Modal Analysis of Functionally Graded Cylindrical Panel in Thermal Field

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Functionally graded materials (FGMs) is one kind of composite material accomplished by continuously varying the volume fractions in the thickness direction to obtain a predetermined profile. They have been receiving increasing attention in both research community and industry due to their excellent thermo-mechanical properties. These structures are often subjected to vibration with thermal and dynamic loadings. The loadings include large temperature gradients, thermo-elastically induced loading and dynamic pressure.

In this paper, modal analysis of functionally graded cylindrical curved plate with the edges of both ends clamped and both free in thermal environments is presented. This cylindrical panel is subjected to transverse excitations. Material properties are assumed to be temperature-dependent. The thermal effect due to one-dimensional temperature gradient is included in the analysis. The cell sheet Shell99 element model is used. The natural frequency and modal shapes of the first 8 modes of the panel are given. It can be seen that there exist the transversal, torsional and extensional vibration. The transverse vibration occur among 1,2,4,6,8 modes mainly and the torsional vibration exist among 3,5,7 modes. The results can be used for optimization design for cylindrical panel.

Keywords: functionally graded materials; cylindrical curved plate; modal analysis; ANSYS