSCE). In this role he works with the UTC business units to ensure capability in systems engineering and controls is available for product development.

Prior to his role as Chief Scientist for UTSCE he worked as the Chief Scientist, Controls for UTC and before that at the United Technologies Research Center (UTRC) in management and technical positions since 1995. He has held positions at UTRC as Director of the Carrier Program Office responsible for creating and managing projects in a stage gate project planning and execution process and also Director of the Systems Department at UTRC responsible for capability in the areas of systems engineering.

Dr. Jacobson received his Ph.D degree in electrical engineering in 1986 from Rensselaer Polytechnic Institute. He was an Associate Professor at Northeastern University in Boston from 1986–1995.
## GENERAL SCHEDULE OF MONDAY, MARCH 10

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## GENERAL SCHEDULE OF TUESDAY, MARCH 11

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## GENERAL SCHEDULE OF WEDNESDAY, MARCH 12

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SCIENTIFIC PROGRAM – TUESDAY MARCH 11

TIME | ROOMS | SESSIONS
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09:00 | MA1 | Keynote 1, Dr. Hilding Elmqvist
09:25 | MA2 | Opening Session
09:30 | MA3 | General Session of Monday, March 10
09:40 | MA3 | Exhibition Automotive
09:20 | MA4 | Exhibition Aerospace
09:40 | MA4 | Exhibition Building Energy
10:40 | MA5 | Lunch
10:10 | MA4 | Tutorials
10:30 | MA4 | Keynote 1, Dr. Hilding Elmqvist
Chair: Hubertus Tummescheit
11:00 | MA5 | Opening Session, Venue: Aulan, Kårhuset
11:20 | MA5 | Exhibition FMI 1
11:40 | MA5 | Exhibition Building Energy
12:00 | MA5 | Exhibition Electro-Magnetic
12:20 | MA5 | Exhibition Modelica Tools 3
13:30 | MA5 | Exhibition Modelica Tools 2
14:00 | MA5 | Exhibition Modelica Tools 1
14:30 | MA5 | Exhibition Automotive
14:40 | MA5 | Exhibition Modelica Electrical Power
15:00 | MA5 | Exhibition Mechanical Power, Energy
15:30 | MA5 | Exhibition Numerical Aspects
16:00 | MA5 | Exhibition Thermofluid
16:30 | MA5 | Exhibition Industrial Control
17:00 | MA5 | Exhibition Hybrid Systems
17:30 | MA5 | Exhibition General Session of Tuesday, March 11
18:00 | MA5 | Final Assembly
19:00 | MA5 | Conference Dinner
20:00 | MA5 | Coffee Break
21:00 | MA5 | Poster Session, Venue: Matteannexet basement
22:00 | MA5 | Coffee Break

## Scientific Program - Tuesday March 11

**Venue:** Matteannexet

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<tr>
<td>13:20</td>
<td>Implementing stabilized co-simulation of strongly coupled systems using the Functional Mock-up Interface 2.0</td>
<td>Transmission Modeling in Modelica: A consistent approach for several software development platforms</td>
<td>The Modelica House Models Library: Presentation and Evaluation of a Room Model with the ASHRAE Standard 140</td>
<td>Phenomenological Li-ion battery modelling in Dymola</td>
<td>Verification and Design Exploration through MetaTool Integration with OpenModelica</td>
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<td>Antoine Viel</td>
<td>Jochen Köhler, Michael Kuebler and Julian King</td>
<td>Ana Constantin, Rita Streibl and Dirk Müllert</td>
<td>Kotub Uddin and Alessandro Picarelli</td>
<td>Zsolt Lattmann, Adrian Pop, Johan De Kleer, Peter Fritzon, Bill Janssen, Sandeep Neema, Ted Batty, Xenon Koutsovios, Matthew Klink, Daniel Bobrow, Bhaskar Saha and Tolga Kurtoglu</td>
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<tr>
<td>13:40</td>
<td>Context-based polynomial extrapolation and slackened synchronization for fast multi-core simulation using FMI</td>
<td>Vectorized single-track model in Modelica for articulated vehicles with arbitrary number of units and axles</td>
<td>Modelica Library for Building and Low-Voltage Electrical AC and DC Grid Modeling</td>
<td>A Modelica Based Lithium Ion Battery Model</td>
<td>Parallel Model Execution on Many Cores</td>
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<td>Abir Ben Khaled, Laurent Duval, Mongi Ben Gaid and Daniel Simon</td>
<td>Peter Sundström, Bengt Jacobson and Leo Laine</td>
<td>Juan Van Roy, Robbe Salenbien and Johan Driesen</td>
<td>Johannes Gerl, Leonard Janczyk, Imke Krüger and Nils Modrow</td>
<td>Hilding Elmqvist, Sven Erik Mattsson and Hans Olsson</td>
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<td>14:00</td>
<td>Model-Based Integration Platform for FMI Co-Simulation and Heterogeneous Simulations of Cyber-Physical Systems</td>
<td>Multibody Model of a Motorbike with a Flexible Swingarm</td>
<td>Tool coupling for the design and operation of building energy and control systems based on the Functional Mock-up Interface standard</td>
<td>Behavioral Modeling of Power Semiconductors in Modelica</td>
<td>A toolchain for Rapid Control Prototyping using Rexroth controllers and open source software</td>
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<td>Himanshu Neema, Jesse GoH, Zsolt Latmann, Janos Szepesvari, Gabor Karsai, Sandeep Neema, Ted Batty, John Bafle, Hubertus Tammescheit and Chandrasekar Sureshkumar</td>
<td>Gianni Ferretti, Bruno Scaglioni and Andrea Rossi</td>
<td>Thierry Stephane Noudiu and Michael Wetter</td>
<td>Patrick Denz, Thomas Schmitt and Markus Andres</td>
<td>Nils Menager, Niklas Worschel and Lars Mikelsons</td>
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<td>14:20</td>
<td>Adapting Functional Mockup Units for HLA-compliant Distributed Simulation</td>
<td>Modelling and parameter identification of a semi-active vehicle damper</td>
<td>Coupling occupant behaviour with a building energy model – A FMI application</td>
<td>Modular Multi-Rate and Multi-Method Real-Time Simulation</td>
<td>Bernhard Thiele, Martin Otter and Sven Erik Mattsson</td>
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<td>Faruk Yılmaz, Umut Durak, Koray Taylan and Halit Oğuztüzün</td>
<td>Michael Fleps-Dezasse, Jakub Tobolar and Johannes Pitzer</td>
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<td>15:10</td>
<td>Significant Reduction of Validation Efforts for Dynamic Light Functions</td>
<td>Stefan-Alexander Schneider, Johannes Frimberger and Michael Folie</td>
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<td>with FMI for Multi-Domain Integration and Test Platform</td>
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<td>Hardware In The Loop Simulation with Modelica – A Design Tool for</td>
<td>Sidney Balter, Thomas Lichius, Jörg Gissing, Peter Jeck, Lutz Eckstein and Jörg Küfen</td>
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<td>Thermal Management Systems</td>
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<td>Human-Nature Interaction in World Modeling with Modelica</td>
<td>Rodrigo Castro, Peter Fritzson, François Cellier, Safa Motesharrej and Jorge Rivas</td>
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<td>Flexible modeling of electrical power systems – the Modelica Power</td>
<td>Rüdiger Franke and Hansjürg Wesmann</td>
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<td>Integrated Vehicle Thermal Management in Modelica: Overview and</td>
<td>John Batteh, Jesse Gohli and Chandrasekar Sureshkumar</td>
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<td>From Modelica Models to Fault Diagnosis in Air Handling Units</td>
<td>Raymond Sterling, Peter Strauss, Jesús Febres, Umbreen Sabir and Marcus Keane</td>
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<td>1D/2D Cellular Automata Modeling with Modelica</td>
<td>Victorino Sanz, Alfonso Uquía and Alberto Leva</td>
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<td>Implementation of a Multi-Level Power Electronic Inverter Library in</td>
<td>Christopher Hill, Paolo Giangrande, Chris Gerada and Serhiy Bozhko</td>
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<td>Modeling Parameter Sensitivities via Equation-based Algorithmic</td>
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<td>Differentiation Techniques: The ADMS.L.Electrical.Analog Library</td>
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<td>Virtual Integration for hybrid powertrain development, using FMI and</td>
<td>Lionel Belmon</td>
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<td>Simulation for verification and validation of functional safety</td>
<td>Lars Mikeløns and Zhou Su</td>
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<td>Physiolibrary – Modelica library for Physiology</td>
<td>Marek Mateják, Tomáš Kultánek, Jan Šilar, Pavol Privitzer, Filip Ježek and Jiří Kohřánek</td>
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<td>Mixed phasor and time domain modeling of AC networks with</td>
<td>Hakan Paridjar and Alberto Leva</td>
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<td>Modelica Based Parser Generator with Good Error Handling</td>
<td>Arunkumar Palanisamy, Adrian Pop, Martin Sjölund and Peter Fritzson</td>
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**Venue:** Matteannexet
Keynote 2. Chair: Hubertus Tummescheit  
Modelica: Systems Engineering, Technology Readiness & Industrial Opportunities Dr. Claus A. Jacobson

Venue: Matteannexet

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<td>08:30</td>
<td>Aerospace Applications 1</td>
<td>Industrial Equipment</td>
<td>Control Applications</td>
<td>Thermofluid Systems, Models and Libraries 1</td>
<td>Hybrid Systems</td>
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<td>Chair: Michael Sielemann</td>
<td>Chair: Michael Tiller</td>
<td>Chair: Maria Henningsson</td>
<td>Chair: Wilhelm Tegethoff</td>
<td>Chair: Hans Olsson</td>
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09:30
- Nonlinear inverse models for the control of satellites with flexible structures
  Matthias Reiner and Johann Bals
- Model-Based Energy Recuperation of Multi-Axis Machines
  Tamas Juhasz, Matthias Kennel, Marco Franke and Ulrich Schmucker
- Exploiting Actuator Limits with Feedforward Control based on Inverse Models
  Manuel Gräber
- Interfacing Models for Thermal Separation Processes with Fluid Property Data from External Sources
  Kai Weilner, Carsten Trapp, Gerhard Schmitz and Francesco Casella
- An Operational Semantics for Hybrid Systems Involving Behavioral Abstraction
  Simon Bliudze and Sébastien Furic

09:50
- Modelica Stage Separation Dynamics Modeling for End-to-End Launch Vehicle Trajectory Simulations
  Paul Acquatella and Matthias Reiner
- A Generalized Power-Based Modelica Library with Application to an Industrial Hydraulic Plant
  Ilja Alkov, Robin Diekmann and Dirk Weidemann
- An FMI-based Framework for State and Parameter Estimation
  Marco Bonvini, Michael Wetter and Michael D. Sohn
- Development of a Real-Time Fuel Processor Model for HIL Simulation
  Karin Frijd, Karin Axelson, Ivar Torstensson, Erik Åberg, Erik Osvaldsmon, Gregor Dolanc, Bostjan Pregelj, Jonas Eborn and Jens Pålsson
- An example of beneficial use of variable-structure modeling to enhance an existing rocket model
  Alexandra Mehlthau, Daniel Gomez Esperon, Jüri Bergmann and Marcel Merkle

10:10
- A Modelica Library for Scalable Modelling of Aircraft Environmental Control Systems
  Philip Jordan and Gerhard Schmitz
- Physical Design of Hydraulic Valves in Modelica
  Chandrasekar Sureshkumar and Hubertus Tummescheit
- Grey-box Building Models for Model Order Reduction and Control
  Roel De Coninck, Fredrik Magnusson, Johan Åkesson and Lieve Helsen
- ThermoCycle: A Modelica library for the simulation of thermodynamic systems
  Sylvain Quoilin, Adriano Desideri, Jorrit Wronski, Ian Bell and Vincent Lemort
- Efficient Monte Carlo simulation of stochastic hybrid systems
  Marc Bouissou, Hilding Elmquist, Martin Otter and Albert Benveniste
### SCIENTIFIC PROGRAM – WEDNESDAY MARCH 12

**Venue: Matteannetet**

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<td><strong>Aerospace Applications 2</strong>&lt;br&gt;Chair: Chad Schmitke</td>
<td><strong>Power, Energy &amp; Process Applications 1</strong>&lt;br&gt;Chair: Leo Gall</td>
<td><strong>Numerical Aspects of Modelica Tools</strong>&lt;br&gt;Chair: Bernhard Bachmann</td>
<td><strong>Thermo-fluid Systems, Models and Libraries 2</strong>&lt;br&gt;Chair: John Batteh</td>
<td><strong>Modelica Tools 3</strong>&lt;br&gt;Chair: Dan Henriksson</td>
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#### TIME

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<tr>
<td>Multi-Level Library of Electrical Machines for Aerospace Applications&lt;br&gt;Paolo Giangrande, Christopher Hill, Chris Gerada and Serhey Bozhko</td>
<td>Industrial application of optimization with Modelica and Optima using intelligent Python scripting&lt;br&gt;Karin Dietl, Stephanie Gallardo Yances, Anna Johnsson, Johan Åkesson, Kilian Link and Stéphane Velut</td>
<td>Restoring algorithms for simulation problems with discontinuities&lt;br&gt;Fatemeh Mohammad, Carmen Arévalo and Claus Führer</td>
<td>Advanced Hybrid Model for Borefield Heat Exchanger Performance Evaluation, an Implementation in Modelica&lt;br&gt;Damien Picard and Lieve Helsen&lt;br&gt;Thomas Beutlich, Gerd Kurzbach and Uwe Schnabel</td>
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<td>Modelica for large scale aircraft electrical network V&amp;V&lt;br&gt;Martin R. Kuhn and Yang Ji</td>
<td>Simulation of Smart-Grid Models using Quantization-Based Integration Methods&lt;br&gt;Xenofon Floros, Federico Bergero, Nicola Ceriani, Francesco Casella, Ernesto Kolman and François Cellier</td>
<td>Discontinuities handled with events in Assimulo&lt;br&gt;Emil Fredriksson, Christian Andersson and Johan Åkesson</td>
<td>The DLRVisualization Library – Recent development and applications&lt;br&gt;Matthias Helfer, Tobias Belmann and Florian Schiegel</td>
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<tr>
<td>Implementation of a Modelica Library for Simulation of Electro-mechanical Actuators for Aircraft and Helicopters&lt;br&gt;Franciscus van der Linden, Clemens Schlegel, Markus Christmann, Gergely Regula, Christopher Hill, Paolo Giangrande, Jean-Charles Maré and Imanol Egaña</td>
<td>On the Simulation of Offshore Oil Facilities at the System Level&lt;br&gt;Joris Costes, Jean-Michel Ghidaglia, Philippe Mugnerra, Keld Lund Nielsen, Xavier Rou, Jean-Philippe Saut and Nicolas Vayatis</td>
<td>Noise Generation for Continuous System Simulation&lt;br&gt;Andreas Klöckner, Franciscus van der Linden and Dirk Zimmer</td>
<td>Adsorption energy systems library – Modeling adsorption based chillers, heat pumps, thermal storages and descant systems&lt;br&gt;Uwe Bau, Franz Lanzarath, Manuel Gräber, Stefan Graf, Heike Schreiber, Niklas Thielem and André Bardow&lt;br&gt;Automated Modelica Package Generation of Parameterized Multibody Systems in CATIA&lt;br&gt;Daniel Baumgartner and Andreas Pfeiffer</td>
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### Program of the Scientific Session - Wednesday March 12

**Venue: Matteannexet Basement**

**Poster Session, See list of posters**

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<tr>
<td>13:20</td>
<td><strong>Mechanical Systems</strong></td>
<td><strong>Power, Energy &amp; Process Applications 2</strong></td>
<td><strong>Optimization Applications and Methods</strong></td>
<td><strong>Thermal Power Processes</strong></td>
<td><strong>Web-related Modelica Tools</strong></td>
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<td></td>
<td>Chair: Johannes Gerl</td>
<td>Chair: Michael Sasena</td>
<td>Chair: Stéphane Velut</td>
<td>Chair: Rüdiger Franke</td>
<td>Chair: Peter Fritzson</td>
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<tr>
<td>14:00</td>
<td>Modelling elastomer buffers with DyMoRail</td>
<td>Short-term production planning for district heating networks with JModelica.org</td>
<td>Modified Multiple Shooting Combined with Collocation Method in JModelica.org with Symbolic Calculations</td>
<td>Modelling a Lignite Power Plant in Modelica to Evaluate the Effects of Dynamic Operation and Offering Grid Services</td>
<td>Vehicle Thermal Management – A Case Study in Web-Based Engineering Analysis</td>
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<td>Elisabeth Dumont and Werner Maurer</td>
<td>Stéphane Velut, Per Olaf Larsson, Linn Saarinen, Katarina Boman and Johan Windahl</td>
<td>Eugeny Lazurkin, Aboba Gelato, Siegbert Hopfgarten and Pu Li</td>
<td>Moritz Huebel, Sebastian Meinke and André Berndt</td>
<td>Michael Tiller</td>
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<tr>
<td>14:20</td>
<td>A Modelica Contact Library for Idealized Simulation of Independently Defined Contact Surfaces</td>
<td>Modelling the system dynamics of islanding asynchronous generators</td>
<td>DOML - a Compiler Environment for Dynamic Optimization Supporting Multiple Solvers</td>
<td>Use of External Fluid Property Code in Modelica for Modelling of a Pre-combustion CO2 Capture Process Involving Multi-Component, Two-Phase Fluids</td>
<td>recon – Web and network friendly simulation data formats</td>
</tr>
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<td></td>
<td>Felix Oestersötebier, Peng Wang and Ansgar Trächter</td>
<td>Dietmar Winkler and Håkon Molland Edwardsson</td>
<td>Tomasz Tamaweski and Radoslaw Pytlak</td>
<td>Carsten Trapp, Francesco Casella, Teus van der Stelt and Piero Colonna</td>
<td>Michael Tiller and Peter Harman</td>
</tr>
<tr>
<td>14:40</td>
<td>The OneWind Modelica Library for Wind Turbine Simulation with Flexible Structure - Modal Reduction Method in Modelica</td>
<td>Hybrid Energy System Modeling in Modelica</td>
<td>Efficient Implementation of Collocation Methods for Optimization using OpenModelica and ADOL-C</td>
<td>Dynamic modelling of a parabolic trough solar power plant</td>
<td>IDOS – (also) a Web Based Tool for Calibrating Modelica Models</td>
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<td>Philipp Thomas, Xin Gu, Roland Samlaus, Claudio Hillmann and Urs Wikhärt</td>
<td>William Binder, Christiana Paredis and Humberto Garcia</td>
<td>Vitalij Ruge, Willi Braun, Bernhard Bochmann, Andrea Withier and Kshitij Kulcheshtha</td>
<td>Robert Österholm and Jens Pålsson</td>
<td>Radoslaw Pytlak and Tomasz Tamawaski</td>
</tr>
<tr>
<td>15:00</td>
<td>Simulating Collisions within the Modelica MultiBody Library</td>
<td>Dynamic Modeling of Small Modular Nuclear Reactors using MoDSim</td>
<td>Symbolic Transformations of Dynamic Optimization Problems</td>
<td>Testing Power Plant Control Systems in Modelica</td>
<td>Client-side Modelica powered by Python or Java Script</td>
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<tr>
<td></td>
<td>Andreas Hofmann, Lars Mikelsons, Ines Gubisch and Christian Schubert</td>
<td>Richard Hale, Sact Celiner, David Fugate, Lou Qualls, John Batteh and Michael Tiller</td>
<td>Fredrik Magnusson, Karl Berntorp, Björn Olofsson and Johan Åkesson</td>
<td>Kilian Link, Leo Gall, Julien Bonfay and Matthias Buggert</td>
<td>Rüdiger Franke</td>
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<tr>
<td>15:50</td>
<td><strong>Venue: Aulan, Kårhuset</strong></td>
<td><strong>Library Awards</strong></td>
<td><strong>Final Assembly</strong></td>
<td><strong>Final Assembly</strong></td>
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Efficient numerical integration of dynamical systems based on structural-algebraic regularization avoiding state selection

Lena Scholz and Andreas Steinbrecher

Proposal for standardization of Heat Transfer Modelling in NewThermal Library

Susana López Pérez and Itzal Bel Hoyo Arce

Extending JGrafchart with Support for FMI for Co-Simulation

Alfred Theorin and Charlotta Johnsson

Development of Custom Workflows for Simulation and Analysis of Functional Mock-up Units

Chandrasekar Sureshkumar and Jesse Gohl

Statecharts as a Means to Control Plant Models in LMS Imagine.Lab AMESim

Sébastien Furic, Loïc Wagner and Vincent Berthoux

Dynamic modelling of a Condenser with the ThermoSysPro Library

Baligh El Hefni and Daniel Bouskela

Systems Physics Library

Werner Maurer and Elisabeth Dumont

Wavelet Library for Modelica

Jianbo Gao, Yang Ji, Johann Bals and Ralph Kennel

Model-based Verification and Optimization of Batteries for Mobile Power Applications

Marco Franke, Tamás Juhasz and Ulrich Schmucker

A Modelica Power System Component Library for Model Validation and Parameter Identification

Luigi Vanfretti, Tetiana Bogodorova and Maxime Baudette

Modelica Model for the youBot Manipulator

Rhma Dwiputra, Alexey Zakharov, Rouziatam Chakirov and Erwin Prassler

Equation based parallelization of Modelica models

Marcus Walther, Volker Waurich, Christian Schubert and Ines Gubsch

Equation based parallelization of Modelica models

Marcus Walther, Volker Waurich, Christian Schubert and Ines Gubsch

Simulation of 2-dimensional flows in Modelica with the Casacaded Digital Lattice Boltzmann Method

Thomas Baume and Helmut Kühnelt

A Medium Model for the Refrigerant Propane for Fast and Accurate Dynamic Simulations

Roozbeh Sangi, Pooyan Jahangiri, Freerk Klasing, Rita Streblow and Dirk Müller

Consistent Simulation Environment with FMI based Tool Chain

Edo Drenth, Mikael Törnman, Krister Johansson, Bengt-Arne Andersson, Daniel Andersson, Ivar Torstensson and Johan Åkesson

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Sébastien Furic, Loïc Wagner and Vincent Berthoux
Simulation and Optimization with JModelica.org and CasADi

Modelon AB, Johan Åkesson (contact) and the JModelica.org team, Lund Center for Control of Complex Engineering Systems (LCCC) (Fredrik Magnusson) and Joel Andersson, developer of CasADi.

Optimization of non-linear dynamic systems is gaining increased industrial adoption. Key applications include trajectory optimization, Model Predictive Control (MPC), model calibration, state estimation, and design/sizing problems. This tutorial is based on a novel interactive tool-chain which combines the expressiveness and user-friendliness of Modelica and the optimization extension Optimica, with the speed, flexibility and robustness of a modern computational framework dedicated to optimization. Several hands on exercises are offered to demonstrate the capabilities of the new tool-chain, including parameter estimation, trajectory optimization and MPC. Two common methods, collocation and multiple shooting, will be used to solve dynamic optimization problems. In addition, simulation of Modelica models using Python scripting will be demonstrated. Pitfalls and challenges encountered in dynamic optimization of industrial processes are highlighted. The tutorial is based on the open source software JModelica.org, PyFMI/Assimulo and CasADi.

Introduction to Modeling, Simulation, Debugging, and Optimization with Modelica using OpenModelica

Peter Fritzson, Lena Buffoni, Martin Sjölund, Linköping University, Sweden and Bernhard Bachmann, Fachhochschule Bielefeld, Germany

Object-Oriented modeling is a fast-growing area of modeling and simulation that provides a structured, computer-supported way of doing mathematical and equation-based modeling. Modelica is today the most promising modeling and simulation language in that it effectively unifies and generalizes previous object-oriented modeling languages and provides a sound basis for the basic concepts. The Modelica modeling language is bringing about a revolution in this area, based on its ease of use, visual design of models with combination of lego-like predefined model building blocks, its ability to define model libraries with reusable components, its support for modeling and simulation of complex applications involving parts from several application domains, and many more useful facilities.

The tutorial presents an object-oriented component-based approach to computer supported mathematical modeling and simulation through the powerful Modelica language and its associated technology. Modelica can be viewed as an almost universal approach to high level computational modeling and simulation.

The tutorial gives an introduction to the Modelica language to people who are familiar with basic programming concepts. It gives a basic introduction to the concepts of modeling and simulation, as well as the basics of object-oriented component-based modeling for the novice, and an overview of modeling and simulation in a number of application areas. The OpenModelica environment with its graphical user interface and scripting will be used for hands-on exercises.

Moreover, in parallel, for those who already know Modelica, a session on debugging of equation-based models will be given, as well as a short introduction to dynamic optimization (collocation/multiple shooting) with OpenModelica.

Modeling and Simulation of Electrical Drives

Anton Haumer, Haumer Technical Consulting, and Christian Kral, TGM, Austria

The tutorial starts with an introduction to electric machines. This includes induction machines and permanent magnet synchronous machines. Simple applications of starting and operating the machines will be presented using the Machines packages of the Modelica Standard Library: Electrical.Machines and Magnetic.FundamentalWave.

The new developments will be discussed: extension to multiphase machines with phase numbers greater than 3, and the quasi static implementation based on time domain phasors for highest performance of long term simulations. For operating electric machines at variable speed usually closed loop drives are used. The basic principle of a closed loop drive system will be explained. For the examples presented in this tutorial a preview version of the newly developed EDrives library will be utilized. An overview of
the structure of the basic components (machine, power electronics, sensors, control) will be given. An introduction to space phasors used in field oriented control is given, followed by an outline of the basics of controlling permanent magnet synchronous machines.

The torque controlled drive models of a permanent magnet synchronous machine are presented. For these drive types the differences between different combinations of inverter and machine models will be compared:

- quasi static inverter + quasi static machine
- averaging inverter + transient machine
- switching inverter + transient machine

After these examples the usage of a speed controller is shown. These examples will demonstrate the use of predefined records for convenient parameterization of both the machine and the control, based on machine parameters as used in the Modelica Standard Library.

### Advanced Analysis of Modelica Models using MapleSim and Maple

**Orang Vahid and Stefan Vorkoetter, Maplesoft, Canada**

Since its inception, Modelica has held the promise of letting engineers go further with physical modeling than just running simulations. With the connection between MapleSim and Maple, users can create and document their own symbolic and numeric analyses of Modelica models in a rich problem-solving environment, in addition to performing traditional simulations.

This tutorial will guide you through the process of extracting equations from a Modelica model into a form amenable to a wide range of analysis. Through hands-on exercises, it will provide you with basic skills to solve, analyse, manipulate, and simulate these equations.

Examples will include: extracting, interrogating, and solving kinematic and dynamic equations from multibody models; creating, manipulating and discretizing PDEs; creating Modelica components from derived equations; setting-up parameter sweeps and optimizations on Modelica models.

### Functional Mockup Interface 2.0 and HiL Applications

**FMI Modelica Association Project, Dassault Systemés, DLR, ITI and Modelon**

FMI 2.0 has many important extensions compared to FMI 1.0. This tutorial will give an overview about these new capabilities and the roadmap for the next year. Automotive OEMs and suppliers present FMI use cases and workflows. Leading HiL providers demonstrate the FMI support of their systems.

The Modelica FMI test package is introduced which contains test cases for connected FMUs. In practical demonstrations it is shown how FMUs with complex interactions such as coupled mechanical systems can be handled using FMI 2.0. The FMI compliance checker will be utilized for testing the conformity with the specification. It will be shown how FMUs generated by different authoring tools are integrated with a HiL platform.

This tutorial is useful for end users, decision makers and for tool vendors about to implement support for FMI 2.0.

### Modeling Renewable Energy Systems with “Green Building”

**Dipl.-Ing. Torsten Schwan, EA Systems Dresden GmbH and Dipl.-Ing. Christian Kehrer, ITI GmbH**

This tutorial outlines the advantages of a dedicated library for modeling environmentally friendly building systems and energy management concepts. Based on the Modelica language, ITI developed the Green Building library for SimulationX in close collaboration with EA Systems and the Dresden University of Technology. This unique library ena-
A commercial exhibition will take place at the venue, Matteannexet, and will be open:

Tuesday 09.30–17.00
Wednesday 09.00–16.00

**VENDOR | EXHIBITION STAND**

- Modelon AB ............................................ 1
- Dassault Systems ................................. 2
- Esterel Technologies/Ansys .................. 3
- Maplesoft Europe GmbH ..................... 4
- Schlegel Simulation GmbH .................. 5
- Bausch-Gall GmbH ............................. 6
- Cydesign Labs .......................... 11
- D2T ............................................. 12
- ETAS GmbH .......................................... 13
- ITI GmbH ...................................... 14
- Concurrent Real-Time ..................... 15
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**VENUE: MATTEANNEXET SÖLVEGATAN 20A**

**Ventor Session**

Program of the Vendor Session on Tuesday, March 11

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<td>Modelon AB</td>
<td>LMS International</td>
<td>ITI GmbH</td>
<td>Maplesoft Inc.</td>
<td>Open Source Modelica Consortium</td>
<td>Dassault Systèmes</td>
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- **Modelica & FMI products**
  - M. Engström, J. Åkesson, C. Wilhelmsson
- **LMS Imagine.Lab AMESim**
  - N. Grond, M. Sasena
- **SimulationX**
  - A. Magdanz
- **MapleSim**
  - P. Fritzson, A. Pol, B. Bachmann
- **OpenModelica**
  - H. Elmqvist, M. Frouin, G. Terpant
- **Dymola & CATIA**
Venue
The meeting will take place at Matteannexet / Matematikcentrum, the Center of Mathematical Sciences located in the centre of Lund, approximately 15 minutes walking distance from Lund Central Station. Opening and closing ceremony is held at Kårhuset (across the street from the conference venue Center of Mathematical Sciences).

Venue Address
Matematikcentrum/Matteannexet
Center for Mathematical Sciences
Address: Sölvegatan 20A, 223 62 LUND, Sweden

Please note that the following information is in alphabetical order

Exhibition
A commercial exhibition will take place at the venue, Matteannexet, and will be open:
Tuesday 09.30-17.00
Wednesday 09.00-16.00

Emergency
Emergency number is 112. This number will connect you to police, ambulance, or fire department. The emergency number does not require an area code and the phone call is free.

Internet / WiFi
At the conference venue you will be able to access wireless internet, you will find information about this at the registration desk.

Meals
Coffee breaks, lunches and Welcome Reception on Monday 10th of March are included. They will be served in the Exhibition area.

Opening Session / Closing Session
Opening and Closing Session will take place at Kårhuset (across the street from the venue Matteannexet).
Address: Sölvegatan 22a –22e.

Parking
Nearby streets offer available parking spaces. A parking lot is located nearby the building.

Poster sessions
Wednesday 13.00 –14.00 there will be poster sessions held downstairs from the Exhibition and Session hall entrances.

Prices
Prices in Sweden already contain value-added tax (VAT). Additional tips in the amount of 5 –10% of the bill are usual in restaurants if you are satisfied with the food

Registration desk
The registration desk at Matteannexet will be open
Monday 12.00–20.00
Tuesday 08.00–18.00
Wednesday 08.00–16.00

Please contact us (Anagram Live AB) at the registration desk if you have any questions or requests and we will try to help you.

Travel/Transportation Information
Once you have arrived in Lund public transportation or walking is recommended within the city. Buses run regularly and will take you around the city. Please note that tickets can NOT be bought on the green buses, only on the yellow buses. The ticket has to be bought in advance at Skåne- trafiken's customer centre (located at Malmö C and Lund C). For more information on public transport and ticket options see www.skanetrafiken.se

Bus transportation within Lund
From Clemenstorget (the square opposite Lund Central station) to Matteannexet. Green buses (city buses) and yellow buses (regional buses). On the yellow buses you are able to pay with credit-card on the bus or buy ticket at the train station.

Green buses:
Bus number 1, towards “Östra Torn”
and get off at “Tunavägen-LTH”.
Bus number 6, towards “Linero Centrum”,
get off at “Kårhuset”.
Bus number 21, towards “Brunnshög”,
get off at “Kårhuset”.

Yellow buses:
Bus number 160, 166, 169
From Lund Clemenstorget – Lund LTH
Get off at Lund LTH.

Taxi
At Lund central station, taxi area is located right outside. To call a taxi from another place, phone +46–(0)46-330330
330 Taxi Skåne or +46–(0)46-121212 Taxi Lund

Tutorials
All tutorial sessions are held at Matteannexet Monday 10 March 14.00–17.45. Coffee break is included.

Voltage
The voltage in Sweden is 220 V, 50 Hz. Round “European” two-pin plugs and sockets are used.

Water
The tap water in Lund is safe to drink and has a good taste.
Welcome Reception March 10th 18.00–20.00 at Matteannexet (Center for Mathematical Sciences)
The Welcome Reception will take place at Matteannexet. Address: Sölvegatan 20A. The reception will include refreshments and canapés. Please note that no dinner is served.

Conference Dinner March 11th 19.00 at AF Borgen (including bus shuttle)
The Conference Dinner will take place in “Stora Salen” at AF Borgen in the very City Centre of Lund. Address: Sandgatan 2. You will enjoy a nice three course dinner with wine followed by entertainment.

Bus shuttle to the Conference Dinner from 18.15.
Shuttle buses will take you from Matteannexet to the Conference Dinner at AF Borgen. The shuttle starts at 18.15.
For delegates that are booked on the recommended hotels (see below) we also offer bus shuttle back from the Conference Dinner at 23.15, leaving from Sandgatan 2, just outside AF Borgen.

1. Elite Hotel Ideon
2. Hotel Finn
3. Park inn by Radisson
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<td><strong>BAUSCH-GALL GmbH</strong></td>
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<td><strong>DRIVEN BY YOUR VISION.</strong></td>
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<td><strong>ESTEREL Technologies</strong></td>
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<td><strong>COMPUTATION MEETS KNOWLEDGE</strong></td>
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The Conference is organized by Modelon in collaboration with the Linnaeus center LCCC at Lund University in cooperation with the Modelica Association.