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Theoretical investigation of the motion of two-dimensional droplets on inclined substrates NIKOS SAVVA, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London, London SW7 2AZ, UK — We examine theoretically the dynamics of the motion of two- dimensional droplets on inclined topographical substrates. We take into account the effects of gravity and possible substrate vibrations. Assuming the pressence of slip on the substrate and that the contact angle there always remains equal to its static value, the long-wave limit of the Stokes' regime leads to a single equation for the evolution of the droplet thickness. Through a singular perturbation procedure, the flow in the vicinity of the contact points is asymptotically matched to the flow in the bulk of the droplet, to yield a set of integrodifferential equations for the location of the two droplet fronts. Our matching procedure is favorably compared with numerical solutions to the full problem. In the absence of vibrations, we find a substrate-induced hysteresis effect connected with the existence of a critical inclination angle beyond which the droplet can no longer be supported at equilibrium by the substrate. When substrate vibrations are present, we deduce criteria for the peculiar vibration-induced climbing of droplets reported in recent experiments.

Serafim Kalliadasis
Department of Chemical Engineering,
Imperial College London, London SW7 2AZ, UK

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