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Editors

# Numerical Mathematics and Advanced Applications ENUMATH 2015

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# 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), Leicester (2011), and Lausanne (2013).

This book contains a selection of invited and contributed lectures of the ENUMATH 2015 organized by the Institute of Applied Mathematics, Middle East Technical University, Ankara, Turkey, September 14–18, 2015. It gives an overview of recent developments in numerical analysis, computational mathematics, and applications by leading experts in the field. The conference attracted around 300 participants from around the world including 11 invited talks by:

- Assyr Abdulle (EPF Lausanne, Switzerland), *Reduced Basis Multiscale Methods*
- Rémi Abgrall (Universität Zürich, Switzerland), *Recent Progress on Non-Oscillatory Finite Element Methods for Convection Dominated Problems*
- Burak Aksoylu (TOBB University of Economics and Technology, Ankara, Turkey), *Incorporating Local Boundary Conditions into Nonlocal Theories*
- Mark Ainsworth (Brown University, Providence, USA), *Multigrid at Scale?*
- Willi Freeden (TU Kaiserslautern, Germany), *Principles in Geomathematically Reflected Numerics and Their Application to Inverse Potential Methods in Geothermal Exploration*
- Des Higham (University of Strathclyde, Glasgow, UK), *Models and Algorithms for Dynamic Networks*
- Yvon Maday (Université Pierre et Marie Curie, Paris, France), *Towards a Fully Scalable Balanced Parareal Method: Application to Neutronics*
- Kaisa Miettinen (University of Jyväskylä, Finland), *Examples of Latest Interactive Method Developments in Multiobjective Optimization*
- Mario Ohlberger (Universität Münster, Germany), *Localized Model Reduction for Multiscale Problems*

- Anders Szepessy (KTH, Stockholm, Sweden), *On Global and Local Error with Application to Adaptivity, Inverse Problems and Modeling Error*
- Eugene E. Tyrtysnikov (Russian Academy of Sciences, Moscow, Russia), *Tensor Decompositions and Low-Rank Matrices in Mathematics and Applications*

There were 119 minisymposia presentations in 20 sessions, and 89 contributed talks covering a broad spectrum of numerical mathematics. This ENUMATH 2015 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. This book contains a selection of 61 papers by the invited speakers and from the minisymposia as well as the contributed sessions. It is organized in IX parts as follows:

Part I Space Discretization Methods for PDEs

Part II Finite Element Methods

Part III Discontinuous Galerkin Methods for PDEs

Part IV Numerical Linear Algebra and High Performance Computing

Part V Reduced Order Modeling

Part VI Problems with Singularities

Part VII Computational Fluid Dynamics

Part VIII Computational Methods for Multi-Physics Phenomena

Part IX Miscellaneous Topics

We would like to thank all the participants for their valuable contributions and scientific discussions during the conference and to the minisymposium organizers 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 program committee: Franco Brezzi, Miloslav Feistauer, Roland Glowinski, Gunilla Kreiss, Yuri Kuznetsov, Pekka Neittaanmaki, Jacques Periaux, Alfio Quarteroni, Rolf Rannacher, Endre Süli, and Barbara Wohlmuth. We also thank our sponsors for their generous support: Middle East Technical University, Scientific Human Resources Development Program (ÖYP) of Ministry of Development, Turkish Academy of Sciences, Oxford University Press, and Springer Verlag. We would like to acknowledge the tireless effort of ATA Tours; Murat Uzunca, who coordinated the edition of this Proceedings; all the staff of the Institute of Applied Mathematics for their tremendous help in organizing this conference; and our students who have helped us in many ways.

This volume is dedicated to the 60th anniversary of Middle East Technical University.

Ankara, Turkey  
April 2016

Bülent Karasözen  
Murat Manguoğlu  
Münevver Tezer-Sezgin  
Serdar Göktepe  
Ömür Uğur

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