LATTICE BOLTZMANN METHOD FOR MULTI-PHASE FLOWS

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ABSTRACT One of the main advantages of the lattice Boltzmann method (LBM) over the conventional computational fluid dynamics (CFD) is its kinetic nature in dealing with the interface between the phases of fluid flow, which does not need to track the interface. There are four models to simulate multi-phase flows in the LBM: color-gradient, free energy, interface tracking, and Shan–Chen (SC). The color-gradient model has two distribution functions and an extra collision and re-coloring step. Also, it is suitable to specify the wetting conditions. One distribution function is used in the free energy model. However, the Poisson equation needs to solve for each time step. The interface tracking model has two distribution functions. Moreover, the free energy and interface tracking models are inconvenient to specify the wetting conditions. Owing to its simplicity and flexibility, the SC model is the most widely used in the open literature. The SC model has one distribution function and is convenient to specify the wetting conditions. Several approaches have been suggested to modify and improve the SC model, such as using higher-order isotropy, extending the single-relaxation-time LBM to multiple-relaxation-time LBM, coupling the SC model with the Equation of State (EoS), and enhancing the force term. The current work focuses on the SC model and its improvements.