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Abstract

This paper presents static behaviour of functionally graded (FG) sandwich beams by using a quasi-3D theory, which includes both shear deformation and thickness stretching effects. Various symmetric and non-symmetric sandwich beams with FG material in the core or skins under the uniformly distributed load are considered. Finite element model (FEM) and Navier solutions are developed to determine the displacement and stresses of FG sandwich beams for various power-law index, skin-core-skin thickness ratios and boundary conditions. Numerical results are compared with those predicted by other theories to show the effects of shear deformation and thickness stretching on displacement and stresses.

Keywords: A. Hybrid; C. Numerical analysis

1. Introduction

In recent years, there is a rapid increase in the use of functionally graded (FG) sandwich structures in aerospace, marine and civil engineering due to high strength-to-weight ratio. Since the shear deformation effects are more pronounced in these structures, the first-order shear deformation theory and higher-order shear deformation theories should be used. By using these theories, although many papers have been devoted to study static, vibration and buckling analysis of FG structures such as shells ([1]-[3]), plates ([4]-[8]), sandwich plates ([9]-[11]) and beams ([12]-[26]), only some of them are cited here. It should be noted that in these theories the thickness-stretching effect is ignored, which is especially significant for thick FG plates [27]. A quasi-3D theory, which includes both shear deformation and thickness stretching effects, assumes that the in-plane and out-plane displacements

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