

# Preface

The European Conference on Numerical Mathematics and Advanced Applications (ENUMATH) is a series of conferences held every 2 years to provide a forum for discussion on recent aspects of numerical mathematics and scientific and industrial applications. The previous ENUMATH meetings took place in Paris (1995), Heidelberg (1997), Jyväskylä (1999), Ischia (2001), Prague (2003), Santiago de Compostela (2005), Graz (2007), Uppsala (2009), and Leicester (2011).

This book contains a selection of invited and contributed lectures of the ENUMATH 2013 conference organised by the Mathematical Institute of Computational Science and Engineering (MATHICSE), EPFL, and held in Lausanne, Switzerland, August 26–30, 2013. It gives an overview of recent developments in numerical analysis, computational mathematics, and applications by leading experts in the field. The conference attracted around 400 participants from around the world including 11 invited talks by:

- Ruth Elizabeth Baker (University of Oxford, UK), on “Developing multiscale models for exploring biological phenomena”
- Eric Cancès (CERMICS, Ecole des Ponts ParisTech, France), on “Electronic structure calculation”
- Omar Ghattas (ICES, University of Texas at Austin, USA), on “Stochastic Newton MCMC methods for Bayesian inverse problems with application to ice sheet dynamics”
- Ernst Hairer (Université de Genève, Switzerland), on “Long-term analysis of numerical and analytical oscillations”
- Jan Hesthaven (Brown University, USA), on “High-order reduced basis multiscale finite element methods”
- Petr Knobloch (Univerzita Karlova, Czech Republic), on “Finite element methods for convection dominated problems”
- Dmitri Kuzmin (Friedrich Alexander Universität Erlangen-Nürnberg, Germany), on “Vertex-based limiters for continuous and discontinuous Galerkin methods”
- Ilaria Perugia (Università degli studi di Pavia, Italy), on “Trefftz-discontinuous Galerkin methods for time-harmonic wave problems”

- Rolf Stenberg (Aalto University, Finland), on “Mixed finite element methods for elasticity”
- Martin Vetterli (EPFL, Switzerland), public lecture on “Inverse problems regularized by sparsity”
- Barbara Wohlmuth (TU München, Germany), on “Interfaces, corner and point sources”

There were 24 minisymposia and numerous contributed talks covering a broad spectrum of numerical mathematics. This ENUMATH 2013 proceeding will be useful for a wide range of readers giving them a state-of-the-art overview of advanced techniques, algorithms, and results in numerical mathematics and scientific computing. Advances on finite element methods, time integrators, multiscale methods, numerical linear algebra, and discretisation techniques for fluid mechanics and optics are presented. This book contains a selection of 79 papers by the invited speakers and from the minisymposia as well as the contributed sessions. It is organised in 11 parts as follows:

Part I Space Discretisation Methods for PDEs

Part II Time Integration Schemes

Part III A Posteriori Error Estimation and Adaptive Methods

Part IV Numerical Linear Algebra

Part V Multiscale Modeling and Simulation

Part VI Reduced Order Modeling

Part VIII Uncertainty, Stochastic Modeling, and Applications

Part IX Solvers, High Performance Computing, and Software Libraries

Part X Computational Fluid and Structural Mechanics

Part XI Computational Electromagnetics

We would like to thank all the participants for their valuable contributions and scientific discussions during the conference and to the minisymposium organisers for helping to shape the core structure of the meeting. The members of the Scientific Committee have helped us tremendously in reviewing the contributions to this proceedings. This conference would not have been possible without all the work and guidance provided by the Programme Committee: Franco Brezzi, Miloslav Feistauer, Roland Glowinski, Gunilla Kreiss, Yuri Kuznetsov, Jacques Periaux, Alfio Quarteroni, Rolf Rannacher, Endre Süli. We also thank our sponsors for their generous support: the School of Basic Sciences and the Centre Interfacultaire Bernoulli from EPFL, the Center for Advanced Modeling Science (CADMOS), MathWorks and Springer. Last but not least we would like to acknowledge the tireless effort of Virginie Ledouble leading the administration tasks, Corinne Craman who coordinated the edition of this proceedings, all the secretaries of MATHICSE for their tremendous help in organising this conference, and our PhDs and Post-Docs that have helped us in many ways.

We hope that this volume reflects the inspiring talks and lively scientific exchanges that took place at EPFL during the ENUMATH 2013 meeting.

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