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Numerical Simulation of Immiscible Pore Scale Flow: Wettability and Dynamics SOHEIL ESMAEILZADEH, ZHIPENG QIN, Stanford University, AMIR RIAZ, University of Maryland, HAMDI TCHELEPI, Stanford University —
Accurate characterization of fluid-fluid interfacial dynamics is crucial for modeling pore-scale multiphase flows common in water resources management and subsurface applications. In this work, we propose a framework to accurately capture the dynamics of the capillary dominated pore-scale fluid-fluid interfaces in the presence of complex-shaped confinements. The incompressible Navier-Stokes equations are coupled with a multiscale sharp-interface level-set method and a direct-forcing based immersed boundary approach on a cartesian mesh to capture the interfacial dynamics. With the viscous terms being treated semi-implicitly, and a dynamic contact-line model suited for curved surfaces, we study the effects of wettability, contact angles, and pinch-off dynamics.
Keywords: water resources management, pore-scale, level-set method, immersed boundary, multiphase flow

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