

Exploitation of Incremental Energy Minimization Principles in Computational Multiscale Analyses of Inelastic Solids

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The lecture provides an overview about recent developments in the formulation and numerical implementation of incremental minimization principles for inelastic solids and their exploitation with regard to multiscale analyses of deformation microstructures. The point of departure is a general internal variable formulation for standard dissipative materials. Consistent with this type of finite inelasticity we outline a distinct incremental variational formulation of the local constitutive response where an incremental stress potential is obtained from a local minimization problem with respect to the internal variables. The existence of the incremental stress potential allows the formulation of IBVPs for standard dissipative solids as a sequence of incremental minimization problems. For this scenario, multiscale microstructure developments in stable and instable dissipative solids can be based on incremental minimization principles of homogenization and energy relaxation. These concepts are applied to conceptual model problems which treat multiscale microstructure evolutions in stable / instable and a priori heterogeneous / homogeneous elastic–plastic solids.

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