ALE-FEM for two-phase flows with insoluble surfactants

Andreas Hahn[1]   Lutz Tobiska[2]

We present a finite element method for the flow of two immiscible incompressible fluids in two and three dimensions. Thereby the presence of surface active agents (surfactants) on the interface is allowed, which alter the surface tension.

The model consists of the incompressible Navier-Stokes equations for velocity and pressure and a convection-diffusion equation on the interface for the distribution of the surfactant. A moving grid technique is applied to track the interface, on that account a Arbitrary-Lagrangian-Eulerian (ALE) formulation of the Navier-Stokes equation is used. The surface tension force is incorporated directly by making use of the Laplace-Beltrami operator technique. Furthermore, we use a finite element method for the convection-diffusion equation on the moving hyper surface. isoparametric finite elements are used. In order to get a high accurate method the interface, velocity and pressure are approximated by isoparametric finite elements.

---

[1] Otto-von-Guericke Universität, Institut für Analysis und Numerik, Magdeburg, Germany,
`Andreas.Hahn@ovgu.de`

[2] Otto-von-Guericke Universität, Institut für Analysis und Numerik, Magdeburg, Germany,
`Lutz.Tobiska@ovgu.de`