Abstract Submitted
for the DFD19 Meeting of
The American Physical Society

Fully implicit force splitting scheme to two-phase lattice Boltzmann equation in pressure-velocity formulation TAEHUN LEE, City College of New York — We present a numerical procedure for solving the lattice Boltzmann equation (LBE) in the pressure-velocity formulation with the low Mach number approximation. We propose a unique algorithm based on the Strang splitting procedure to solve LBE for immiscible incompressible flows. Our procedure includes leading order intermolecular forcing terms within the streaming step, while keeping high-order forcing terms within the collision step such that conservative moments do not change due to collision. By coupling the finite difference/element method with a stable time-stepping technique, our scheme can easily handle stiff source term or external force. We will show that the perfect shift implementation is recovered under unity CFL condition as a special case of the proposed approach. The force splitting scheme is implemented in a fully implicit manner and applied to a novel pressure-velocity formulation of LBE. We have observed that the pressure-velocity formulation offers better numerical stability at high Reynolds numbers and reduced interfacial thickness, and the implicit formulation eliminates pressure oscillations. With the hope that this technique can be used for applications in complex geometries, benchmark calculations are performed on both uniform and non-uniform meshes.

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Date submitted: 01 Aug 2019 Electronic form version 1.4