عنوان مقاله:

Magneto-Thermo-Elastic Stresses and Perturbation of Magnetic Field Vector in a Thin Functionally Graded Rotating Disk

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خلاصه مقاله:

In this paper, a semi-analytical solution for magneto-thermo-elastic problem in an axisymmetric functionally graded (FG) hollow rotating disk with constant thickness placed in uniform magnetic and thermal fields with heat convection from disk's surfaces is presented. Solution for stresses and perturbation of magnetic field vector in a thin FG rotating disk is determined using infinitesimal theory of magneto-thermo-elasticity under plane stress conditions. The material properties except Poisson's ratio are modeled as power-law distribution of volume fraction. The non-dimensional distribution of temperature, displacement, stresses and perturbation of magnetic field vector throughout radius are determined. The effects of the material grading index and the magnetic field on the stress and displacement fields are investigated. The results of stresses and radial displacements for two different boundary conditions are compared with the case of a thin FG rotating disk with the same loading and boundary conditions but in the absence of magnetic field. It has been found that imposing a magnetic field significantly decreases tensile circumferential stresses. Therefore, the fatigue life of the disk will be significantly improved by applying the magnetic field. The results of this investigation can be used for optimum design of rotating disks.

کلمات کلیدی:

FG rotating disk, Magneto-thermo-elastic stress, Heat convection, Perturbation of Magnetic Field Vector