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Droplet spreading over topographical substrates NIKOS SAVVA, SERAFIM KALLIADASIS, Department of Chemical Engineering, Imperial College London — Consider contact line motion over topographical substrates by using a two-dimensional droplet of a partially wetting fluid spreading over such substrates as a model system. The spreading dynamics is modelled under the assumption of small contact angles where the long-wave expansion in the Stokes-flow regime can be employed to derive a single equation of the evolution type for the droplet thickness. Through a singular perturbation approach, the flow in the vicinity of the contact line is matched asymptotically with the flow in the bulk of the droplet to yield a set of two coupled differential equations for the spreading rates of the two droplet fronts. Analysis of these equations reveals a number of intriguing features that are not present when the substrate is flat. In particular, we demonstrate the existence of multiple equilibrium states which allows for a hysteresis-like effect on the apparent contact line. Further, we demonstrate a stick-slip- type behavior of the contact line as it moves along the local variations of the substrate shape and the interesting possibility of a relatively brief recession of one of the contact lines.

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