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A Nonlocal Plasticity-Damage Formulation Based on the Micromechanics of Defect Growth

R.H.J. Peerlings, R.A.B. Engelen, M.G.D. Geers

Eindhoven University of Technology, Eindhoven, The Netherlands

A large-strain plasticity formulation is coupled with a damage influence in order to model damage development in ductile materials. Two damage variables are used: one which characterises the defect volume fraction and which is predominantly governed by hydrostatic stress and plastic dilatation, and one which describes the average defect shape and is particularly sensitive to shearing. Growth relations for these variables as well as the yield surface are determined from unit cell analyses of defect growth and defect extension by fitting relations whose structure is based on relatively simple mechanical assumptions. The resulting evolution laws are formulated in terms of nonlocal effective plastic strain measures, which are obtained as the solution of two additional boundary value problems. As a result, no pathological localisation and mesh-sensitivity effects are observed in applications.

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