ABSTRACT

In this work, the creep and creep rupture behavior of both the spherical vessel and rotating disk, subjected to an internal pressure, are studied in details based on the local continuum damage mechanics approach using the element technique. A strained-controlled creep rupture damage law is derived from a more complex strained-dependent creep damage law. This law expresses creep damage solely in terms of creep strain, which indicates the creep strain is the only factor controlling the creep damage. Based on this one-dimensional creep damage law, a multi-dimensional creep damage law is postulated using respectively the maximum principal tensile strain criterion, the maximum principal tensile stress criterion, the maximum octahedral shear stress criterion and the mixed criterion. The solution procedure models the development of creep damage, due to the accumulation of creep strain, and involves the repetitive solution for the associated boundary-value problem, which consists of two successive time periods. While it is a typical boundary-value problem for the first period, it becomes a moving boundary-value problem for the second period. During the first period when the local value of creep damage throughout the vessel is less than a critical value, the stresses redistribute and the damage develops monotonically. During the second period, an initial rupture front propagates through the member and which leads eventually to a complete collapse. Finally, partial analytical solution for the spherical vessel is derived and used to verify the validity of the numerical results obtained.

Keywords: Creep rupture; Rupture Front

REFERENCES