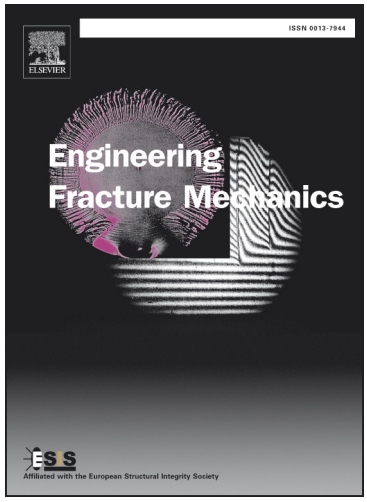

Numerical simulation of ductile fracture based on mean field homogenization method: modeling and implementation

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Numerical simulation of ductile fracture based on mean field homogenization method: modeling and implementation

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Abstract

A mean filed homogenization method at large deformation is presented to describe the damage softening effects due to nucleation and growth of voids during ductile fracture. The developed homogenization frame is combined with the Nucleation-And-Growth model and the percolation theory based coalescence model for describing ductile damage evolution. A semi-implicit numerical algorithm is developed to solve the ductile damage model. Based on the model, we have carried out numerical simulations of the spall fracture of a Al 2024-T4 plate and a Ti-6Al alloy plate under impact loads. The simulated free surface velocity profiles show good agreement with experimental measures.

Keywords: Homogenization; elasto-plasticity; Damage; Ductile failure; Spall.

1. Introduction

By experiment observations and molecular dynamics simulations, it is confirmed that the main damage mechanism of ductile failure is cavitation, i.e., nucleation, growth and coalescence of microvoids [1–4]. Nucleation of microvoids is induced by the cracking or debonding of second-phase particles and inclusions. In the course of a

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