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Computational Mathematics Seminar Series

Optimal Control of a Free Boundary Problem with Surface Tension Effects

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Assistant Professor

Johnston Hall 338
November 06, 2012 - 03:30 pm

Abstract:

We consider a PDE constrained optimization problem governed by a free boundary problem. The state system is based on coupling the Laplace equation in the bulk with a Young-Laplace equation on the free boundary to account for surface tension, as proposed by P. Saavedra and L.R. Scott. This amounts to solving a second order system both in the bulk and on the interface. Our analysis hinges on a convex constraint on the control such that the state constraints are always satisfied. Using only first order regularity we show that the control to state operator is twice Fr'echet differentiable. We improve slightly the regularity of the state variables and exploit this to show existence of a control together with second order sufficient optimality conditions. Next we prove the optimal a priori error estimates for the control problem and present numerical examples. Finally, we give a novel analysis for a more practical model with Stokes equations in the bulk and slip boundary conditions on the free boundary interface.

Speaker's Bio:

H. Antil is currently an assistant professor at the George Mason University in Fairfax, VA. He got his PhD from University of Houston under the
supervision of Prof. Ronald Hoppe. After spending one year at Rice University he moved to University of Maryland to work with Ricardo Nochetto. His research interests include: PDE constrained optimization, and model reduction.