ABSTRACT

The present investigation essentially deals with calculation of the temperature distribution in thick finite plates subjected to generalized thermal boundary conditions and evaluation of thermo-elastic behaviour of the laminated composite plates subjected to mechanical as well as thermal loads.

A three dimensional finite element heat conduction analysis in fiber reinforced composite laminates has been developed to get realistic temperatures in the laminates under different thermal boundary conditions. These temperature values are subsequently taken as a part of the input information to the thermo-elastic analysis. A higher-order bending theory has been chosen and a finite element programme is developedto predict the in-plane stresses and deflections in composite laminated plates with varying (a) geometrical aspect ratios, (b) fiber orientation and (c) layer sequence. The composite plates considered for analysis include (i) homogeneous plates, (ii) cross-ply laminates and (iii) angle-ply laminates and (iv) hybrid laminated plates.

The three-dimensional thermal fields obtained in thick single-layer as well as angle-ply laminated fiber-reinforced composite plates reveal that the temperature variation across the thickness of the plate is non-linear for all aspect ratios, thermal boundary conditions, fiber

orientation angle and layer sequence. For these thick plates under the chosencombined mechanical and thermal loadings, the deflections and stresses are found to be predominantly due to the thermal effects. In case of thin plates (B/H > 50), temperature variation is linear across the thickness and the influence of mechanical loading is prominent.

Key words: Fiber reinforced Composite, Laminate, Orthotropy, Heat conduction, Higher-order theory, Finite element method, Temperature distribution, Thermal stresses and deformations.