Exact solution for functionally graded variable-thickness rotating disc with heat source

ABSTRACT

Exact elastic solutions for axisymmetric variable-thickness hollow rotating discs with heat source made of functionally graded (FG) materials under freeð free and fixedð free boundary conditions are presented. Material properties and disc thickness profiles are assumed to be represented by specified power law distributions. The effect of the heat source and the geometry of the disc on stress and displacement fields are investigated. It is found that the location of maximum radial stress owing to thermal load does not tend towards the outer surface like radial stress owing to mechanical load for freeð free FG discs with an increase in parameter m related to the thickness profile. The temperature distribution in a disc with hyperbolic thickness profile is the smallest compared with other thickness profiles. The FG disc with hyperbolic convergent thickness profile has smaller stresses because of thermal load compared with the disc with uniform thickness profile.

Keyword: Functionally graded material; Heat source; Rotating disc; Variable thickness