Numerical simulation of ductil fracture problems using a weak discontinuity approach

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A finite thickness band method, for computational simulation of ductil fracture problems, is presented. The methodology is based on a Gurson constitutive material model, with material degradation defined through an evolution law of internal variables simulating the process of nucleation, growth and cavitation of micro-voids ([1] and [2]).

In order to provide a regularization of the constitutive model, and therefore, to introduce an objetive reponse for the strain localization process in the material softening regime, a finite thickness band methodology is defined, across which a weak discontinuity is developed. In this context, the thickness "*D*"of the band becomes a material parameter of the model which must be characterized, and governs the energy dissipated during the fracture process ([3]).

The weak discontinuity mode is introduced in the analysis once a material failure criterion, based on the material stability or bifurcation condition, is verifyied. This criterion also provides additional information about the crack propagation (or weak discontinuity mode) direction.

Several topics, related with the numerical implementation of the model, are additionally addressed in the presentation, such as:

- An embedded finite element technique;
- Different alternatives for determinig the fracture path across the finite element mesh: global tracking algorithm and new trends to avoid it;
- Robust numercial schemes (Impl-Ex) to perform the time integration of the model equations.

To show the numerical performance of the algorithm, a number of numerical solutions are presented. Typical bar tests (taken from[4]) are reproduced.

Bibliography

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