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Three-Dimensional J-Integral and ΔJ Based on a Domain Integral Method for Finite Strain Elastic-Plastic Fracture Problems

Problems of Low Cycle Fatigue and Non-Uniform Materials

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ABSTRACT: In this presentation, we discuss a new three-dimensional J-integral based on the virtual crack extension and the domain integral method. It is the three-dimensional version of the $T^*\epsilon$ which represents the energy dissipation into a small volume surrounding the crack front, per unit crack extension. Engineering structures sometimes undergo large deformations prior to their failures. It has been pointed out that the so-called path independent property was lost because of finite rotation. To retain the path-independent property, an additional term must be included. Such formulation was presented as the $T^*\epsilon$ integral. Recently researchers proposed a new three-dimensional J-integral formulation considering the virtual crack extension. They also included the additional term. The J-integral was extended to the ΔJ to characterize crack propagation phenomena under cyclic loads. In this presentation, we will present the derivations of new J-integral and ΔJ . Some numerical examples on the evaluation of J-integral and a ductile crack propagation analysis under a large cyclic load will be shown.

BIOGRAPHY: Hiroshi Okada's has worked on the Boundary Element Method, Automobile Crash Analysis, Computational Meso-mechanics analysis such as Homogenization Method Currently, his research interests are in the field of Computational Engineering Fracture Mechanics. He has proposed efficient and accurate methodologies for the evaluations of linear and nonlinear fracture mechanics parameters from the results of finite element analysis using automatically generated mesh with the tetrahedral finite element. He and his colleagues are developing a crack propagation analysis software system. He has published more than 100 archival papers in international and domestic journals. He has made numerous international and domestic conference presentations. He was the recipient of the 2016 Japan Association for Computational Mechanics Award for Computational Mechanics.

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