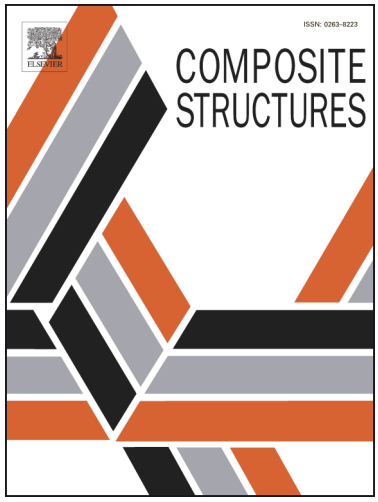

An efficient higher order non-polynomial Quasi 3-D theory for dynamic responses of laminated composite plates

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An efficient higher order non-polynomial Quasi 3-D theory for dynamic responses of laminated composite plates

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Abstract

In this work, a new simple Quasi 3-D theory based on linear variation of transverse displacement along the thickness of plate is proposed for free and forced vibration of laminated composite plates. The theory satisfies both zero transverse shear stress conditions at top and bottom surfaces of the plate and non-linear distribution of transverse shear stresses across the thickness of plate. Therefore, the necessity of shear correction factor can be avoided. The governing equations of motion are obtained by using Lagrange equation. The finite element discretization of the plate is presented by considering an eight noded serendipity element. The forced vibration of the plate under different time dependent loads is also illustrated. The Newmark's time integration techniques is employed to obtain the forced response of laminated plate. The adaptability of the proposed theory is demonstrated by solving several numerical examples and validated with available results. The effect of various parameters like thickness ratio, aspect ratio, modulus ratio and temperature on fundamental frequency of plate is investigated through several examples. The results shows that, the free vibration regime of the plate is greatly affected by the duration of blast load on plate. The theory gives an excellent agreement with available literature.

Keywords: Quasi 3-D shear deformation theory, finite element method, Free and Forced vibration, Laminated composite plate

1. Introduction

With rapidly growing industries like aerospace, civil, nuclear, mechanical etc. the demand of high performacne laminated composite materials have increased significantly because of various reasons like high strength to weight ratio, low cost, high fatigue life, its tailor-made properties etc. The bend extensional and bend twist coupling properties of these structures have led to their extensive use in aerospace industries. However, these laminated composites

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