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Computing stress intensity factors for curvilinear fractures

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ABSTRACT

Computing stress intensity factors around curvilinear fractures from numerical approximations of the elastic fields could be said to be still a largely open problem in computational fracture mechanics. Existing methods fail to provide a convergent rate >0.5, if at all. In this study, I will describe a new formulation of interaction integrals for curvilinear cracks that enable us to compute stress intensity factors around curved fractures with first and second order convergence rates, depending on the accuracy of the approximation used for the elastic fields. We verify the proposed methods through several examples including the benchmark of the circular arc crack problem as well as body force and crack face loaded problems, for which we construct analytical solutions. We further validate and showcase the robustness of the method for the simulation of curvilinear crack propagation [1] where the proposed numerical tools allow for the convergent computation of crack paths in complex fracturing problems. This study is a collaboration with Yongxing Shen, Leon Keer, and Maurizio Chiaramonte.

REFERENCE

[1] Rangarajan R., Chiaramonte M.M., Shen Y., Hunsweck M.J., Lew A.J. Simulating curvilinear crack propagation with universal meshes. *Int. J Numer Meth Engng.* (in press).