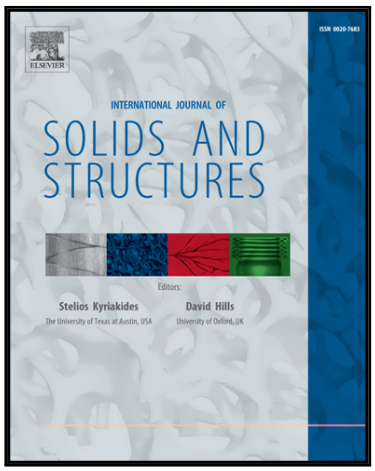

3D application of the coupled criterion to crack initiation prediction in epoxy/aluminum specimens under four point bending

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3D application of the coupled criterion to crack initiation prediction in epoxy/aluminum specimens under four point bending

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Abstract

Until now, the coupled stress and energy criterion has mainly been used in 2D applications, but it is possible to extend it to a 3D case. Herein the crack initiation in epoxy/aluminum bimaterial specimens under four point bending is predicted through a 3D numerical application of the coupled criterion. The stress and the energy conditions are computed by means of 3D finite element modeling of both undamaged and cracked specimens. The crack initiates at the epoxy/aluminum interface, meshes of the cracked specimens take into account the crack topology which is determined using the interface normal stress isocontours. By indirect confrontation to experimental tests on aluminum/epoxy bimaterial specimens of different width, the proposed approach allows determining the interface strength and fracture energy. The blind application of the proposed method to a crack initiation in aluminum/epoxy/aluminum specimens of different epoxy layer thickness under four point bending leads to a reasonable agreement with experimental data.

Keywords: Bending, Bimaterial, Crack, Energy release rate, Fracture

1. Introduction

Crack initiation is a main issue in material and structure design. In an industrial process, predictive modeling tools are needed in order to reduce the number of experimental tests that may be costly and time consuming.

An efficient method for crack initiation prediction in brittle materials, the so called "coupled criterion", has been proposed by Leguillon [8]. It is based on the fact that crack nu-