Computational Mathematics Seminar Series

A New Mixed Formulation For a Sharp Interface Model of Stokes Flow and Moving Contact Lines

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Johnston Hall 338
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Abstract:

Two phase fluid flows on substrates (i.e. wetting phenomena) are important in many industrial processes, such as micro-fluidics and coating flows. These flows include additional physical effects that occur near moving (three-phase) contact lines. We present a new 2-D variational (saddle-point) formulation of a Stokesian fluid with surface tension that interacts with a rigid substrate. The model is derived by an Onsager type principle using shape differential calculus (at the sharp-interface, front-tracking level) and allows for moving contact lines and contact angle hysteresis through a variational inequality. We prove the well-posedness of the time semi-discrete and fully discrete (finite element) model and discuss error estimates (ongoing). Simulation movies will be presented to illustrate the method. We conclude with some discussion of a 3-D version of the problem as well as future work on optimal control of these types of flows.

Speaker's Bio:

Shawn Walker is an assistant professor in mathematics at LSU. He received his Ph.D. from the University of Maryland, College Park. He held a postdoctoral position at the Courant Institute (New York University), and joined the LSU faculty in 2010 in the computational mathematics group. His research interests include: PDEs and finite element methods for moving domain problems, PDE-constrained (shape) optimization, and mesh generation.

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