

PROCEEDINGS OF

**The 9th EUROSIM Congress
on Modelling and Simulation
EUROSIM 2016**

**The 57th SIMS Conference
on Simulation and Modelling
SIMS 2016**

Editors: Esko Juuso, Erik Dahlquist, and Kauko Leiviskä

Organized by Scandinavian simulation society (SIMS),
Finnish Society
of Automation (FSA),
Finnish Simulation Forum (FinSim),
University of Oulu
and
Finnish Automation Support Ltd.

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c/o Esko Juuso, Control Engineering, Faculty of Technology

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Preface

The 9th Eurosim Congress on Modelling and Simulation (Eurosim 2016) and the 57th SIMS conference on Simulation and Modelling (SIMS 2016) were held jointly in the City of Oulu, Finland. The Federation of European Simulation Societies (Eurosim) was set up in 1989. The purpose of EUROSIM is to provide a European forum for regional and national simulation societies to promote the advancement of modelling and simulation in industry, research and development. The program committee has organized an exciting and balanced program comprising presentations from distinguished experts in the field, and important and wide-ranging contributions on state-of-the-art research that provide new insights into the latest innovations in the field of modelling and simulation. EUROSIM 2016 was organized by Scandinavian simulation society (SIMS), Finnish Society of Automation (FSA), Finnish Simulation Forum (FinSim), University of Oulu and Finnish Automation Support Ltd. SIMS was founded in 1959. The event was technically co-sponsored by IEEE Finland Section, IEEE Computer Society and International Federation of Automatic Control Technical Committees on

- TC 3.2. Computational Intelligence in Control,
- TC 6.1. Chemical Process Control,
- TC 6.2. Mining, Mineral and Metal Processing,
- TC 6.3. Power and Energy Systems, and
- TC 6.4. Fault Detection, Supervision & Safety of Technical Processes-SAFEPROCESS.

Networking events were organized on three levels: Federation of European Simulation Societies (Eurosim) had Executive Board and Board meetings; Scandinavian simulation society (SIMS) had Board and Annual Meetings and Finnish Simulation Forum (FinSim), founded in 2001, had Board and Annual Meetings.

The overall management was done by the Eurosim Board, consisting of representatives of 17 European Simulation Societies lead by the Eurosim President Dr. Esko Juuso. The NOC was chaired by Prof. Kauko Leiviskä with Co-Chair Dr. Esko Juuso and Vice-Chair Industry Dr. Timo Ahola (FinSim). The IPC Chair Prof. Erik Dahlquist (SIMS), Co-Chair Prof. Bernt Lie (SIMS) and Vice-Chair Industry Dr. Lasse Eriksson were leading the IPC which consisted of 49 scientists. The Publication committee was chaired by Dr. Peter Ylén with C-Chairs Prof. Lars Eriksson and Prof. David Al-Dabass. Industry-based people participated in the congress committees. Eurosim and SIMS Boards were in the IPC. Eurosim members participated actively: 20 Eurosim countries from 14 member societies participated in the congress.

EUROSIM 2016 proved to be very popular and received submissions with authors from more than 40 countries. The conference program committee had a very challenging task of choosing high quality submissions. Each paper was peer reviewed by several independent referees of the program committee and, based on the recommendation of the reviewers, 184 regular papers were accepted for presentation. The papers offer stimulating insights into emerging modelling and simulation techniques and their applications in a wide variety of fields within science, technology, business, management and industry. Contributions are structured by

- Application domains, including Bio- and ecological systems, Building and construction, Economic and social systems, Energy, Industrial processes, Security and military, Transportation and vehicle systems, Water and wastewater, Weather and climate;
- Functionalities, including Control and optimization, Communication and security, Education and training, e-Learning, Fault detection & fault tolerant systems, Human-Machine interaction, Mechatronics and robotics, Planning and scheduling, Sensing, Virtual reality and visualization;
- Methodologies, including Computational intelligence, Conceptual modelling, Complex systems, Data analysis, Discrete event simulation, Distributed parameter systems, Parallel and distributed interactive systems, Simulation tools and platforms.
- Minisymposia integrate these areas in Control education, Wastewater, Applied energy, Solar thermal power plants, Complex dynamic systems, Chemical processes, Big data analysis and Soft computing, Innovative technology and Cooperative automation.

Panel discussions were organised for three topics: Modelling and Simulation in Processes and Cleantech, Future energy systems and Intelligent Systems and IoT in Future Automation. Three technical tours covered energy production, radio technology, printed electronics and mining. Tutorials were arranged on simulation tools and platforms.

The congress was very international: there were 181 participants from 33 countries. There were participants from all the continents, except Africa, but there were co-authors also from Africa. The program included 6 plenaries, 175 regular oral and 7 poster presentations. The focus was in Europe: 1/4 from Finland, 1/5 from other Nordic countries and 1/3 from other European countries. Far East was active: 26 participants, where 18 from Japan. In addition, there were 13 participants from other areas (Middle East, Americas and Australia). In total 22% of the participants were from outside Europe, almost as many as from Finland. The Proceedings includes includes 165 selected and revised papers.

Education for students was covered by the Control Education minisymposium organized The Education Committee of The Finnish Society of Automation and extended with papers from Education and Training, e-Learning track. IEEE Finland Section organized a workshop for early career development in the world of technology for young professionals. High school students visited some sessions.

We would like to express our sincere thanks to the plenary speakers, authors, session chairs, members of the program committee and additional reviewers who made this conference such an outstanding success. Finally, we hope that you will find the proceedings to be a valuable resource in your professional, research, and educational activities whether you are a student, academic, researcher, or a practicing professional.

Esko Juuso, Erik Dahlquist and Kauko Leiviskä

Congress location

The main venue and the exhibition site was the Oulu City Theatre in the City of Oulu, Capital of Northern Scandinavia.

Opening session, 13 September 2016

The Vice Rector for Cooperation affairs, Dr. Matti Sarén, University of Oulu, Finland
President of EUROSIM, Dr. Esko Juuso, University of Oulu, Finland
President of SIMS, Prof. Erik Dahlquist, Mälardalen University, Sweden
Congress Chair, Prof. Kauko Leiviskä, University of Oulu, Finland

Plenary presentations, 13 - 15 September 2016

Thermal Management Simulations within Power Engineering at ABB
Prof. Rebei Bel Fdhila, ABB Corporate Research, Sweden

Modelling and Simulation of the Electric Arc Furnace Processes
Assistant Professor Vito Logar, Laboratory of Modelling, Simulation and Control, Faculty of Electrical Engineering, University of Ljubjana, Slovenia

Part 1: Autonomous Driving and Levels of Automation,
Part 2: Situation Awareness and Early Recognition of Traffic Maneuvers
Dr Galia Weidl, Daimler AG, Germany

Simulating the Composition of the Atmosphere
Adjunct Professor Harri Kokkola, Atmospheric Research Centre of Eastern Finland, Finnish Meteorological Institute, Finland.

Using the Power of Simulation to bring Bottom Line Benefits to the Mining, Minerals and Metals Operations
Roy Calder, Director, Technical Sales, Global Solutions SimSci by Schneider Electric, Warrington, United Kingdom

Online Simulation Platform for Biophotonic Applications
Dr Alexey Popov, Optoelectronics and Measurement Techniques Laboratory, University of Oulu, Oulu, Finland

Congress topics, 13 - 15 September 2016

Application domains (pp. 19-340)

Functionalities (pp. 321-502)

Modelling and simulation methodologies (pp. 505-811)

Minisymposia, 13 - 15 September 2016 (pp. 812-1128)

Best practices and new trends in control education
Organizer: Finnish Society of Automation, Education Committee, Chair: Dr. Kai Zenger, Aalto University, Espoo, Finland

Modelling and control aspects in wastewater treatment processes
Organizer: Dr. Jesus Zambrano, Mälardalen University, Västerås, Sweden

Modelling and simulation in applied energy
Organizer: Prof. Erik Dahlquist, Mälardalen University, Sweden

Modelling and simulation in solar thermal power plants
Organizer: Dr. Luis J. Yebra, CIEMAT, Plataforma Solar de Almería, Spain

Object-Oriented technologies of computer modelling and simulation of complex dynamical systems
Organizer: Russian Federation the National Simulation Society, Chair: Prof. Yuri Senichenkov St. Petersburg Polytechnic University, Russia

Chemical Process Systems Simulation
Organizer: Dr. Esko Juuso, University of Oulu, Finland

Industrial Optimization Based on Big Data Technology and Soft Computing

Organizers: Prof. Yukinori Suzuki, Muroran Institute of Technology, Japan, and Dr. Kai Zenger, Aalto University, Espoo, Finland

Simulation as Enabler for Innovative Technology

Organizer: Prof. Agostino G. Bruzzone, Genoa University, Italy

Cooperative Automation

Organizer: Dr. Esko Juuso, University of Oulu, Finland

Panel discussions, 13 - 15 September 2016

Modelling and Simulation in Cleantech

*Chairs: Bernt Lie, University College of Southeast Norway, Norway
Jesús Zambrano, Mälardalen University, Sweden*

Future Energy Systems

*Chairs: Erik Dahlquist, Mälardalen University, Sweden,
Cristian Nichita, University of Le Havre, France*

Intelligent Systems and IoT in Future Automation

*Chairs: Esko K. Juuso, University of Oulu, Finland,
Lars Eriksson, Linköping University, Sweden*

Workshops and tutorials

Career development in the world of technology and Young Professionals Meetup event

Chair: Rafal Sliz, University of Oulu, IEEE Finland Section

The basis of object-oriented modelling with Rand Model Designer

Prof. Yuri Senichenkov, St. Petersburg Polytechnic University, Russia

Introduction to modeling and simulation with Modelica using OpenModelica

Dr. Adrian Pop, Linköping University, Sweden

Closing session, 15 September 2016

Final Proceedings and Publication of revised papers

President of EUROSIM 2013-2016, Dr. Esko Juuso, University of Oulu, Finland

The Presidency period 2016 – 2019, EUROSIM 2019 Congress & Venue

President of EUROSIM 2016-2019, Prof. Emilio Jiménez Macías, CEA-SMSG, Spain

Technical tours, 16 September 2016

Tour I: Energia

Oulun Energia is the leading energy company in Northern Finland. Two power plants are visited:

- Laanila Eco Power Plant, 50 MW Waste to Energy Plant, uses municipal solid waste as a fuel.
- Toppila CHP Power Plants, 267 MW and 315 MW units, uses peat and wood as a fuel.

Tour II: Radio Technology and Printed Intelligence

- Factory tour at Nokia's Radio Technology Center Site.
- VTT, PrintoCent Pilot Factories, including the new 5G Test Environment and Maxi IoT pilot line

Tour III: Mining Engineering

Oulu Mining School (OMS) integrates scientific disciplines along the value chain from exploration to mining and mineral processing. OMS has a unique continuous and automated concentrator minipilot facility.

Social program

Welcoming reception, The Oulu City Theatre, 12 September 2016.

The City-Reception, Oulu City Hall, 13 September 2016.

Banquet, Hotel Radisson Blu Oulu, 14 September 2016

Selected and revised papers

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