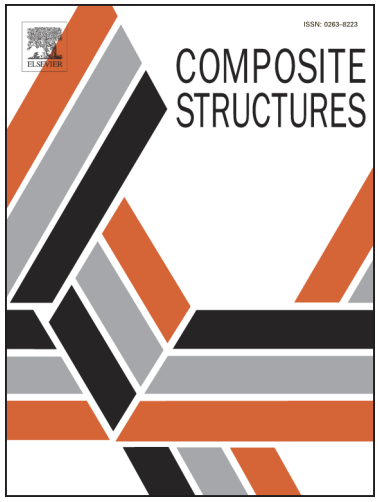

Post-buckling behavior of functionally graded circular plates under asymmetric transverse and in-plane loadings

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Post-buckling behavior of functionally graded circular plates under asymmetric transverse and in-plane loadings

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Abstract

Based on the first-order nonlinear von Karman theory, the post-buckling analysis of FG circular plates under asymmetric transverse and in-plane loadings are presented. The nonlinear governing equations are reformulated using a stress function and a boundary layer function, and solved by employing a multi-parameter perturbation technique and Fourier series method. The material properties are assumed to vary through the plate thickness according to a power-law distribution of the volume fractions of the constituents. The results are verified with the known results in the literature. The effects of loading, material properties, and boundary conditions on different response quantities are studied. It is observed that the buckling load in clamped FG plates under asymmetric in-plane loading is lower than that of the same plate under axisymmetric in-plane loading. It is concluded that under downward transverse loading, the snap buckling occurs in simply-supported FG plates with an initial considerable upward deflection caused by an in-plane load. In addition, the behavior of boundary layer in FG plates under in-plane loading is studied and compared with that in transverse loading.

Keywords: Post-buckling; In-plane loading; Asymmetric loading; Functionally graded materials; Perturbation method;

1. Introduction

Functionally graded (FG) materials, first introduced in 1984 in Japan [1], are microscopically inhomogeneous materials, whose properties vary smoothly and continuously

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