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An arbitrary Lagrangian-Eulerian method for interfacial flows with insoluble surfactants XIAOFENG YANG, ASHLEY J. JAMES, University of Minnesota — We present an arbitrary Lagrangian-Eulerian (ALE) method for interfacial flows with insoluble surfactants. The interface is captured using a coupled level set and volume of fluid method. By directly tracking the surfactant mass, the method conserves surfactant to machine accuracy, and prevents surfactant from diffusing off the interface. Interfacial area is also tracked. To accurately approximate the interfacial area, the fluid interface is reconstructed using piece-wise parabolas. The surfactant concentration, which determines the local surface tension through an equation of state, is then computed as surfactant mass per interfacial area. The evolution of the level set function, volume fraction, interfacial area, and surfactant mass are performed using a Lagrangian-Eulerian method. Adaptive triangular grids are used for illustration. However, the ALE method can be applied to any kind of grid. The surface tension force is included in the momentum equation. The fluid flow is simulated using a Stokes solver for illustration. Other flow solvers, such as a Navier-Stokes solver or a viscoelastic flow solver, can also be used.

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