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Analytical and Numerical Results for Free Vibration of Laminated Composites Plates

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Abstract : The reinforcement and repair of concrete structures by bonding composite materials have become relatively common operations. Different types of composite materials can be used: carbon fiber reinforced polymer (CFRP), glass fiber reinforced polymer (GFRP) as well as functionally graded material (FGM). The development of analytical and numerical models describing the mechanical behavior of structures in civil engineering reinforced by composite materials is necessary. These models will enable engineers to select, design, and size adequate reinforcements for the various types of damaged structures. This study focuses on the free vibration behavior of orthotropic laminated composite plates using a refined shear deformation theory. In these models, the distribution of transverse shear stresses is considered as parabolic satisfying the zero-shear stress condition on the top and bottom surfaces of the plates without using shear correction factors. In this analysis, the equation of motion for simply supported thick laminated rectangular plates is obtained by using the Hamilton’s principle. The accuracy of the developed model is demonstrated by comparing our results with solutions derived from other higher order models and with data found in the literature. Besides, a finite-element analysis is used to calculate the natural frequencies of laminated composite plates and is compared with those obtained by the analytical approach.

Keywords : composites materials, laminated composite plate, finite-element analysis, free vibration
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