

An Exploration of Numerical Approaches to Boltzmann Equation Regarding Hydrodynamics

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Abstract

The Lattice Boltzmann Method (LBM) has become an alternative tool for computational fluid dynamics (CFD). While traditional CFD methods are based on Navier-Stokes equations that describe the fluid in terms of macroscopic quantities, LBM takes a mesoscopic description of the fluid thus closing the gap between macroscale and microscale. Overall, LBM provides a simple and efficient framework for simulation of fluid flows. In this approach, Boltzmann kinetic equation with BGK collision operator is discretized over a square lattice and solved to compute the evolution of a particle distribution function whose velocity moments are connected to the macroscopic primitive variables such as velocity and density. In this talk, we present two main approaches in the velocity discretization of the Boltzmann equation, namely, Galerkin and Collocation approaches. The foundations leading to these approaches are systematically laid down and some numerical examples are presented.

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