Modeling of plastic-like media via structured deformations

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Some applications of the theory of structured deformations to plasticity are reviewed, showing how this theory can capture several aspects of material behavior which characterize plastic materials.

Roughly, one can define two basic types of plasticity, incremental and periodic, depending on the analytical shape assumed for the interfacial energy which determines the stress response in the presence of internal structural changes of the material [1]. Periodic plasticity seems more suitable to describe the behavior of crystalline solids, while incremental plasticity fits better to materials with disordered structure such as polycrystals, concrete, soils and rocks. In the first part of my talk I discuss briefly two examples, the multiple slips of single crystals [3, 4] and the shear accompanied by shear-induced dilatation in a damaged continuum with periodic microstructure [5].

The second part of the presentation is devoted to the equilibrium problem of a one-dimensional continuum subject to structured deformations. I show that, in the absence of macroscopic discontinuities in the displacement field, this problem coincides with the equilibrium problem for a one-dimensional elastic-perfectly plastic continuum [2]. An application to Structural Analysis, concerning the formation of plastic hinges in a bar subject to bending [6] is discussed.

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