Modelling of Adiabatic Shear Band and Microvoid induced Material Degradation

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ABSTRACT

A phenomenon possibly leading to catastrophic failure of high strength materials like steel and titanium alloys during high strain rate loading is the adiabatic shear banding. Adiabatic shear bands (ASB) are intensely sheared plastic zones resulting from thermomechanical instability. Thus it is essential to numerically model this phenomenon.

A 3D large deformation modelling of the material response in the presence of ASB under impact loading has been carried out (see e.g. Longère et al. [1]). Contrary to the numerous fine micromechanical modelling of the shear banding, a large scale postulate is adopted herein where bands are contained within the representative volume element with a view to be applied to engineering applications involving large structures. The model accounts for ASB consequences in terms of anisotropic material degradation and plastic flow deviation in the band plane.

In the experimental observations by Longère and Dragon [2], in the post localization stage, there has been evidence of the presence of micro-voids in the wake of the ASB. Hence recently, this model has been enriched in the late pre-failure regime by incorporating the consequence of the formation and growth of micro-voids, see Longère and Dragon [3]. Numerical implementation of this enhanced model as a user material in the engineering finite element computational code LS-Dyna has been carried out and its performances evaluated using initial boundary value problems.

REFERENCES

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