World Academy of Science, Engineering and Technology
International Journal of Mechanical and Materials Engineering
Vol:17, No:09, 2023

A Large-Strain Thermoviscoplastic Damage Model

Authors : João Paulo Pascon

Abstract : A constitutive model accounting for large strains, thermoviscoplasticity, and ductile damage evolution is proposed in the present work. To this end, a fully Lagrangian framework is employed, considering plane stress conditions and multiplicative split of the deformation gradient. The full model includes Gurson's void growth, nucleation and coalescence, plastic work heating, strain and strain-rate hardening, thermal softening, and heat conductivity. The contribution of the work is the combination of all the above-mentioned features within the finite-strain setting. The model is implemented in a computer code using triangular finite elements and nonlinear analysis. Two mechanical examples involving ductile damage and finite strain levels are analyzed: an inhomogeneous tension specimen and the necking problem. Results demonstrate the capabilities of the developed formulation regarding ductile fracture and large deformations.

Keywords : ductile damage model, finite element method, large strains, thermoviscoplasticity
Conference Title : ICDM 2023 : International Conference on Damage Mechanics
Conference Location : Toronto, Canada
Conference Dates : September 18-19, 2023