Effect of various constraints on vibration behaviour of functionally graded circular plates under thermal environment

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Abstract

Composite materials are being tailored successfully by engineers to acquire the desired mechanical properties in one/more directions by mixing two or more materials, due to their wide applications in various technological situations. One of the sub-class of such materials known as functionally graded materials (FGMs), is recently invented in 1984. Usually, FGMs are made from a mixture of ceramics and metals. The ceramic phase offers thermal barrier effects and protect the metal from corrosion and oxidation while metallic constituent strengths the structure and prevents material failure. The study for free axisymmetric vibrations of functionally graded thin/thick circular plates subjected to non-linear temperature distribution has been presented. The top and bottom surfaces of the plate are under uniform thermal environment. The mechanical properties of the plate material are assumed to be temperature-dependent. The equations for thermo-elastic equilibrium as well as axisymmetric motion have been derived using Hamilton's principle. Employing approximate methods, the numerical values of thermal displacements from thermo-elastic equilibrium equation and frequencies from the equation of motion for the lowest three modes of vibration have been computed for clamped and simply-supported plates. The effect of the temperature difference at the surfaces together with other constraints on the frequencies has been investigated. For the validity of present considerations and the technique, frequency parameter has been compared for some special cases with published results obtained from other approximate methods

Biography:

Rahul Saini is presently working as Senior Research Fellow in the Department of Mathematics, Indian Institute of Technology Roorkee, India. He graduated in 2012 from Gurukul Kangari Vishwavidyalaya, Haridwar, India. He obtained his master's degree in Applied Mathematics in 2015 from Indian Institute of Technology Roorkee. He is also the reviewer of various International journals. Recently, he has received "Young Scientist Award" by Uttarakhand State Council for Science and Technology.

Speaker Publications:

1. Roshan Lal and Rahul Saini, "Vibration analysis of FGM circular plates under non-linear temperature variation using generalized differential quadrature rule", Applied Acoustics, 158, 107027, 2020, Q1, IF-2.28, DOI: 10.1016/j.apacoust.2019.107027.
2. Roshan Lal and Rahul Saini, "On the high-temperature free vibration analysis of elastically supported FGM plates under mechanical in-plane force via GDQR", Journal of Dynamical Systems, Measurement and Control, 141(10) 101003-1-12, 2019, Q2, IF-1.48, DOI: 10.1115/1.4043489.
3. Roshan Lal and Rahul Saini, "Thermal effect on radially symmetric vibrations of temperature-dependent FGM circular plates with nonlinear thickness variation", Materials Research Express, 6, 0865f1, 2019, Q1, IF-1.45, DOI: 10.1088/2053-1591/ab24ee.
4. Roshan Lal and Rahul Saini, "On radially symmetric vibrations of functionally graded non-uniform circular plate including non-linear temperature rise", European Journal of Mechanics / A Solids, 77, 103796, 2019, Q1,IF-2.93,DOI: 10.1016/j.euromechsol.2019.103796.
5. Roshan Lal and Rahul Saini, "Vibration analysis of functionally graded circular plates of variable thickness under thermal environment by generalized differential quadrature method", Journal of Vibration and Control, 26(1-2),73-87,2019,Q1,IF-2.86,DOI: 10.1177/1077546319876389.

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