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A Higher Order Shear and Normal Deformation Theory for Functionally Graded Sandwich Beam

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Abstract : In this work, a new analytical approach using a refined theory of hyperbolic shear deformation of a beam was developed to study the free vibration of graduated sandwiches beams under different boundary conditions. The effects of transverse shear strains and the transverse normal deformation are considered. The constituent materials of the beam are supposed gradually variable depending the height direction based on a simple power distribution law in terms of the volume fractions of the constituents; the two materials with which we worked are metals and ceramics. The core layer is taken homogeneous and made of an isotropic material; while the banks layers consist of FGM materials with a homogeneous fraction compared to the middle layer. Movement equations are obtained by the energy minimization principle. Analytical solutions of free vibration and buckling are obtained for sandwich beams under different support conditions; these conditions are taken into account by incorporating new form functions. In the end, illustrative examples are presented to show the effects of changes in different parameters such as (material graduation, the stretching effect of the thickness, boundary conditions and thickness ratio - length) on the vibration free and buckling of an FGM sandwich beams.

Keywords : functionally graded sandwich beam, refined shear deformation theory, stretching effect, free vibration
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