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The influence of scale yielding conditions in the determination of the fracture load using both analytical and numerical approaches for the study of the elasto-static anti-plane problem of a crack in a semi-infinite strip containing a non-homogeneous zone

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Abstract : The elasto-static anti-plane problem of a crack in a semi-infinite strip containing a non-homogeneous zone was studied using two approaches. The first one consist on an analytical approach based on the solution of a Singular Integral Equation (SIE formulation) using the Dugdale-Barenblatt cohesive model and the second approach is a numerical method based on a finite element analysis using a bilinear cohesive model (FEM-CZM approach). The results were expressed in term of fracture load. The length of the developing cohesive zone ahead of the crack tip was deduced at the crack initiation. This critical length size which was normalized with the crack size is taken as a characteristic length for defining the small/large scale yielding conditions of the particular studied case. For the small cohesive zone sizes (small scale yielding conditions), the computed values of the fracture load show a small difference between analytical and numerical approaches. In the other hand for the case of large cohesive zone sizes, the obtained values of the fracture load show significant discrepancy between the two approaches.

Keywords : Crack, Singular Integral Equation, FEM, cohesive models, scalCrack, scale yielding conditions