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A Discontinuous Galerkin *hp*-adaptive Finite Element Method for Accurate Brittle Crack Modelling

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One of the most difficult aspects of fracture mechanics is accurately determining the configurational force (CF) at the crack tip, this is especially important for fracture fatigue problems. In this paper the discontinuous Galerkin symmetric interior penalty (SIPG) method is used to determine the CF value at the crack tip, for small strain, linear elastic problems. We show that current methods for calculating the CF are domain dependent or unable to converge to correct solution, hence we present a novel domain independent strategy for determining the CF.

Furthermore, current mesh refinement strategies for determining the CF at the crack tip are naïve and are only able to achieve accuracies in the region of 0.01% [1]. Using the novel technique presented here for determining the CF, in conjunction with an *a posteriori* error estimator which drives an *hp*-adaptive scheme, previously unobtainable accuracies in the CF are achieved. The efficacy of the error estimator for improving the accuracy of the CF is verified against the analytical double crack problem, presented by Westergaard [2] for mode 1, 2 and mixed mode problems. The method is then used to provide benchmarks for crack tip stress intensity factors for problems with no analytical solution. Additionally domain independence is demonstrated for these more complex problems.

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