REFINED THEORY FOR ISOTROPIC PLATES.

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Transactions of the Canadian Society for Mechanical Engineering
Vol. 8, Issue.1, 1984

Abstract: A new theory for the bending of plates is developed to include the effects of transverse shear, transverse normal stress and transverse normal strain. The transverse normal strain effect is incorporated by the use of a transverse displacement function w whose distribution through the thickness is explicitly obtained on physical grounds as a fourth degree function in z as opposed to second degree w functions suggested earlier by E. Reissner and by P. M. Naghdi based on mathematical considerations of the existence of epsilon //z. The theory is tested by comparison with an exact solution from the theory of elasticity. It is found to yield good results for stresses and displacements for loadings with a characteristic variation L of the magnitude of the thickness of the plate h. An interesting feature is the increasing effect of the transverse normal strain on the stress and strain distribution as the ratio h/L increases. Other features include the nonlinear distribution of bending and inplane shearing stresses through the thickness (magnified as h/L increases) and boundary conditions which are described in terms of physical stress resultants of existing plate and shell theory.