

Editorial: Lattice Boltzmann method

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About two decades ago, a numerical technique, which is now termed Lattice Boltzmann method (LBM), emerged as a promising and alternative tool to conventional numerical methods for simulating fluid flows and associated transport phenomena. Unlike the conventional computational fluid dynamics (CFD) methods that solve macroscopic continuum equations, LBM is based on microscopic models of fluids or mesoscopic kinetic equations describing the evolution of fluid particles. Because of its kinetic nature, LBM possesses some distinctive features that make it very suitable for simulating fluid systems that may be rather difficult by the conventional methods. From computational point of view, the structure of the algorithm is very simple compared with other CFD methods, conservative laws are automatically satisfied during the computation, boundary conditions can easily be implemented, and the physics of the algorithm is rather clear. What is more important, the algorithm involves local computations only, so that the algorithm can be easily implemented on parallel computers. This feature is crucial for practical engineering problems.

LBM has witnessed rapid developments over the past decade in both fundamentals and applications. In particular, this method has achieved great success in modelling various challenging problems arising from science and engineering, such as flows in porous media, colloidal suspension systems, flows involving chemical reactions, electrokinetics transport problems, multi-component and multi-phase systems, and so on. In this special issue, twelve papers on several interesting topics, ranging from fundamental problems of LBM to practical applications in different areas are presented. Many of the contributors are leading experts in their respective areas. All the papers were carefully reviewed by scientists in this field.

I am greatly indebted to the participating authors for their excellent contributions. I would also like to thank Professor M.A. Dorgham, Editor-in-Chief, and Professor A.C. Benim, Executive Editor, for inviting me to edit this special issue. I am also grateful to all the reviewers who have made great contributions in ensuring the quality of the accepted papers.