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Electrified Flow in Slender V-Groove Microchannels: Generalized Stability of Steady State Configurations[1] VILDA MARKEVICIUTE, NICHOLAS WHITE, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd., MC 128-95, Pasadena, CA — Although spontaneous capillary flow can be an especially rapid process in slender open microchannels resembling V-grooves, enhanced flow control is possible through implementation of electric field distributions which generate opposing electrohydrodynamic pressures along the air/liquid interface to modulate the capillary pressures. Important fundamental work by Romero and Yost (1996) and Weislogel(1996) has elucidated the behavior of Newtonian films in slender V-grooves driven to flow solely by the streamwise change in capillary pressure due to the change in radius of curvature of the circular arc describing the interface of wetting or non-wetting fluids. Here we augment the Romero and Yost model with inclusion of Maxwell stresses for perfectly conducting wetting films and examine which electric field distributions allow formation of steady state film shapes for various inlet and outlet boundary conditions. We investigate the stability of these steady solutions to small perturbations in film thickness using a generalized stability analysis. These results reveal how the ratio of Maxwell to capillary stresses influences the degree of linearized transient growth or decay for thin films confined to flow within an open V-groove.

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