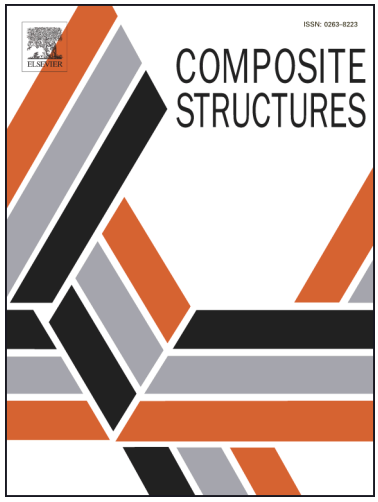

Edge effects in adhesively bonded composite joints integrated with piezoelectric patches

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Edge effects in adhesively bonded composite joints integrated with piezoelectric patches

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Abstract

Analytical electromechanical solutions to the interfacial stresses in the adhesively bonded composite joints integrated with piezoelectric actuator are presented in this paper within the framework of full layerwise theory. Two lap joints with and without interfacial void are studied, and the edge effects near the end-points of the bondline as well as around the void are investigated. Sets of fully coupled governing equations of equilibrium are derived using the principle of minimum total potential energy and are simultaneously solved using the state space approach. It was observed that the edge effects results in significant interfacial stress concentrations around the void edges that may cause propagation of microcracks and debonding.

Keywords: Adhesive joint; Laminated composite; Stress analysis; Edge effect; Full layerwise theory; Piezoelectric

1. Introduction

Linear piezoelectricity is a mutual interaction of electromechanical characteristics of non-centric crystals [1]. In piezoelectric materials, an external electric charge causes molecular polarization, and the consequent dielectric displacement results in

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