The present study is an attempt to investigate the steady state creep behavior of a rotating disk made of isotropic composite containing aluminum/aluminium alloy matrix reinforced with silicon carbide particles or whiskers. The creep behavior of the composite is described by a threshold stress based creep law. The creep parameters appearing in the law have been extracted from the experimental uni-axial creep data available for Al–SiCp.

In the first segment of the study, the effect of stress exponent, appearing in the creep law, has been studied on the steady state creep of a constant thickness rotating disk made of isotropic Al–SiCp composite. The stresses and strain rates have been estimated by assuming the values of stress exponent as 3, 5 and 8. The study reveals that the values of stresses and strain rates in the disk are significantly affected by varying the stress exponent. The steady state creep rates in the disk increases by about two orders of magnitude with the increase in stress exponent from 3 to 8.

The next segment of the study investigates steady state creep in a variable thickness rotating disk made of Al-SiCp. The creep stresses and creep rates have been estimated in the composite disks having linear and hyperbolic thickness profiles. It is revealed that the stresses and strain rates in the disk could be reduced significantly by varying the disk thickness profile. The composite disk having linearly varying thickness exhibits the lowest stresses and strain rates than that observed in hyperbolic or uniform thickness disk.

The third segment of the study deals with the analysis of creep behavior in a rotating disk made of functionally graded composite and having
linearly varying thickness. The content of SiCp reinforcement in the FGM disk is assumed to decrease linearly from the inner to the outer radius. The study indicates that with the increase in SiCp gradient in the disk, the radial stress increases over the entire radius, whereas the tangential and effective stresses increase near the inner radius but decrease towards the outer radius. The steady state strain rates in the FGM disk are significantly lower than similar composite disk but having uniform distribution of reinforcement. The strain rates in the FGM disk are also observed to reduce significantly with the increase in thickness gradient of the disk.

The next segment of the study presents an analysis of steady state creep in a rotating disk made of silicon carbide whiskers reinforced in a matrix of 6061Al in the presence of thermal residual stress. The yielding has been described by Hoffman’s yield criterion. The radial and tangential stresses in the disk are marginally affected by the presence of tensile residual stress. However, the presence of thermal residual stress leads to increase the steady state strain rates in the composite disk significantly.

The last segment of the study investigates the effect of transient period on long-time creep behavior of a rotating composite disk. Following the time-hardening creep law, the expressions for stresses and creep strains in the disk have been derived. The study reveals that during the transient period the tangential and radial stresses in the disk undergo a significant redistribution. The tangential strain in the disk decreases by about three orders of magnitude when the disk undergoes from initial elastic to steady state condition.