Finite element formulation of laminated beams with capability to model the thickness expansion

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Abstract

This paper presents a static analysis of laminated beams by using a 6 degree-of–freedom hybrid type quasi-3D higher order shear deformation theory (HSDT). The governing equations are derived by employing the principle of virtual work and solved by means of Hermite-Lagrangian finite element method for laminated beams with several boundary conditions. A mixed interpolation, C1 cubic Hermite and a C0 linear Lagrange interpolation are used for the kinematic variables. Different types of shear strain shape functions were introduced a priori and in general manner to model the displacement field of the laminated beams. Convergence studies were performed in order to validate the HSDTs solved through finite element method and the results are compared with a Navier solution. Numerical results of the present generalized quasi-3D theory are also compared with FEM solutions predicted by other HSDT and with experimental results.

5 Figures