Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

An energy-stable phase-field method for moving contact line problems[1] PENGTAO YUE, Virginia Tech — The phase-field method has become a popular numerical tool for moving contact-line problems because it can easily regularize the contact-line singularity by diffusion. Another advantage of the phase-field method is its energy law, which guarantees that the whole system is dissipative. This energy law, however, may not be satisfied if the equations are not discretized appropriately. In this talk, we will present an energy-stable scheme for the fully coupled phase-field and Navier-Stokes equations. A finite-element method and a modified Crank-Nicolson method are used for spatial and temporal discretizations, respectively. For two fluids with matched densities, the fully discretized system satisfies the exact physical energy law and is unconditionally stable. As a result, the numerical solution is dissipative and free of parasitic currents. For non-matched densities, the scheme only satisfies the energy law approximately; but it is sufficient to keep the parasitic currents well under control. A C++ code is developed based on the open source finite element library deal.ii and is made parallel by multi-threading. To demonstrate the efficiency and accuracy of the proposed method, we will present some 2D and 3D simulations including capillary rise and sliding drop.

[1]NSF-DMS 1522604

Pengtao Yue
Virginia Tech

Date submitted: 31 Jul 2017 Electronic form version 1.4