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Stress analysis of functionally graded rotating discs:analytical and numerical solutions

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Abstract This study deals with stress analysis of annular rotating discs made of functionally graded materials (FGMs).Elasticity modulus and density of the discs are assumed to vary radially according to a power law function, but the material is of constant Poisson's ratio. A gradient parameter *n* is chosen between 0 and 1.0. When *n*=0, the disc becomes a homogeneous isotropic material. Tangential and radial stress distributions and displacements on the disc are investigated for various gradient parameters *n* by means of the diverse elasticity modulus and density by using analytical and numerical solutions. Finally, a homogenous tangential stress distribution and the lowest radial stresses along the radius of a rotating disc are approximately obtained for the gradient parameter *n* = 1.0 compared with the homogeneous, isotropic case *n*=0. This means that a disc made of FGMs has the capability of higher angular rotations compared with the homogeneous isotropic disc.

Keywords: Functional graded materials Stress analysis Analytical analysis Finite element analysis (FEA)

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