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Nonlinear response and buckling analysis of eccentrically stiffened FGM toroidal shell segments in thermal environment

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Abstract. This paper presents an analytical approach to study nonlinear response and buckling analysis of FGM toroidal shell segments reinforced by FGM stiffeners surrounded by elastic foundations in thermal environment and under external pressure. The formulations are based on Reddy's third-order shear deformation shell theory (TSDT) with von Karman nonlinearity, Pasternak type elastic foundations and smeared stiffener technique. By applying Galerkin's method and using stress function, closed-form expressions for determining the static critical external pressure load and postbuckling load–deflection curves are determined. Finally, the influences of geometrical parameters, volume fraction index, elastic foundations, and the effectiveness of stiffeners on the stability of shells are considered.

Keywords: *Eccentrically stiffened FGM toroidal shell segment; nonlinear response and buckling analysis; TSDT; thermal environment; elastic foundations.*

1. Introduction

The material has variable mechanical property with international name Functionally Graded Material and often abbreviated FGM is a type of new generation composite, intelligent composite, appears as a result of actual demands for a material that can overcome the disadvantages of traditional metals and laminated normal composites. This functionally graded material is formed from two component materials of ceramic and metal in which the volume ratio of each composition varies smoothly and continuously from this side to the other side according to the structure wall thickness in order to be suitable for the characteristic strength of the component materials. This material combines the metal's advantage of high durability and the ceramic's advantage of high temperature durability, so FGM structures have many practical applications. Therefore, the problems of stability and fluctuations of FGM structures such as FGM plates and shells have