A fully Eulerian approach to fluid-solid interaction in elasto-capillarity

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ABSTRACT

The interaction of an elastic substrate with liquid droplets is at small length scales dominated by surface tension forces. Understanding how these forces deform the solid is crucial for the design of new materials, structures and fabrication techniques. In this work, we present a fully Eulerian approach to the interaction between a two-phase fluid and an incompressible solid [1,2]. The solid-fluid interface is represented by a matched Finite-element grid and moved in the typical Arbitrary-Lagrangian–Eulerian way. As all equations are formulated in a Eulerian frame of reference, we obtain a single momentum equation including the solid and both fluid materials, which is very simple to solve monolithically. We illustrate the numerical robustness of this novel method and compare it to recent experimental and numerical results. We conclude with first numerical simulations of a two-phase fluid interacting with a viscoelastic Kelvin-Voigt solid.

REFERENCES
