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Effects of Soluble Surfactant on Lateral Migration of a Bubble in a Shear Flow[1] METIN MURADOGLU, Koc University, GRETAR TRYGGVASON, The University of Notre Dame — Motivated by the recent experimental study of Takagi et al. (2008), direct numerical simulations are performed to examine effects of soluble surfactant on the lateral migration of a deformable bubble in a pressure-driven channel flow. The interfacial and bulk surfactant concentration evolution equations are solved fully coupled with the incompressible Navier-Stokes equations. A non-linear equation of state is used to relate interfacial surface tension to surfactant concentration at the interface. A multiscale method is developed to handle the mass exchange between the interface and bulk fluid at high Peclet numbers, using a boundary-layer approximation next to the bubble and a relatively coarse grid for the rest of the flow. It is found that the surfactant induced Marangoni stresses can dominate over the shear-induced lift force and thus alter the behavior of the bubble completely, i.e., the contaminated bubble drifts away from the channel wall and stabilizes at the center of the channel in contrast with the corresponding clean bubble that drifts toward the wall and stabilizes near the wall.

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Metin Muradoglu
Koc University

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