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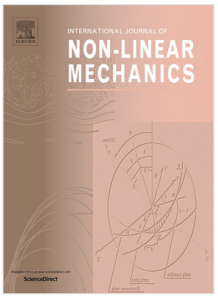

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Geometrically Nonlinear Transient Analysis of Laminated Composite Super-elliptic Shell Structures with Generalized Differential Quadrature Method

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Abstract

In this study, geometrically nonlinear dynamic behavior of laminated composite super-elliptic shells is investigated using generalized differential quadrature method. Super-elliptic shell can represent cylindrical, elliptical or quasi-rectangular shell by adjusting parameters in super-ellipse formulation (also known as Lamé curve formulation). Geometric nonlinearity is taken into account using Green-Lagrange nonlinear strain-displacement relations that are derived using differential geometry and theory of surfaces. Transverse shear effect is considered through the first-order shear deformation theory. Equation of motion is obtained using virtual work principle. Spatial derivatives in equation of motion is expressed with generalized differential quadrature method and time integration is carried out using Newmark average acceleration method. Several super-elliptic shell problems under uniform distributed load are solved with the proposed method. Effects of layer orientations, boundary conditions, ovality and ellipticity on dynamic behavior are investigated. Transient responses are compared with finite element solutions.

Keywords: Generalized Differential Quadrature, Transient Analysis, Geometric Nonlinearity, Laminated Composite, Super-elliptic Shell

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