FINITE-DEFORMATION SHEAR BAND ELEMENTS FOR THREE-DIMENSIONAL SHEAR BAND PROPAGATION ANALYSIS

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Abstract

A finite-deformation shear band model and its three-dimensional finite element implementation are presented, which enable the accurate and efficient simulation of the dynamical formation of shear bands in thermo-elasto-viscoplastic solids. The shear band element governs the initiations and formation of shear bands with a prescribed constitutive law, and is compatible with conventional finite element discretizations of the bulk material. The versatility and predictive ability of the method are demonstrated through a simple shear test, the simulation of the dynamic impact of a pre-notched C300 steel sample by a steel projectile, and the ductile fracture and fragmentation of U-6%Nb alloy rings.

Key Words: shear band element, finite deformation, three dimensional, adiabatic heating, dynamic shear bands

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