

## **The eXtended Finite Element Method: State of the Art and Challenges Ahead**

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### **ABSTRACT**

After basically 10 year or so of existence, this is probably a good time to take a look back at the extended finite element method (X-FEM). Since the initial papers devoted to the growth of a crack without remeshing using the partition of unity, many improvements have been proposed by several researchers. The method is now mature to model and grow 2D cracks and close to mature for 3D cracks in linear elastic fracture mechanics. The different steps to reach maturity with a better understanding of integration, convergence and conditioning issues will be detailed.

Then, we will discuss the use of X-FEM for nonlinear fracture mechanics. In particular, the transition from damage to fracture is currently a very active area of research.

Finally, we will sketch the current extent of applications of the X-FEM. Initially introduced for fracture mechanics, the X-FEM method has indeed dramatically increased its area of application in computational science. The success of the extension is the genericity of the enrichments proposed as well as the coupling with level set methods.