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Numerical simulation of high shear rate two-phase flow with high density ratio[1] DOKYUN KIM, Stanford University, MARCUS HERRMANN, PARVIZ MOIN, CTR, Stanford University — It is a challenging problem to simulate two-phase flow in the incompressible limit with high density ratio when there is also high shear rate, since a numerical instability can develop at the phase interface. Even if a kinetic energy-conserving scheme is used for the single phase regions in the one fluid approach, kinetic energy can grow at the phase interface and overall energy is not conserved. We present a numerical method that addresses this problem. We descritize the variable density Navier-Stokes equations based on a finite volume formulation with a balanced force algorithm. A central-difference scheme is used for the convective term in the single phase regions ensuring kinetic energy conservation there. The central- difference scheme switches to an upwind-biased dissipative scheme at the phase interface to control the potential numerical instability. In order to track the phase interface, the Refined Level Set Grid (RLSG) method is used, which solves the level set equations on a separate equidistance Cartesian grid. The present numerical method is applied to representative two-phase flow problems with high density ratio and high shear rate, including liquid jet atomization. It is shown to be stable and accurate.

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