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Incremental Energy Minimization in Material Instaqbility Problems

Henryk Petryk(1), Klaus Thermann(2)

(1) *Institute of Fundamental Technological Research Polish Academy of Sciences, Warsaw, Poland*
(2) *Department of Mechanical Engineering, Dortmund University, Dortmund, Germany*

Recent theoretical developments of the incremental energy minimization and its novel applications to material instability problems in time-independent inelastic solids are presented, following the concept and computational method developed earlier by the authors. Necessity of imposing a symmetry restriction on the constitutive law is discussed. In the internal-variable formulation of multi-mode inelasticity, theorems are formulated and proven that provide a novel justification of the second-order incremental energy minimization as the condition necessary for stability of a solution path. New examples are given that show how instability of a uniform deformation path can lead to the formation of a higher-rank laminated microstructure in an initially homogeneous inelastic material. As a conclusion, the non-convex minimization of incremental energy yields a natural criterion of selection of the post-critical deformation pattern and provides a computational method for determining deformation paths with automatic branch switching.

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