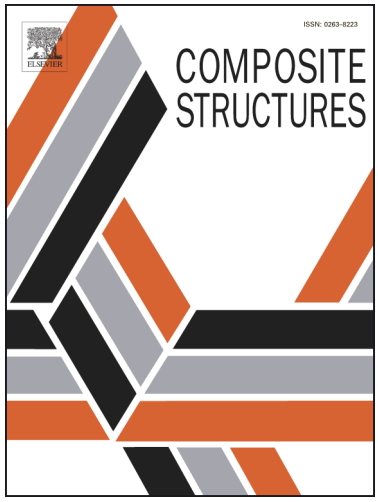

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Interactive geometric interpretation and static analysis of thin-walled bi-directional functionally graded beams

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Abstract

The paper aims to present an analysis of static behaviors and interactive geometric interpretation for modeling of thin-walled bi-directional functionally graded beams regarding monosymmetric I- and channel-sections. Several material distributions based on a typical power law are provided. The model of thin-walled bi-directional FG beams was originally developed from Vlasov's theory in which warping has been taken into account. Since the variation of constituent phases such as metal or ceramic in both longitudinal and through-the-thickness directions, properties of the thin-walled beam have considerably changed. It is shown that in each cross section, center of gravity and shear center are highly sensitive to geometries, materials and thus need to be reconsidered. For that reason the external load cannot be randomly applied. Effects of gradient parameters on the static behavior of a thin-walled bi-directional FG beam under various loadings and boundary conditions have also been parametrically studied.

Keywords: Bi-directional FGMs; Thin-walled beam; Static behavior; Computational modeling.

1. Introduction

Composite structures have been widely applied in diverse areas and play a predominant role in a variety of structures. Typically, its applications can be found in airplane flap, rockets, fuselage structures, hulls of submarines, etc. Recent years, many researches of thin-walled laminated composites [1–3] and FGMs [4, 5] have been boosted significantly by the further development and application of advanced fabrication techniques such as powder metallurgy, melt processing, automated fiber placement machines. Overcoming obstacles of cracks initiation and propagations or separation at the interface surfaces, numerous papers and techniques have been reported, e.g. Kieback et al. [6], Nemat-Alla et al. [7], Jayakumar

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