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Analysis of Secondary Stage Creep in Thick-Walled Composite Cylinders Subjected to Rotary Inertia

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Abstract : Composite materials have drawn considerable attention of engineers due to their light weight and application at high thermo-mechanical loads. With regard to the prediction of the life of high temperature structural components like rotating cylinders and the evaluation of their deterioration with time, it is essential to have a full knowledge of creep characteristics of these materials. Therefore, in the present study the secondary stage creep stresses and strain rates are estimated in thick-walled composite cylinders subjected to rotary inertia at different angular speeds. The composite cylinder is composed of aluminum matrix (Al) and reinforced with silicon carbide (SiC) particles which are uniformly mixed. The creep response of the material of the cylinder is described by threshold stress based creep law. The study indicates that with the increase in angular speed, the radial, tangential, axial and effective stress increases to a significant value. However, the radial stress remains zero at inner radius and outer radius due to imposed boundary conditions of zero pressure. Further, the stresses are tensile in nature throughout the entire radius of composite cylinder. The strain rates are also influenced in the same manner as that of creep stresses. The creep rates will increase significantly with the increase of centrifugal force on account of rotation.

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