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Implementation of a Lattice Boltzmann Method for Multiphase Flows with High Density Ratios

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Abstract : We present a Lattice Boltzmann Method (LBM) for multiphase flows with high viscosity and density ratios. The motion of the interface between fluids is modelled by solving the Cahn-Hilliard (CH) equation with LBM. Incompressibility of the velocity fields in each phase is imposed by using a pressure correction scheme. We use a unified LBM approach with separate formulations for the phase field, the pressure less Naiver-Stokes (NS) equations and the pressure Poisson equation required for correction of the velocity field. The implementation has been verified for various test case. Here, we present results for some complex flow problems including two dimensional single and multiple mode Rayleigh-Taylor instability and we obtain good results when comparing with those in the literature. The main focus of our work is related to interactions between aerated or non-aerated waves and structures so we also present results for both high viscosity and low viscosity waves.

Keywords : lattice Boltzmann method, multiphase flows, Rayleigh-Taylor instability, waves
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