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Postbuckling behavior of functionally graded graphene-reinforced composite laminated cylindrical shells under axial compression in thermal environments

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Abstract

The current research deals with the postbuckling behavior of axially-loaded graphene-reinforced composite (GRC) laminated cylindrical shells under thermal environmental conditions. The piece-wise GRC layers are arranged in a functionally graded (FG) pattern along the thickness direction of the shells. The material properties of GRCs are assumed to be temperature-dependent and are estimated by the extended Halpin-Tsai micromechanical model. The governing equations for the GRC laminated cylindrical shells are based on the Reddy's third order shear deformation shell theory and include the effects of the temperature variation. The nonlinearity effects are taken into account in the sense of von Kármán nonlinear kinematic assumptions. The buckling loads and the postbuckling equilibrium paths for the perfect and geometrically imperfect GRC laminated cylindrical shells can be obtained by solving the governing equations with a singular perturbation technique in conjunction with a two-step perturbation approach. The results show that the buckling loads and the postbuckling strengths of the GRC laminated cylindrical shells may be enhanced through piece-wise functionally graded distribution of graphene reinforcement.

Keywords: Postbuckling; Laminated cylindrical shell; Axial compression; Nanocomposites; Functionally graded materials; Temperature-dependent properties

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