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Steady two-layer flow in a topographically patterned channel RICHARD D. LENZ, SATISH KUMAR, University of Minnesota — The steady behavior of the interface between two liquid layers flowing in a channel with one flat wall and one exhibiting a step-change in surface topography is considered. A 1D model based on the lubrication approximation is used to describe the interfacial shape. This shape is determined in part by the nature of the topographic variations encountered, but influenced strongly by the driving forces for flow and the liquid layer thickness and viscosity ratios. Interfacial behavior is characterized over a range of problem parameters and connected to the properties of simpler single-phase flows. Variations in the capillary length scale are explained through a scaling analysis, and the use of repulsive van der Waals forces to suppress interfacial features is explored. The results are of relevance to several current technological applications including microfluidics, multilayer coating, and lithographic printing.

Satish Kumar
University of Minnesota

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