Foreword

The Summer School on multiresolution and adaptive mesh refinement methods was held at Frejus, France, June 10th to 16th, 2010 and organized by the GDR Calcul (see `http://calcul.math.cnrs.fr` for more information on this research group). The school addressed both methods and implementation issues such as the choice of adequate data structures. Multiresolution and Adaptative mesh refinement methods are strongly correlated with implementation issues which involve high difficulties, in particular for the choice of the data structures implementation.

The present proceedings contains the lecture notes for three courses:

- "Block-Structured Adaptive Mesh Refinement - Theory, Implementation and Application", Ralf Deiterding (Oak Ridge National Laboratory, USA)
- "Adaptive Multiresolution Methods", Margarete O. Domingues (Laboratório Associado de Computação e Matemática Aplicada, INPE, São Paulo, Brazil), Sonia M. Gomes (Instituto de Matemática, Universidade Estadual de Campinas, São Paulo, Brazil), Olivier Roussel (Centre de Mathématiques et Leurs Applications, Ecole Normale Supérieure de Cachan, France) and Kai Schneider (CMI, Universite de Provence, Marseille, France)
- "Adaptive Multiresolution Methods : Practical issues on Data Structures, Implementation and Parallelization", Kolja Brix, Sorana Melian, Sigfried Müller, Mathieu Bachmann (Institut für Geometrie und Praktische Mathematik, RWTH Aachen University, Germany).

In addition, we organised two tutorials:

- "Sparse data structure design for wavelet-based methods", Guillaume Latu(CEA, France)
- "Tutorials on Adaptive multiresolution for mesh refinement applied to fluid dynamics and reactive media problems", Christian Tenaud (LIMSI, France) and Max Duarte (EM2C, Ecole Centrale Paris, France)

dedicated to the implementation issues with a practical use of computer codes with equal weight given to methods and implementation issues such as the choice of adequate data structures. The exercices of the training sessions are available online : see `http://calcul.math.cnrs.fr/spip.php?article141`.

A seminar was also given on the application of multiresolution techniques:

- New Resolution Strategy for Multi-scale Reaction Waves using Time Operator Splitting and Space Adaptive Multiresolution: Applications to Human Ischemic Stroke, Max Duarte, Marc Massot, Frédérique Laurent (EM2C, Ecole Centrale Paris, France), Stéphane Descombes (Laboratoire

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J. A. Dieudonné, Université de Nice - Sophia Antipolis, France), Christian Tenaud (LIMSI, France), Thierry Dumont, Violaine Louvet (Institut Camille Jordan, Université Lyon 1, France).

About 30 researchers attend the school, including mathematicians and computer scientists. The organizing committee was composed of Max Duarte (EM2C, ECP, Paris), Thierry Dumont (Institut Camille Jordan, Lyon), Sylvain Faure (Maths,Orsay), Loïc Gouarin (Maths, Orsay), Violaine Louvet (Institut Camille Jordan, Lyon).

The scientific committee was composed of Stéphane Descombes (Dieudonné, Nice), Marc Massot (ECP, Paris), Marie Postel (LJLL, Paris), Kai Schneider (CMI, Marseille), Eric Sonnendrücker (IRMA, Strasbourg), Christian Tenaud (LIMSI, Orsay).

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We are very grateful to our colleagues who gave lectures and made a considerable editorial work whith this proceedings.

We cordially thank Eric Cancès, Editors-in-Chief of ESAIM Proceedings for making possible the publication of this volume.

Last but not least, we would like to express our gratitude to all the participants for their involvements and kindness.

Violaine Louvet and Marc Massot