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Material Failure Process Simulation by Improved Finite Elements with Embedded Discontinuities

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Abstract : This paper shows the advantages of the material failure process simulation by improve finite elements with embedded discontinuities, using a new definition of traction vector, dependent on the discontinuity length and the angle. Particularly, two families of this kind of elements are compared: kinematically optimal symmetric and statically and kinematically optimal non-symmetric. The constitutive model to describe the behavior of the material in the symmetric formulation is a traction-displacement jump relationship equipped with softening after reaching the failure surface. To show the validity of this symmetric formulation, representative numerical examples illustrating the performance of the proposed formulation are presented. It is shown that the non-symmetric family may over or underestimate the energy required to create a discontinuity, as this effect is related with the total length of the discontinuity, fact that is not noticed when the discontinuity path is a straight line.

Keywords : variational formulation, strong discontinuity, embedded discontinuities, strain localization
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