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Preface

Special Issue for the 20th International Conference on Discrete Simulation of Fluid Dynamics (DSFD)

This special issue contains contributions of selected papers presented at the 20th International Conference on Discrete Simulation of Fluid Dynamics (DSFD) held August 8-12, 2011 in Fargo, North Dakota, dedicated to the memory of Steven Orszag.

The field of Discrete Simulation of Fluid Dynamics arose from the seminal Frisch, Hasslacher and Pomeau paper that introduced a hexagonal lattice for a lattice gas that, for the first time, allowed a realistic simulation of fluid dynamics. This discovery caused quite a stir. The Washington Post stated in a front-page article that the potential of the lattice gas method was "one thousand to one million times faster than previous methods" and even reported that the United States Department of Defense had to considered whether the method "should be classified to keep out of Soviet hands." To explore the possibilities that arose from this discovery a meeting was organized in Los Alamos. From then on yearly or bi-yearly meetings have been organized that were, eventually, called the international conference on Discrete Simulation of Fluid Dynamics which is typically held in rotation in the Americas, Asia, and Europe. Either by accident, or maybe using C notation, the Los-Alamos meeting was counted as the 0th meeting and we convened for the 20th meeting in Fargo, North Dakota, where we were hosted by North Dakota State University.

Much has happened in the development of Discrete Fluid Dynamics since the promising first meeting. From the two-dimensional lattice gas models a large variety of new methods have evolved. There are different generalizations: some methods relax the requirements for particles to sit on lattice positions, like Stochastic Rotation Dynamics, but retain the lattice for particle interactions. Another decedent, the lattice Boltzmann method, does not only retain the lattice base, but gives up the discreteness of the particles, opting instead for particle distributions. These descendants have proven extremely versatile and find applications in many areas. Advantages of these methods are the relative ease of their implementation on massively parallel architectures and their ease of dealing with complex boundary conditions.

The reader of this special journal will gain a feeling for the particular strength of the lattice Boltzmann method, for this is the method of choice for most of the contributions. What stands out are several advantages: the first is dealing with complex solid boundaries, either fixed ones for porous media, or moving ones for suspended particles. The second one dealing with multi-phase flows in the thermodynamically consistent manner.

The reach of these methods extends to phenomena like nucleation, coarsening and cavitation. And lattice Boltzmann includes inertial effects, which play a crucial role in some applications.

In 2011 we lost Steven Orszag, who will be sorely missed by the community. This special journal is dedicated to his memory.

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