

Piercing the water surface with a blade: Singularities of the contact line

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Abstract

© 2016 AIP Publishing LLC. An external meniscus on a narrow blade with a slit-like cross section is studied using the hodograph formulation of the Laplace nonlinear equation of capillarity. On narrow blades, the menisci are mostly shaped by the wetting and capillary forces; gravity plays a secondary role. To describe a meniscus in this asymptotic case, the model of Alimov and Kornev ["Meniscus on a shaped fibre: Singularities and hodograph formulation," *Proc. R. Soc. A* 470, 20140113 (2014)] has been employed. It is shown that at the sharp edges of the blade, the contact line makes a jump. In the wetting case, the contact line sitting at each side of the blade is lifted above the points where the meniscus first meets the blade edges. In the non-wetting case, the contact line is lowered below these points. The contours of the constant height emanating from the blade edges generate unusual singularities with infinite curvatures at some points at the blade edges. The meniscus forms a unique surface made of two mirror-symmetric sheets fused together. Each sheet is supported by the contact line sitting at each side of the blade.

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