Dynamics analysis of a FGM rectangular Mindlin plate undergoing large overall motion in temperature field

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Abstract

In this paper, dynamic responses and vibration characteristics of a rotating functionally graded material (FGM) Mindlin plate in the temperature field are investigated. The deformation field of the plate is described by radial point interpolation method (RPIM) based on the first-order shear deformation theory (FSDT). The Lagrange's equation of the second kind is used to derive the rigid-flexible coupling dynamics equation of the functionally graded material plate undergoing large overall motion. The results obtained with these methods are compared and validated with results found in the literature. The results show effectiveness of used numerical approach and fast convergence of obtained results to exact values. The correctness of the theoretical model is verified by comparing the present results with the reference data. The dynamic responses and vibration characteristics are studied for the rotating FGM rectangular plate with different temperature fields, angle speed, the ratio of the hub radius to the plate length, the aspect ratio and the volume fraction index. Parameter studies indicated that temperature rise and volume fraction index can reduce the natural frequencies and increase the deformation of the rotating FGM plate. Phenomena of frequency loci veering can also be observed in the plates.

Keywords: Functionally graded material plate, Radial point interpolation method, temperature field, dynamics

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