

Multi-stage Numerical Model for Shear Bands with Application to CEC and TWC Set-up

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Abstract: The formation of adiabatic shear bands travels three stages: stabilization stage, perturbation growth stage and fluid-like stage. The micro-structures of material between different stages have great changes. To describe the complex behavior of material, a multi-stage numerical model for shear bands is presented. Within the polycrystalline ductile metal, various defects exist inherently. It is these widespread defects that led to in-homogeneity in material space. To reflect this in-homogeneity in the macroscopic constitutive relationship, a probability constitutive relationship is proposed. The yield stress in material space is assumed to meet normal distribution. The multi-stage model is applied to simulate the destruction process of Contained Explosive Cylinder (CEC) and Thick-Walled Cylinder (TWC) geometry. A close agreement is found between simulation results and experimental observations reported in the literatures, such as the failure mechanism, shear band spacing.

Keywords: Shear bands, Simulation, Probability constitutive relationship, Multi-stage model, Instability