عنوان مقاله:

Nonlinear analysis of radially functionally graded hyperelastic cylindrical shells with axially-varying thickness and non-uniform pressure loads based on perturbation theory

محل انتشار:

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خلاصه مقاله:

In this study, nonlinear analysis for thick cylindrical pressure vessels with arbitrary variable thickness made of hyperelastic functionally graded material properties in nearly incompressible state and clamped boundary conditions under non-uniform pressure loading is presented. Thickness and pressure of the shell are considered in axial direction by arbitrary nonlinear profiles. The FG material properties of nearly incompressible hyperelastic shell are graded in the radial direction with a power law distribution. Effective combination of shear deformation theory and match asymptotic expansion of perturbation theory are used to derived and solve the nonlinear governing equations, respectively. A numerical modelling based on finite element method is presented to validate the results of the current analytical solution. The effect of material constants, non-homogeneity index, geometry and pressure profiles on displacements, stresses and hydrostatic pressure distributions are illustrated for different hyperelastic material properties and case studies. This approach enables insight to the nature of the deformation and stress distribution through the thickness of rubber vessels and may offer the potential to study the mechanical functionality of blood vessels such as artificial or natural arteries in physiological pressure range.

کلمات کلیدی:

Hyperelastic FGMs, FG cylindrical shells, Variable thickness, Perturbation theory, Hyperelastic pressure vessel