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A new approach for nonlinear buckling analysis of imperfect functionally graded carbon nanotube-reinforced composite plates

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Abstract

This paper presents an analytical approach to analyze the nonlinear static buckling of imperfect functionally graded carbon nano-reinforced composite (FG-CNTRC) plates subjected to axial compression. The material properties of the FG-CNTRC are assumed to be graded through the thickness direction according to several linear distributions of the volume fraction of carbon nanotubes. The theoretical formulations are based on the classical plate theory (Kirchhoff plate) with von Karman-type of nonlinearity and the initial geometrical imperfection. The approximate solution is developed for simply supported and freely movable boundary conditions. By applying the traditional Galerkin method and the Airy stress function, the results for the critical load are obtained in closed-form solutions, which are convenient to be used in engineering design. Some illustrative examples are also presented in details to investigate the effects of the imperfection, carbon nanotubes, and geometrical parameters on the nonlinear static behavior the plates.

Keywords: Carbon nanotube-reinforced composite; Nonlinear static buckling analysis; Airy stress function; Imperfection.

1. Introduction

The carbon nanotubes (CNTs) have been considered to be one the hottest research topics in various fields of research and technology over the past decade. Most

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