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Ashish Mishra, Sivasambu Mahesh

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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)

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