Abstract Submitted
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Exact solutions for contact lines on a soft substrate with uniform surface tension LAURENT LIMAT, Laboratoire MSC, UMR 7057 of CNRS and University Paris Diderot, France, JULIEN DERVAUX, Laboratoire LIED, UMR 8236 of CNRS and University Paris Diderot, France — We have found an analytical solution describing the deformations of a soft substrate with uniform surface tension loaded by a straight contact line. Starting from the exact solution of this Flamant-Cerruti problem, we have extended our solution to contact lines with finite microscopic width, and to the case of a liquid strip between two straight contact lines (a 2D rivulet). These solutions are close to the approximate logarithmic ones proposed by one of us [1], except when two length scales of the problem are not separated. We discuss the liquid/solid force transmission, and the double transition of Lubbers et al [3], when two contact lines at finite distance are deforming a material with increasing softness. We provide analytical expressions for substrate distortion, as a function of the three length scales involved: distance between contact lines, microscopic scale, and elastocapillary length. Finally we discuss the selection of apparent contact angle, the possible extension to circular contact lines and the comparison with available experiments.

[1] L. Limat, EPJ-E Soft Matter 35, 134 (2012).
[2] L. A. Lubbers, J.H. Weijs, L. Botto, S. Das, B. Andreotti and J.H. Snoeijer, J. Fluid Mech. 747, R1 (2014).

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