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Abstract

This paper presents a new discontinuous damage model for modeling fatigue crack growth in composites. This new fatigue model is formulated based on the thick level set interface approach which we developed recently. In this approach the thick level set (TLS) method is combined with interface elements for modeling delamination growth. Crack growth under cyclic loading is described with the Paris relation. In contrast with popular cohesive zone methods, this new approach provides an accurate non-local evaluation of the energy release rate as well as a framework in which the crack growth rate can be directly imposed. The proposed 3D mixed-mode model is validated against experimental and theoretical data.

Keywords: Delamination; Splitting; Fatigue ; Thick level set; Progressive failure analysis

1. Introduction

Delamination is a common mode of failure in laminated composites. Delamination growth is mostly modeled with the cohesive zone method in combination with interface elements. This method was initially developed for modeling crack growth under quasi-static loading and later extended to fatigue analysis [1–6].

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