Matched asymptotic solution for crease nucleation in soft solids

Pasquale Ciarletta[1,2]

[1] MOX Laboratory, Dipartimento di Matematica, Politecnico di Milano, piazza Leonardo da Vinci 32, 20133 Milano, Italy
[2] CNRS, Sorbonne Universites, UMR7190, Paris Cedex 05, France
pasquale.ciarletta@upmc.fr; pasquale.ciarletta@polimi.it

A soft solid subjected to a large compression develops sharp self-contacting folds at its free surface, known as creases. Creasing is physically different from structural elastic instabilities, like buckling or wrinkling. Indeed, it is a fully nonlinear material instability, similar to a phase-transformation. I will provide theoretical insights of the physics behind crease nucleation [1]. Creasing is proved to occur after a global bifurcation allowing the co-existence of an outer deformation and an inner solution with localised self–contact at the free surface. The most fundamental result here is the analytic prediction of the nucleation threshold, in excellent agreement with experiments and numerical simulations. A matched asymptotic solution is given within the intermediate region between the two co-existing states. The self-contact acts like the point-wise disturbance in the Oseen's correction for the Stokes flow past a circle. Analytic expressions of the matching solution and its range of validity are also derived.

Références

1. P. Ciarletta, Matched asymptotic solution for crease nucleation in soft solids, Nature Communications **9**, doi :10.1038/s41467-018-02979-6 (2018).

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