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Free Vibration Analysis of Composite Sandwich Plates

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ABSTRACT

In this study, the fundamental frequencies of symmetrically laminated composite angle-ply plates (θ/-θ/-θ/θ) subjected to uniaxial compressive loads are maximized with respect to fibre orientations. The first-order shear deformation (FSDT) theory is used for finite element analysis of laminated plates. Modified Feasible Direction (MFD) method is used for the optimization routine. Finally, the significant effects of plate aspect ratios, compressive load and boundary conditions on the results are demonstrated and the results are compared.

Key Words: Composite sandwich plates; Free vibration; Finite element solution.

1 INTRODUCTION

The use of sandwich structures in marine, transport, civil construction and aerospace applications is growing rapidly because of advantageous features such as high strength to weight ratio and low maintenance cost. With the increased interest and use of sandwich structures in many challenging situations over the years, it is therefore very important to study its behaviour in various circumstances. Due to neglect of transverse shear effects, the classical laminated plate theory based on the Kirchhoff hypothesis usually overestimates the natural frequencies of laminated structures. To take into account the transverse shear effects, the first-order shear deformation theories were extended to predict the dynamic response of laminated composite structures. However, transverse shear strains in the first-order theory are assumed to be constant through the thickness of laminates, so that the shear correction factors were usually used to adjust the transverse shear stiffness. The accuracy of results obtained from the first-order theory strongly depends on the shear correction factors.