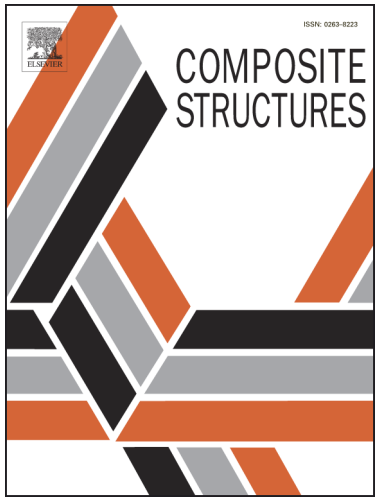

Elastostatic analysis of two-directional functionally graded beams using various beam theories and symmetric smoothed particle hydrodynamics method

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ELASTOSTATIC ANALYSIS OF TWO-DIRECTIONAL FUNCTIONALLY GRADED BEAMS USING VARIOUS BEAM THEORIES AND SYMMETRIC SMOOTHED PARTICLE HYDRODYNAMICS METHOD

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Abstract

The elastostatic behaviour of two-directional functionally graded beams (FGBs) subjected to various sets of boundary conditions are investigated for the first time by using the Euler-Bernoulli, Timoshenko and Reddy-Bickford beam theories and the Symmetric Smoothed Particle Hydrodynamics (SSPH) method. To validate the developed code, a simply supported conventional FGB problem is studied and the comparison studies are performed along with the analytical solutions and the results from previous studies. The numerical calculations in terms of maximum dimensionless transverse deflections, dimensionless axial and transverse shear stresses are performed based on different beam theories with varying gradation exponents (power-law index), different aspect ratios (L/h) and sets of boundary conditions.

Keywords: Meshless Method; Functionally Graded Beam; Bending Deflection; SSPH Method; Shear Deformation Theories

1. Introduction

One of the biggest problems that the engineers face with during the new product development process is the selecting of the proper material to be used for the engineering applications. There are many factors to be considered for the optimization of the selection process such as the cost of raw material and production, fabrication techniques, logistics, material properties, requirements of customers with severe operating conditions. For instance; the material should be hard but also ductile or the material can withstand very high surface temperature of 2000K