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Optimization and Control of Nonsmooth and Complementarity-Based Systems: Theory and Numerics

Instantaneous Control of a Model of Electrowetting on Dielectric with Complementarity-based Contact-Line Pinning

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Abstract: We consider a time-discrete spatially-continuous model of electrowetting on dielectric (EWOD) with contact line pinning as the forward problem in an optimal control framework. Since the pinning phenomenon is modelled by a subdifferential condition on the boundary of the droplet the associated control problem may be considered a type of mathematical program with equilibrium constraints (MPEC) in function space. In addition to the physical variables for velocity, pressure, and voltage, the solid-liquid-air interface, i.e., the contact line, arises as a geometric variable, which evolves in time. Due to the difficulties associated with the geometric variable, a method for the instantaneous control is considered. Optimality conditions are derived and a numerical method is proposed. The performance is then demonstrated by a few examples.