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Numerical Simulation of Conductivity Gradient-Induced Electrokinetic Flow Instabilities STEPHEN BRADFORD, UC Santa Barbara, CARL MEINHART, UC Santa Barbara, JON POSNER COLLABORATION, JUAN SANTIAGO COLLABORATION — This research is focused on the electrokinetic flow instabilities observed in long, thin microchannels with conductivity gradients orthogonal to the streamwise direction and applied potential. This situation often occurs in field amplified sample stacking (FASS) and isoelectric focusing, where control of the instabilities is imperative. Alternatively, the inherently chaotic flow patterns can be leveraged to fabricate an efficient micromixer under specific conditions. These instabilities arise from fluid body forces generated by the action of applied electric fields on electrolyte concentration-based conductivity gradients. A model is developed to describe the phenomena in general and applied specifically to thin microchannels with the conductivity gradient perpendicular to the applied field (both DC and AC). A higher-order, depth averaged correlation is proposed to account for the out of plane effects. Numerical simulations performed using COMSOL 3.2 are compared to 2-D and 3-D simulations as well as experimental data for multiple geometries with good agreement.

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