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Pore-scale modeling of moving contact line problems in immiscible two-phase flow ALEC KUCALA, DAVID NOBLE, MARIO MARTINEZ, Sandia National Laboratories — Accurate modeling of moving contact line (MCL) problems is imperative in predicting capillary pressure vs. saturation curves, permeability, and preferential flow paths for a variety of applications, including geological carbon storage (GCS) and enhanced oil recovery (EOR). Here, we present a model for the moving contact line using pore-scale computational fluid dynamics (CFD) which solves the full, time-dependent Navier-Stokes equations using the Galerkin finite-element method. The MCL is modeled as a surface traction force proportional to the surface tension, dependent on the static properties of the immiscible fluid/solid system. We present a variety of verification test cases for simple two- and three-dimensional geometries to validate the current model, including threshold pressure predictions in flows through pore-throats for a variety of wetting angles. Simulations involving more complex geometries are also presented to be used in future simulations for GCS and EOR problems. Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

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