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**Generalized Stability Analysis of Capillary Flow in Slender V-Grooves**[1] NICHOLAS WHITE, SANDRA TROIAN, California Institute of Technology, 1200 E. California Blvd., MC 128-95, Pasadena, CA — Spontaneous capillary flow, an especially rapid process in slender open microchannels resembling V-grooves, is of significant importance to many applications requiring passive robust flow control. Many types of biomedical devices for point-of-care use in developing countries are being designed around this principle. Important fundamental work by Romero and Yost (1996) and Weislogel(1996) elucidated the behavior of Newtonian films in slender V-grooves driven to flow 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. Self-similar solutions describing Washburn type dynamics were found but other solutions are possible. Here we extend the Romero and Yost model to include a variety of inlet and outlet boundary conditions and examine the transient growth and generalized stability of perturbations to steady state and self-similar flows. Although most cases examined for wetting fluids exhibit robust stability against small perturbations, some exceptions reveal unstable flow. In total, these results support decades of experimental work which has found this method of flow control to be especially reliable, robust and self-healing.

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