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Hygro-thermal effects on vibration and **thermal** buckling behaviours of **functionally graded** beams

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Abstract

The hygro-thermal effects on vibration and buckling analysis of **functionally graded** beams are presented in this paper. The present work is based on a higher-order shear deformation theory which accounts for a hyperbolic distribution of transverse shear stress and higher-order variation of in-plane and out-of-plane displacements. Equations of motion are obtained from Lagrange's equations. Ritz solution method is used to solve problems with different boundary conditions. Numerical results for natural frequencies and critical buckling temperatures of **functionally graded** beams are compared with those obtained from previous works. Effects of power-law index, span-to-depth ratio, transverse normal strain, temperature and moisture changes on the results are discussed.

Keywords: Advanced composite beams; Hygro-thermal loadings; Buckling; Vibration.

1. Introduction

Hygro-thermal stresses arising from a variation of temperature and moisture content can affect structural responses of engineering structures. Therefore, an accurate evaluation of environmental exposure is important to investigate hygro-thermal effects on their behaviours. Owing to the low density and high stiffness and strength, composite structures become popular in several applications of aerospace, automotive engineering, construction, etc. They became more attractive due to an introduction of functionally graded (FG) materials. The general benefit of these structures compared to conventional ones is a continuous variation of hygro-thermo-elastic properties in a required direction so that interfacial issues found in laminated composite structures could be neglected.

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