ABSTRACT

This thesis deals with the analysis of stresses and deformations in beams of composites. The analysis is done by Airy's stress function approach. The beams analysed include both statically determinate and indeterminate homogeneous and non-homogeneous ones. In deriving the compatibility condition of anisotropic medium, subjected to body and surface forces, and thermal loading, the integrated form of the body forces are used rather than body force potential. A new technique to choose Airy's stress function in rectangular coordinates is proposed with the help of Strength of Materials Theory. This technique is simple and direct compared to the existing ones. Analysis of indeterminate anisotropic homogeneous beam is presented. Euler and modified Timoshenko beams are interpreted as special cases of orthotropic beams. Closed form solutions of 3-layered beams with three types of interlayer surface conditions are given. The effect of structural parameters like span-to-depth ratio (λ), bottom layer-to-top layer thickness ratio (ξ) and middle layer-to-top layer thickness ratio (ζ), and elastic modulus ratio (ρ), on the response of beam is studied. A loading rig to simulate the uniformly distributed load is designed and fabricated. The theoretical deflection and stress at the mid-sections of simply supported and hinged-hinged perfectly bonded 3-layered beams are compared with experimental values, and are found in good agreement.