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Equilibrium and Stability of Two-Phase Deformations within the Framework of Phase Transition Zones

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The phase boundaries in nonlinear elastic solids are considered as surfaces of discontinuity in deformation gradient at continuous displacements. The analysis of the conditions on the equilibrium interface leads to the concept of phase transition zones (PTZ). Given a material, the PTZ represents all deformations allowed on the equilibrium interface. Every point of the PTZ corresponds to some piece-wise homogeneous two-phase deformation. We develop a procedure to examine the stability of such deformations that gives necessary stability conditions in a general case. The stability is investigated with the aid of two criteria. One is a kinetic stability criterion, the other one is the energy criterion. The difference between the stability of two-phase deformations and deformations in a joint body is clarified. Spherically symmetric two-phase deformations are studied in detail to demonstrate efficiency of the approaches developed. Deformations which correspond to stable and unstable two-phase configurations are related with the PTZ.

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