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خلاصه مقاله:

In this paper, the effects of different rotational speed functions in the elastic-plastic deformation and stress analysis of a rotating annular thin disk of functionally graded material (FGM) in Reddy model is studied using the analytical and FEM methods. In this regard, differential equations governing dynamic equilibrium for displacements and stresses in the elastic region of the FGM rotating disk have been derived using the theory of elasticity in plane stress condition and have been solved by the shooting method. Then, the equations governing the distribution of plastic radial and circumferential stresses on the disk have been extracted using the Prandtl-Reuss theory of plasticity and based on the Ludwig hardening law in conjunction with the von Mises yield criterion. Also, by modeling the annular thin disk in the environment of finite element software ANSYS, the results obtained from the elastic analytical solution and the finite element numerical solution have been compared to each other and to the results reported in the literature for specific cases and validated accordingly. The effects of variation of the disk geometric parameters, functionally graded material power index as well as different type of the time-dependent rotational speed functions such as the constant speed, exponential, and accelerated/decelerated linear, quadratic, and square root functions on the elastic behavior of the disk and distribution of radial displacement, and also distribution of radial, circumferential, and shear stresses on the disk have been studied. Moreover, the results of plastic analysis have been presented for distribution of radial and circumferential stresses on the disk.

کلمات کلیدی:

Annular FGM rotating thin disk, Accelerated/decelerated rotational speed, Elastic-plastic analysis, Ludwig hardening law, von Mises yield criterion

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