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Cahn-Hilliard modeling of particles suspended in two-phase flows
PATRICK ANDERSON, YOUNG JOON CHOI, Eindhoven University of Technology — We study the dynamics of particles suspended in two-phase flows by coupling the Cahn-Hilliard theory with the extended finite element method (XFEM). In the Cahn-Hilliard model the interface is considered to have a small but finite thickness, which circumvents explicit tracking of the interface. For the direct numerical simulation of particle-suspended flows, we incorporate an XFEM, in which the particle domain is decoupled from the fluid domain. To cope with the movement of the particles, a temporary ALE scheme is used for the mapping of field variables at the previous time levels onto the computational mesh at the current time level. The model is general, but to demonstrate and validate the technique, here the dynamics of a single particle at a fluid-fluid interface is studied. First, we apply a small disturbance on a particle resting at an interface between two fluids, and investigate the particle movement towards its equilibrium position. In particular, we are interested in the effect of interfacial thickness, surface tension, particle size and viscosity ratio of two fluids on the particle movement towards its equilibrium position. Finally, we show the movement of a particle passing through multiple layers of fluids.

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