

Development of Rousselier model for creep damage problems with eXtended finite element method (XFEM) approach

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Abstract

This paper contributes to the knowledge about creep by investigating creep damage behaviour by means of a modified Rousselier model using continuum damage mechanics (CDM) without need to re-mesh discontinuous elements. A modified damage model in creep using a Rousselier model will be introduced using a commercial software via a user-subroutine based on ABAQUS/ Standard module (UMAT). In addition, an extension analysis using eXtended Finite Element Method (XFEM) is required to enhance the capability of the creep damage analysis due to crack growth and propagation. Following this, the developed subroutine were being tested and validated with the analytical and other benchmark problems. As a result, good agreements were achieved in the developed model, in which indicates the capability of this model to give an accurate and precise estimation of the creep damage behaviour of material. Void volume fraction has been introduced in the model of Rousselier solution as a damage variable, in order to solve the creep damage problems. Therefore, a new variable for creep damage based on the Rousselier model was successfully developed in which to resolve the creep damage problem and to allow crack growth to take place without any remeshing.

Keypoints:Rousselier model; creep damage; XFEM; UMAT-subroutine; creep crack growth