ABSTRACT

This study displays an analytical investigation of the influence of stiffener's geometric shape on nonlinear natural frequencies of imperfect eccentrically stiffened functionally graded material for the simply supported cylindrical panels strengthened with various forms of the stiffeners for both longitudinal and transverse directions rest on elastic foundation subject to thermal-mechanical loads.

Based on the classical shell theory with the geometrical shape of nonlinear in von Karman–Donnell means, smeared stiffeners method, and first-order shear deformation theory, the governing equations of motion are derived in order to determine the difference between these two theories.

The properties of nonlinear responses and free vibration are studied. The mechanical properties assumed to be graded smoothly and continuously toward the thickness of the cylindrical panel according to power law distribution.

The numerical approach that employs the fourth-order Runge-Kutta and Galerkin's procedure are conducted for the dynamic analysis of the shells to provide expression of non-linear dynamic responses and the natural frequencies.

The validation of the current study is gained by comparing the results with other researchers, where a very good agreement obtained in the results presented. The effect of different geometric stiffener's shape, volume fraction index, radius to thickness ratio, excitation force, imperfection, angular velocity, (FGM) thickness, elastic foundation, and finally the temperature were studied on the natural frequency and