Preface

For several years, the *Groupe de Travail Numérique* has been organized in Orsay (Université Paris 11, Laboratoire de Mathématiques); its aim is to discover new results in the domains of modelling, numerical analysis and scientific computing. In 1999, it was re-organized; the chosen formula was thematic. Each trimester, the weekly talks are selected on a main scientific subject. In addition, small courses are proposed, which consist of 6 to 10 hours lectures. In this volume, a selection of 8 articles from talks given in 2007-2008 is proposed.

The first three articles deal with modelling of original problems and investigating properties of solutions.

- C. Grandmont, A. Soualah, *Solutions fortes des équations de Navier-Stokes avec conditions dissipatives naturelles*, presents the modelling of the air flow in the respiratory tract. The authors investigate global weak solutions for Navier-Stokes equations with natural and non-standard boundary conditions.

- P. Le Gall, C. Prieur, L. Rosier, *Exact controllability and output feedback stabilization of a bimorph mirror*, presents the controllability and the output feedback stabilization for both 1D and 2D models of a bimorph mirror composed of three layers.

- A. Perasso, B. Laroche, *Well-posedness of an epidemiological problem described by an evolution PDE*, presents the well-posedness for a non linear transport equation system that models the spread of prion diseases in a managed flock. Existence and uniqueness of solutions are proved in the case of a Lipschitz perturbation and presence of boundary conditions and an implicit expression of the solution is given.

The second group of five articles deal with the analysis of numerical schemes.

- P. Joly, A. Semin, *Construction and analysis of improved Kirchoff conditions for acoustic wave propagation in a junction of thin slots*, analyzes via the theory of matched asymptotics the propagation of a time harmonic acoustic wave in a junction of two thin slots. Improved Kirchoff conditions for the 1D limit problem are proposed, analyzed and validated numerically.

- P. Loreti, M. Mehrenberger, *Observabilité uniforme de l'équation des ondes 1D*, completes the new Ingham type theorems previously developed by the authors in order to establish the uniform observability of the wave equation in 1D. In a second part, they give an example of Ingham type inequality where the position of the interval is a key point in the determination of the optimal time.

- C.-H. Bruneau, T. Colin, <u>S. Tancogne</u>, *Simulation of the break-up of diphasic jets in a microchannel*, simulates diphasic flows driven by pressure gradient in channels of a few hundred of micrometres square sections are. Tridimensional numerical simulations are presented to understand the Plateau-Rayleigh instability and more generally to study the behaviour of diphasic fluids evolving in square microchannels.

- <u>P. Jaisson</u>, F. de Vuyst, *A novel second order accurate hybrid numerical approach for conservation laws*, proposes a novel one-parameter hybrid scheme for the hyperbolic systems of conservation laws. The parameter allows to have the good properties of the Lax-Wendroff scheme when the solution is smooth and to switch smoothly to the Lax-Friedrichs scheme if necessary in order to respect the Total Variation Diminushing property in all cells.

- M. Gander, <u>M. Petcu</u>, *Analysis of a Krylov subspace enhanced parareal algorithm for linear problems*, presents and analyzes a variant of the parareal algorithm, recently proposed in the PITA framework for systems of second order ordinary differential equations, the parareal algorithm being a numerical method to integrate evolution problems on parallel computers.

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Sylvain Faure, Benjamin Graille,
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