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Numerical simulation of the surfactant-laden drop deformation and breakup using an ALE method XIAOFENG YANG, ASHLEY J. JAMES, University of Minnesota — An arbitrary Lagrangian-Eulerian (ALE) method method on an adaptive grid has been developed to simulate interfacial flows with insoluble surfactants. The interface is captured using a coupled level set and volume of fluid method. The surfactant mass in each grid cell is directly tracked by solving a convection-diffusion equation, which ensures the surfactant mass conservation. The surfactant concentration, which determines the local surface tension through an equation of state, is then computed as surfactant mass per interfacial area. To accurately approximate the interfacial area, the fluid interface is reconstructed using piece-wise parabolas. The evolution of the level set function, volume fraction, and surfactant mass is performed using an ALE approach. The flow velocity is obtained by solving the Stokes equations, with the surface tension force incorporated using a continuum-based method. The method is applied to simulate the effect of surfactants on drop deformation and breakup in a Stokes flow. The results are compared with available analytical and experimental results in literature.

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