

# Discrete Simulation of Fluid Dynamics

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## Foreword

The lecture series “Discrete Simulation of Fluid Dynamics (DSFD)” began in 1986 in Los Alamos thanks to Gary D. Doolen’s initiative. Since then, this annual conference has allowed researchers to take stock of the progress being made in fluid mechanics simulation using kinetic methods on networks. The many topics covered in this lecture series include lattice Boltzmann schemes, particulate dissipative approaches, particle hydrodynamics, direct Monte Carlo methods, etc.

The Scientific Committee of the International Conference DSFD proposed that Paris welcome its 23th edition in 2014. This choice stemmed from the international reputation of the city of Paris both scientifically and culturally. In addition, the discrete kinetic approach to fluid mechanics was born in the years 1970–1990 between the mechanics lab at the Université Pierre et Marie Curie (Paris 6 University) and the physics lab of the Ecole Normale Supérieure in Paris. The lattice Boltzmann approach also uses theoretical tools inspired by the Boltzmann kinetic framework, which is a theme of excellence of the French school of mathematics.

Given the various physical areas covered by numerical methods exposed during DSFD conferences, one of the objectives of the 2014 edition, which took place at the Ecole Normale Supérieure in Paris from 28 July to 1 August 2014, was to promote a multi-disciplinary approach by hosting conferences and lectures on highly theoretical subjects, such as those

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aimed at justifying the Boltzmann lattice algorithms, as well as on very applied topics and even industrial ones. At the fundamental level, conference-goers noted the Lattice Boltzmann models of high order, multi-speed models, boundary conditions, etc. Among the numerous applications which may be mentioned are optimization of the aerodynamic shape of a car, the problems of multiphase flow for the oil industry, colloidal suspensions, simulation of micro-fluidic devices, etc.

Lattice Boltzmann methods (LBM) have developed in recent decades in all countries of the world. It is sufficient to be convinced to read the list of the 13 members of the International Scientific Committee of the conference DSFD 2014: Ilya Karlin (Chairman, *Eidgenössische Technische Hochschule Zürich, Switzerland*), Santosh Ansumali (*Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, India*), Bruce Boghosian (*Boston, USA and American University of Armenia, Yerevan*), Jean-Pierre Boon (*Université Libre de Brussels*), Bastien Chopard (*University of Geneva, Switzerland*), Paul Dellar (*University of Oxford, United Kingdom*), Jens Harting (*Technical University, Eindhoven, Netherlands*), Takaji Inamuro (*Kyoto University, Japan*), Paulo Cesar Philippi (*Federal University of Santa Catarina, Brazil*), Marisol Ripoll (*Forschungszentrum Jülich, Germany*), Shan Xiaowen (*Beijing Aero-Science & Technology Research Institute, China*) Sauro Succi (*National Research Council (CNR), Italy*) and Alexander Wagner (*North Dakota State University, USA*).

During the DSFD 2014 conference, we counted 155 participants, including 60 students or post-docs, with more than 30 nationalities from five continents. The conference was structured in 24 sessions, some specialized on granular materials, rarefied gases, transport of particles in fluid flows, compressible flows, turbulence, rheology, porous media, biophysics, and one of them entirely dedicated to industrial applications, particularly in industrial simulation software from the “LaBS” project (Lattice Boltzmann Solver).

The local organizing committee DSFD 2014 composed of Stéphane Dellacherie (*CEA, centre de Saclay, France and Ecole Polytechnique de Montréal, Canada*), François Dubois (*CNAM Paris and Université Paris-Sud, France*), Stéphan Fauve (*Ecole Normale Supérieure, Paris, France*), Renée Gatignol (*Université Pierre et Marie Curie, Paris, France*) and Dominique d’Humières (*CNRS and Ecole Normale Supérieure, Paris, France*) was responsible for contacts with the Journal of Statistical Physics for publishing a thematic issue.

This issue entitled “*Discrete Simulation of Fluid Dynamics*” brings together 14 selected contributions proposed by the Local Organizing Committee and validated by the International Scientific Committee. Each contribution has led to a review process by two referees.