

Patrick Sodr 

Optimal Control of a Free Boundary Problem with Second Order Sufficient Optimality Conditions

We are interested in solving a PDE constrained optimization problem governed by a free boundary problem. The state system is based on the one proposed by P. Saavedra and L. R. Scott in 1991. It involves a Laplace equation in the bulk and a Young-Laplace equation on the free boundary to account for surface tension. This amounts to solving a second order system both in the bulk and on the interface. Our analysis provides a set of box constraints on 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 chet differentiable. We demonstrate how to improve the regularity of the state variables up to second order. Existence of a control together with second order sufficient optimality conditions is shown under the enhanced second order regularity. Finally, we present the optimal second order convergence rate for the optimal control.