A Continuum Elastic–plastic Model for Woven-fabric/Polymer-matrix Composite Materials under Biaxial Stresses

G. Odegard[a], K. Searles[b] and M. Kumosa[a]

[a] *Center for Advanced Materials and Structures, Department of Engineering, University of Denver, 2390 S. York, Denver, CO 80208, USA*
[b] *Department of Materials Science and Engineering, Oregon Graduate Institute of Science and Technology, PO Box 91000, Portland, OR 97291-1000, USA*

Abstract

In this study a simple continuum model for the macro-mechanical prediction of the elastic–plastic behavior of woven-fabric/polymer-matrix composites has been proposed. This model uses a scalar hardening parameter (which is a function of the current applied stress state) instead of an effective stress-strain relation to determine plastic strain increments. For simplicity, the stresses are expressed as invariants based on the material symmetry. It has been shown, by the use of experimental data for two different woven-fabric/polymer-matrix composite materials, that the newly proposed model accurately describes the non-linear mechanical behavior for different in-plane biaxial stress states ranging from pure shear to pure tension.

Keywords: Textile composites; Mechanical properties; Modeling; Plastic deformation