Buckling and free vibration of laminated beams with arbitrary boundary conditions using a refined HSDT

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Abstract

This paper presents an analytical solution for the buckling and free vibration analysis of laminated beams by using a generalized higher order shear deformation theory (HSDT) which includes the thickness stretching effect. Further development of HSDTs for beams can be done just by modifying the shear strain shape functions. The eigenvalue equation is derived by employing the Rayleigh quotient, using a Ritz solution to approximate the displacement field and Lagrange multipliers to consider the boundary conditions. Ritz solution with hybrid series is used to improve the accuracy of the results. Convergence of the results is analyzed. For validation, numerical results of the present theory are compared with other theories and the 3D FEM solutions. Nondimensional frequencies and critical buckling loads are obtained for a variety of stacking sequences.

4 Figures