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ISOGEOMETRIC METHOD FOR COHESIVE FRACTURE ANALYSIS

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The computational modelling of crack propagation is of crucial importance for the assessment of structural integrity. In contrast to purely brittle fracture, the failure process in quasi-brittle materials takes place in a finite zone where normal and shear tractions can be transferred across the crack surfaces due to interlocking and friction. The cohesive zone model introduced by Dugdale and Barenblatt is commonly employed to model the process zone. It is easily incorporated in a finite element formulation, especially when the crack path is pre-defined, such as in delamination of composite structures. In general, the challenge of implementing a cohesive zone model lies in the description of internal crack interface. Over the past decades, various discretisation technologies have been presented to capture the crack interface, such as interface elements and embedded discontinuities. Recently, isogeometric analysis (IGA) has also been introduced in the crack propagation analysis [1, 2]. Advantages of IGA are that it accurately predicts the structural response, and that the stress does not oscillate around the crack tip.

In this contribution, we will employ locally refined (LR) T-splines for cohesive crack modelling without a pre-defined interface. In the analysis, the crack is introduced by meshline insertions in the LR T-mesh, which yields $\mathcal{C}^{-1}$ continuous basis functions. To implement the method in existing finite element programs, Bézier extraction is employed. It is adopting an element-wise point of view for the crack propagation and extension. A detailed description is given how the cohesive crack path is inserted and how the domain is reparameterized after insertion. The accuracy of the approach to model free crack propagation is demonstrated by several numerical examples, including an L-shaped beam, a SEN beam, and the Nooru-Mohamed concrete panel.

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