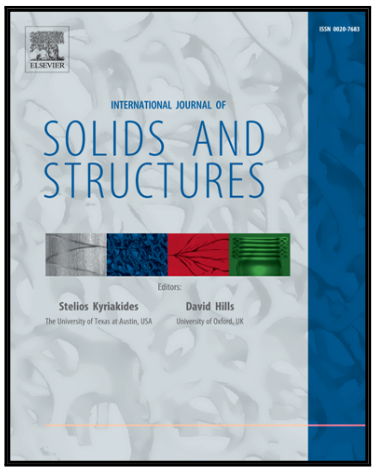

A New Yield and Failure Theory for Composite Materials under Static and Dynamic Loading

Isaac M. Daniel , Sam M. Daniel , Joel S. Fenner

PII: S0020-7683(17)30400-6
DOI: 10.1016/j.ijsolstr.2017.08.036
Reference: SAS 9715

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

Received date: 23 June 2017
Revised date: 4 August 2017
Accepted date: 30 August 2017

Please cite this article as: Isaac M. Daniel , Sam M. Daniel , Joel S. Fenner , A New Yield and Failure Theory for Composite Materials under Static and Dynamic Loading, *International Journal of Solids and Structures* (2017), doi: 10.1016/j.ijsolstr.2017.08.036

A New Yield and Failure Theory for Composite Materials under Static and Dynamic Loading

Isaac M. Daniel[1], Sam M. Daniel[2] and Joel S. Fenner[1]

ABSTRACT

To facilitate and accelerate the process of introducing, evaluating and adopting new material systems, it is important to develop/establish comprehensive and effective procedures of characterization, modeling and failure prediction of composite structures based on the properties of the constituent materials, e. g., fibers, matrix, and the single ply or lamina. A new yield/failure theory is proposed for predicting lamina yielding and failure under multi-axial states of stress including strain rate effects. It is based on the equivalent stress concept derived from energy principles and is expressed in terms of a single criterion. It is presented in the form of master yield and failure envelopes incorporating strain rate effects. The theory can be further adapted and extended to the prediction of in situ first ply yielding and failure (FPY and FPF) and progressive damage of multi-directional laminates under static and dynamic loadings. The significance of this theory is that it allows for rapid screening of new composite materials without extensive testing and offers easily implemented design tools.

Keywords: A**:** Mechanical characterization; B: Yield criteria; C: Failure criteria; D: Failure envelopes; E: Strain rate effects

[1] Robert McCormick School of Engineering and Applied Science, Northwestern University 2137 Tech Drive, Evanston, IL 60208, USA.
[2] Mathematica consultant, Tucson, AZ

Corresponding author. Isaac M. Daniel, e-mail: imdaniel@northwestern.edu, Tel:(847)491-5649, Fax: (847) 491-5227.