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# Conversations about Challenges in Computing

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Are Magnus Bruaset · Aslak Tveito  
(Editors)

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# Preface

We go to work every day, picking up our projects where we left them the day before. It's a mess, of course: complex models, software densely populated with bugs, dubious input data, and so forth.

Most of our attempts to understand matters fail, but every once in while we see the light and are able to add a small contribution to our common collection of scientific knowledge. Enormous amounts of time, money and energy are invested in these attempts to comprehend the world around us. In this light, we should pause now and then to consider which problems most deserve our attention.

To celebrate the tenth anniversary of Simula Research Laboratory, we invited outstanding scientists from around the world to present their recent achievements and their view on future challenges. The talks were intended to fuel vivid discussion at Simula concerning where our scientific efforts are called for. Given this unique assemblage of scientific leaders in communication technology, software engineering, scientific computing, and computational science, we also invited two celebrated writers to interview them. The results of these conversations are presented in this text, which we hope you will enjoy. In addition you will video clips of all talks from the anniversary conference on the special web site <http://challenges.simula.no>.

If you are curious to learn more about Simula, we encourage you to browse our web site, [www.simula.no](http://www.simula.no), and have a look at the factsheet “This Is Simula” on page 101.

Fornebu, February 2013

Professor Are Magnus Bruaset  
*Director of Research at Simula Research Laboratory*

Professor Aslak Tveito  
*Managing Director of Simula Research Laboratory*

# Challenges in Computing

## December 14–15, 2011

All talks were filmed and are available at [challenges.simula.no](http://challenges.simula.no)

### Conference program, day 1

Welcome and introduction

*Professor Aslak Tveito, Managing Director of Simula Research Laboratory*

Opening and announcement of the winner of the Computational Science and Engineering Prize 2011\*

*Tora Aasland, Norwegian Minister of Research and Education*

High-resolution simulation of mantle flow and plate tectonics

*Professor Carsten Burstedde, University of Bonn*

US Ignite

*Professor Keith Marzullo, University of California San Diego & Division Director at the National Science Foundation*

Engineering Software in the Future Era: The Role of Uncertainty

*Professor Paola Inverardi, University of L'Aquila*

Grand Challenges in Computational Inverse Problems with Illustrations from Geophysics

*Professor Omar Ghattas, University of Texas at Austin*

### Conference program, day 2

The Challenges of Computer-based Prediction

*Professor Martin Shepperd, Brunel University*

Simulating Cardiac Function and Dysfunction

*Professor Natalia Trayanova, Johns Hopkins University*

Requirements for Pervasive Privacy

*Professor Bashar Nuseibeh, The Open University & Lero – the Irish Software Engineering Centre*

Model Reduction, Complexity Reduction

*Professor Alfio Quarteroni, École Polytechnique Fédérale de Lausanne, and Politecnico di Milano*

Challenges in the Evolution of the Internet of Things – Processing Real-World Information in the Cloud

*Dr. Heinrich Stüttgen, Vice President of NEC Laboratories Europe*

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\* The CSE Prize is awarded by Springer-Verlag. The 2011 prize was awarded to Laura Alisic, Carsten Burstedde, and Georg Stadler for their outstanding work on simulating global mantle convection at tectonic plate boundary-resolving scales.

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