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A variational formulation of rate-independent phase transformations using an extremum principle. (English) Zbl 1012.74054

Arch. Ration. Mech. Anal. 162, No. 2, 137-177 (2002).

Summary: We propose a rate-independent mesoscopic model for the hysteretic evolution of phase transformations in shape-memory alloys. The model uses deformation and phase-indicator functions as basic unknowns, and potentials for elastic energy and for dissipation as constitutive laws. Using the associated functionals, admissible processes are defined to be the ones which are stable at all times and which satisfy the energy inequality. This concept leads to a natural time-incremental method which consists in a minimization problem. The mesoscopic model is obtained by a relaxation procedure. It leads to new functionals involving the cross-quasiconvexification of the elastic stored-energy density. For a special case involving two phases of linearized elastic materials, we show that the incremental problem provides existence of admissible processes for time-continuous problems, if we let the time-step go to 0.

MSC:

74N30 Problems involving hysteresis in solids
74N15 Analysis of microstructure in solids
82B26 Phase transitions (general) in equilibrium statistical mechanics

Cited in **4** Reviews
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Keywords:

variational formulation; extremum principle; deformation function; phase-indicator function; hysteretic phase transformations; rate-independent mesoscopic model; shape-memory alloys; elastic energy; dissipation; time-incremental method; minimization; relaxation procedure; cross-quasiconvexification; linearized elastic materials

Full Text: DOI

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