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Three dimensional static analysis of viscoelastic FGM cylindrical panel using state space differential quadrature method

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ABSTRACT

Based on 3D elasticity theory, static analysis of viscoelastic cylindrical panel made up of functionally graded material (FGM) and subjected to transverse uniform pressure is performed. Analytical solution presented, using state space method and Fourier expansion for simply supported edges, and semi-analytical approach by state space differential quadrature method (DQM) used for other boundary conditions. Field equations are solved in Laplace domain and results are transferred back to time domain numerically by Laplace inverse technique. In this investigation relaxation modulus of panel is assumed to obey Prony series form and varies in accordance to power law along the radial direction due to inhomogeneous property of FGM across the thickness. Numerical results for elastic cylindrical panel are compared with published results to validate exactness and accuracy of the present approach. In numerical illustration displacement and stress fields are studied. Moreover, effect of relaxation time constant, boundary conditions, mid-radius to thickness ratio and power law index on bending behavior of viscoelastic cylindrical panel are investigated.

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