Foreword

CEMRACS'11 was the sixteenth of the series, devoted to Multiscale Coupling of Complex Models in Scientific Computing. The goal of this event was to bring together scientists from both the academic and industrial communities in order to develop new ideas and innovative methods on these topics, by gathering young researchers in Applied Mathematics, supervised by senior researchers. CEMRACS'11 consisted in four types of events:

- a one week Summer school (July 18th - 22nd);
- a five week Research session (July 25th - August 26th);
- a three days SimTech workshop (August 22nd - 24th);
- a five week Math-Industry brainstorming session (July 25th - August 26th).

During the first week, a classical summer school was proposed. It consisted in several lectures given by leading scientists in the topics of the research projects:

- Emmanuel Frénod (Université de Bretagne Sud): Two-scale convergence;
- Edwige Godlewski (Université Pierre et Marie Curie-Paris 6): Coupling algorithms for hyperbolic systems;
- Francesca Gulminelli (Université de Caen): Phase transition and critical phenomena;
- Siegfried Müller (RWTH Aachen): Multiscale based grid adaptation for finite volume schemes;
- Mario Ohlberger (Universität Münster): A posteriori estimates and adaptation;
- Gabriel Turinici (Université Paris Dauphine): A numerical approach to the Mean Field Games.

The remaining 5 weeks were dedicated to working on the research projects, after a daily morning seminar. Altogether nineteen projects have been conducted covering a wide range of applications. Among them have been compressible multiphase flows, plasma flows and kinetic regimes, suspension dynamics, geophysical and even astrophysical flows. The results of the projects are documented in the 22 peer-reviewed contributions of this book. The editors would like to thank the contributors and the lecturers of the summer school, especially Emmanuel Frénod, who proposed to publish his lecture notes, the first paper hereafter.

During the last week, the Stuttgart Research Centre for Simulation Technology "Simulation Technology" (SimTech) supported a three days workshop about Multiscale models of Multiphase flows.

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