FAILURE CRITERIA OF FIBRE REINFORCED COMPOSITES IN HOMOGENEOUS TEMPERATURE FIELD

by

Dragan I. MILOSAVLJEVIĆ[a]*, Gordana M. BOGDANOVIĆ[a], Ljiljana V. VELJOVIĆ[a], Aleksandar B. RADAKOVIĆ[b], and Mirjana M. LAZIĆ[c]

[a] Faculty of Mechanical Engineering, University of Kragujevac, Kragujevac, Serbia
[b] The State University, University of Novi Pazar, Novi Pazar, Serbia
[c] Faculty of Science, University of Kragujevac, Kragujevac, Serbia

Original scientific paper
UDC: 621.763.001:536.7
DOI: 10.2298/TSCI100610028M

The present paper examines the failure criteria of layered composites with orthotropic properties in the homogeneous temperature field. The composite has modeled by two mechanically equivalent families of fibres. The paper formulates constitutive equations in terms of intrinsic "preferred" directions, which are defined by the orientation of fibers at any point of the composite. A uniformly heated, thermoelastic solid undergoes distortion as well as volume change because it experiences differential expansions in different directions. This effect is more complicated if, in addition of being anisotropic, the material is inhomogeneous, as in the case with laminated materials.
In order to illustrate the influence of temperature on the failure of this group of materials constitutive equations are derived and adopted for use in failure criteria, without the influence of temperatures, and with the influence of increased temperature.

Key words: *failure*, *composite*, *thermo-elasticity*, *fibres*, *reinforcement.*

Introduction

When an isotropic, thermo-elastic material is uniformly heated, it undergoes a uniform expansion without change of shape. By contrast, an anisotropic material has, in general, different thermal expansion coefficients in different directions, and so exhibits distortion as well as volume change when it is subjected to temperature change. This distortion effect is compounded when the material is inhomogeneous as well as anisotropic, because then the preferred direction for expansion vary with position, and this gives rise to further distortion. Laminated materials, which are extensively and increasingly used in advanced materials applications, are extreme cases of inhomogeneous materials. The anisotropic materials types to be considered here will be taken to have orthotropic symmetry

* Corresponding author; e-mail: dmilos@kg.ac.rs