

Foreword

This volume contains articles resulting from research projects initiated during the CEMRACS 2012 dedicated to *Numerical Methods and Algorithms for High Performance Computing*.

The CEMRACS (Centre d'Eté Mathématique de Recherche Avancée en Calcul Scientifique) is an annual summer research session, for PhD students and young researchers, whose goal is to strengthen interdisciplinary collaborations between applied mathematicians and scientists of other fields, both from academia and industry. It is promoted by the SMAI (French Society of Applied and Industrial Mathematics) and was initiated by F. Coquel and Y. Maday, in 1996.

In 2012, the seventeenth edition of the CEMRACS took place at the CIRM (Centre International de Rencontres Mathématiques, Marseille, France) from July 16th to August 24th, 2012. During the first week nine courses were given by:

- Martin Gander (Université de Genève), “Extrapolation and Krylov Subspace Methods for Solving Linear Equations”
- Jean-Luc Guermond (Texas A&M University), “Massively Parallel Splitting Algorithms for the Incompressible and Slightly Compressible Navier-Stokes Equations”
- Koen Hillewaert (CENAERO), “The discontinuous Galerkin method: discretisation, efficient implementation and application to turbulent flows”
- Gianluca Iaccarino (Stanford University), “Quantification of Uncertainties in High-Fidelity Simulations of Turbulent Reactive Flows”
- Petros Koumoutsakos (ETH Zurich), “Particle Methods - Part I - Unbounded Domains and Multiresolution Part II - boundary conditions and multi-scaling”
- Frédéric Nataf (Université Paris VI), “Two-Level Domain Decomposition Methods”
- Yvan Notay (Université libre de Bruxelles), “Aggregation-based algebraic multigrid: from theory to fast solvers”
- Mario Ricchiuto, “Residual distribution : basics, recent developments, and relations with other techniques”
- Ulrich Rüde (University Erlangen-Nuremberg), “Parallel Multigrid Methods - Simulating Complex flows with the Lattice Boltzmann Method”

The following five weeks were dedicated to research projects sponsored by public and industry funds. Participants worked in teams composed of young researchers assisted by one or more senior researchers. About 110 researchers, from 20 different citizenships, attended this edition, including, physicists, computer scientists and mathematicians. Topics of the 14 projects cover a wide range of topics related to high performance computing.

We are very grateful to our colleagues who gave lectures and have proposed and supervised stimulating research projects. We address our warmest thanks to the CIRM staff for their daily kind assistance during six weeks and Maria Konieczny for her precious help in the organization. Finally, we would like to express our gratitude to all the participants who contributed through their involvement to the success of CEMRACS'12.

The organizing committee:
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