SYNOPSIS

The present thesis comprising of five chapters deals with the transition theory of elastic-plastic and creep deformations in solids.

The fundamental concepts of Seth's transition theory of elastic-plastic and creep deformations is given in Chapter I. The need of the transition theory in continuum mechanics is stressed. The transition in continuum is identified with the degeneracy of the material or spatial strain ellipsoids. It is pointed out that this degeneracy is analytically equivalent to the asymptotic behaviour of the governing differential equations which lead to solutions corresponding to plastic and creep deformations. Seth's generalized strain measure is discussed in detail.

In Chapter II, the plastic and creep solutions of spherical shells under uniform pressure are derived. The concept of transition function is introduced. Further, it has been shown that the transition points may be multiple points. Using this concept the plastic and creep stresses in spherical shells under uniform pressure have been obtained, which agree with the classical solutions. The incompressibility condition and the constitutive equations of creep need not be assumed, but instead, follow from the analysis. In course of derivations, it is noted that the use of generalized strain measure does not necessarily imply that the problem under investigation is one of creep. As special cases, the stresses in an infinite medium with a spherical cavity under pressure and in an infinite medium subjected to uniform pressure at infinity with zero tractions on the spherical cavity are obtained. Full discussion on transition functions pertaining to spherical shells under pressure is also given.

In Chapter III, the plastic and creep stresses in cylinders under uniform pressure have been obtained by using transition functions. The stresses obtained agree well with the classical solutions. The incompressibility condition and the creep laws are not assumed. On the other hand, it is shown that the creep stresses and strain-rates, obtained by transition theory, obey the usual creep laws. As special cases, the stresses in an infinite medium with a cylindrical cavity have been obtained for different boundary conditions. The transition functions corresponding to this problem are discussed in detail.

In Chapter IV, the plastic and creep stresses in rotating disks of constant as well as variable thickness have been derived. The creep stresses agree with those obtained by Wahl using the classical theory of creep. As stated earlier, creep laws are not assumed, but the creep stresses and strain-rates obtained obey them.

In Chapter V, the problem of creep of composite spheres and cylinders under pressure has been solved. The solution obtained agree with those of classical theory of creep.