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Vibration of functionally graded carbon nanotubes reinforced composite truncated conical panels with elastically restrained against rotation edges in thermal environment

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Abstract

As a first endeavor, the vibration behavior of functionally graded carbon nanotubes reinforced composite (FG-CNTRC) truncated conical panels is studied. Panels with the elastically restrained against rotation edges under thermal environment are analyzed. The governing equations are derived based on the first-order shear deformation theory (FSDT) of shells, and are solved using the differential quadrature method (DQM). In addition to the temperature dependence of material properties, the influences of initial thermal stresses are considered. After validating the present approach, the effects of the carbon nanotubes (CNTs) distribution in thickness direction, the geometrical parameters, the elastic coefficients of the edge restraints, the temperature rise, and the initial thermal stresses on the frequency parameters are investigated. It is shown that the initial thermal stresses have significant effects on the natural frequencies and cannot be neglected. The results prove that the panels with (FG-X) and (FG-O) CNTs distributions have the largest and the smallest natural frequencies, respectively. Moreover, the critical buckling temperature rise of the panels can be extracted from the presented diagrams of the fundamental frequency parameters verses the temperature rise.

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