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Migration of rigid particles in two-phase viscoelastic shear flow
PATRICK ANDERSON, NICK JAENSSON, MARTIEN HULSEN, Eindhoven Univ of Tech — We present simulations of particle migration in two-phase flows, where one of the fluids is viscoelastic, whereas the other is Newtonian. The fluid-fluid interface is assumed to be diffuse, and is described using Cahn-Hilliard theory. The equations are solved using the finite element method on moving meshes that are aligned with the particle boundary. The meshes used are highly refined in the interfacial region between the fluids and near the particle boundary, which allows us to perform simulations with a small interfacial thickness. Four regimes of particle migration are observed. The first regime, migration away from the interface, occurs if normal stresses in the viscoelastic fluid are absent, i.e. a Newtonian fluid. Due to the deformation of the interface, as Laplace pressure is build up, effectively pushing the particle away from the interface. The second regime, halted migration, occurs if the particle migrates toward the interface, but the migration is halted due to the Laplace pressure. In the third regime, interface penetration, the interfacial tension is not large enough to halt the migration, and the particle moves into the Newtonian fluid, encapsulated by a film of viscoelastic fluid. In the final fourth regime the particles are adsorbed at the interface.

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