
Nonlinear phenomena in solids; examples

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Abstract

Abstract: Solid mechanics makes a huge field of research started by Cauchy in the mid nineteenth century. Cauchy limited himself to the case of small deviations, namely to the limit where the strain tensor is small. This dimensionless quantity is the spatial rate of change of the displacement field. Many solids, the brittle solids, cannot stand strain bigger than a few percent without breaking. It does not mean however that they do not yield interesting nonlinear phenomena. This is because a small deviation accumulated on "large" distances may have a strong effect. This is what happens in the all important case of curled hairs! However some solids can stand large strain without breaking, the gels. 'll limit myself to cases where strain is big enough to bring by itself non linear phenomena and spatial chaos. I shall explain 3 situations, all related to large deformations of gels:

- 1) Rayleigh-Taylor instability in soft solids.

- 2) Generation of cascade in strained cylinders of gel.

- 3) Cutting and slicing soft matter.

All this will report work done with Serge Mora of the University of Montpellier.

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