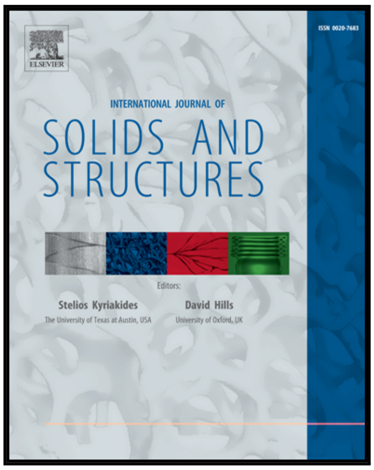
Accepted Manuscript



A deformation-theory based model of a damaged metal matrix composite

Ashish Mishra, Sivasambu Mahesh

PII: S0020-7683(17)30242-1
DOI: 10.1016/j.ijsolstr.2017.05.032
Reference: SAS 9594

To appear in: *International Journal of Solids and Structures*

Received date: 10 February 2016
Revised date: 24 March 2017
Accepted date: 23 May 2017

Please cite this article as: Ashish Mishra, Sivasambu Mahesh, A deformation-theory based model of a damaged metal matrix composite, *International Journal of Solids and Structures* (2017), doi: 10.1016/j.ijsolstr.2017.05.032

A deformation-theory based model of a damaged metal matrix composite

Ashish Mishra[a], Sivasambu Mahesh[a,*]

[a] *Department of Aerospace Engineering, Indian Institute of Technology Madras, Chennai 600036 India.*

Abstract

A shear-lag and deformation-theory based model for a metal matrix composite reinforced by continuous unidirectional fibres is proposed. The model accounts for fibre and matrix cracking, matrix plasticity, and fibre-matrix interfacial sliding through seven characteristic non-dimensional parameters, which combine geometric, phase and interface properties. It allows arbitrary tensile loading and unloading history along the fibre direction, and predicts the history-dependent elastoplastic displacement, strain, and stress fields in all the fibre and matrix elements. Broken elements may be present initially, or form during the imposed loading history. Non-linear one-dimensional governing differential and algebraic equations are formulated on the basis of the model. A computationally fast solution methodology based on pseudospectral collocation is implemented. The present model is employed to predict the elastic strain profiles in a Ti/SiC composite tape near pre-existing breaks. These predictions agree well with experimental measurements reported in the literature.

Keywords: Metal matrix composite, Unidirectional, Shear lag, Nonlinear, Failure

*Corresponding author

Email addresses: ae13d212@smail.iitm.ac.in (Ashish Mishra), smahesh@iitm.ac.in (Sivasambu Mahesh)