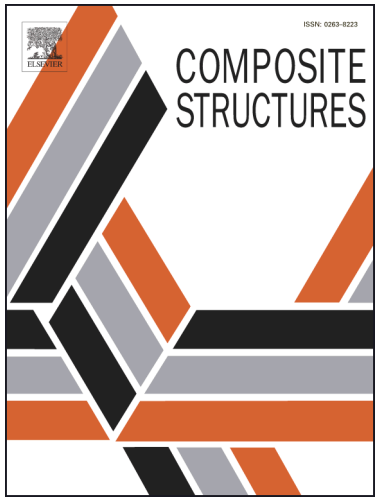

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Analytical Predictions of Delamination Threshold Load of Laminated Composite Plates subject to Flexural Loading

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Abstract

An analytical approach is proposed to determine delamination threshold loads of fiber-reinforced laminated composite plates with arbitrary stacking sequences under transverse loading conditions. Following the concept of cohesive zone modeling, a laminated plate is considered as an assembly of two sub-laminates connected by a virtual elastic-brittle layer with infinitesimal thickness. The problem is formulated and solved by the Rayleigh-Ritz method based on first-order shear deformation theory. The problem of quasi-static face-on (transverse) indentation test is analyzed as an example. The results, including elastic stiffness of flexural response, traction distributions over the potential crack interface, and threshold loads and initiating locations of delamination, are found to be in very good agreement with finite element simulations using cohesive elements. The modeling strategy, therefore, is useful for aerospace structural engineers at the preliminary design stage of laminated composite aerospace structures.

Keywords: laminate, plate, analytical, Rayleigh-Ritz, FSDT, cohesive zone modeling, delamination threshold load, flexural response

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