

Numerical Simulation of Two-Phase Incompressible Flows

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We consider a flow problem with two different immiscible incompressible newtonian phases (fluid-fluid or fluid-gas). A standard model for this consists of the Navier-Stokes equations with viscosity and density coefficients that are discontinuous across the interface and with a localized surface functional that describes surface tension effects. This fluid dynamics model can be coupled with a model for mass transport between the phases and a model for transport of surfactants on the interface. In certain cases one also has to include a model for the effect of solid nanoparticles that attach to the interface. In this talk we discuss these mathematical models and indicate why their numerical simulation has a very high complexity. We treat special finite element techniques that have been developed for this problem class. A few results on theoretical error analyses are given. Illustrations by means of results of numerical simulations of droplet sedimentation will be presented.