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The GDQ Method of Thermal Vibration Laminated Shell with Actuating Magnetostrictive Layers

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Abstract

The research of laminated magnetostrictive shell under thermal vibration was computed by using the generalized differential quadrature (GDQ) method. In the thermoelastic stress-strain equations that contain the terms linear temperature rise and the magnetostrictive material with velocity feedback control. The dynamic equilibrium differential equations with displacements were normalized and discretized into the dynamic discretized equations by the GDQ method. Two edges of laminated shell with clamped boundary conditions were considered. The values of interlaminar thermal stresses and center displacement of shell with and without velocity feedback control were calculated, respectively. The purpose of this research is to compute the time responses of displacement and stresses in the laminated magnetostrictive shell subjected to thermal vibration with suitable controlled gain values. The numerical GDQ results of displacement and stresses are also obtained and investigated. With velocity feedback and suitable control gain values are found to reduce the amplitude of displacement and stresses into a smaller value. The higher values of temperature get the higher amplitude of displacement and stresses. The GDQ results of actuating magnetostrictive shells can be applied in the field of morphing aircraft (adaptive structures and smart materials) to reduce and suppress the vibration when under aero-thermal flutter.

Keywords: magnetostrictive shell, thermal vibration, GDQ

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