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Meandering instability of a rivulet confined between two plates
LAURENT LIMAT, ADRIAN DAERR, SAMUEL PAILLAT, Laboratoire Matière et Systèmes Complexes, UMR 7057 of CNRS and Paris Diderot University, JENS EGGERS, Dept of Mathematics, University of Bristol — We have investigated experimentally and theoretically the meandering instability of a rivulet flowing vertically between two plates. In contrast with previous works, we considered pure fluids with no surfactant effects. Experiments on silicon oils of low viscosities, reveal that there is a spontaneous instability leading to traveling meandering patterns, often disordered, but with a well defined wavelength. Strongly ordered patterns can be selected by forcing the entry with a well defined frequency. In both cases, the obtained wavelength is centimetrical and with a week dependence upon flow rate. Theoretically, this instability can be interpreted in terms of centrifugal effects competing with the friction of contact lines on the two plates. Starting from hydrodynamic equations, we have obtained a reasonably simple dispersion relationship that allows us to recover the selected wavelength and the pattern phase velocity. We suggest that this theory should also hold for rivulet on inclined plates, provided that the hysteresis and the noise introduced by the substrate are not too high.

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