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Benefits provided by partitions of unity with high regularity in crack modeling through enrichment procedures

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ABSTRACT

The classical XFEM converges with similar rate that FEM as shown in [1] unless the enrichment is applied in a fixed area independently of the mesh parameter h and requiring some treatment in the transition zone. Thus, in order to achieve better convergence rates more DOF is generated due the larger amount of nodes enriched. In this work, it is shown that improvements may be obtained performing enrichment over PoU with higher regularity. Mesh-based smooth PoU can be built through the so-called C^k-GFEM framework of [2] over which appropriate enrichments can be applied. Approximation capabilities are investigated via convergence analysis of h and p versions considering global measures. Severity crack parameters are also computed in order to verify the local quality of the approximations. For this purpose, the Eshelbian mechanics provides a simple and convenient way to obtain configurational forces [3], that are related to the $\mathcal{J}$-integral [4], through post-processing the computed displacement field and not demanding field decomposition method in case of mixed mode cracks. The performance of the smooth approximations is compared to the C^0 counterparts built using conventional FEM-based PoU.

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