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Modeling and Numerical Predictions of the Dynamic Contact Angle Using a Microscopic Forcing Term GERRY DELLA ROCCA, GUILLAUME BLANQUART, California Institute of Technology — The dynamic contact angle at the wall between two immiscible fluids has been shown to be a function of the static contact angle and the contact line velocity (or Capillary number). In numerical simulations of multiphase flows, this dynamic angle is often directly imposed from either an empirical model or a model based on the molecular-kinetic theory of wetting. In contrast, a hydrodynamic viewpoint is used here to describe the flow around the contact line, and a microscopic forcing term is applied to simulate the molecular interactions at the boundary. The numerical simulations rely on a staggered arrangement of velocities, and a level set method is used to track the interface location. This framework has an inherent amount of slip which can be further supplemented by a Navier-slip condition. For the pressure jump across the interface, a ghost fluid method is employed and the microscopic forcing term is added into the jump condition. An unresolved curvature model is proposed for the microscopic forcing term where a smooth circular arc connects the dynamic and static angles in the sub- grid gap. This model does not rely on any underlying formula connecting the contact angles and the contact line velocity, but rather the dynamic angle evolves due to the nature of the flow. The model predictions for the dynamic contact angle are compared to experimental results.

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