

## Contact modeling based on the lagrangian method with the Stable Generalized Finite Element Method (SGFEM)

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### ABSTRACT

The Generalized or eXtended FEM (GFEM/XFEM), developed intensively in the past 15 years, has become a competitive tool for the solution of problems with evolving discontinuities and singularities. In the present study, we focus on the application of GXFEM/XFEM on contact problems in the context of fracture mechanics. One of the main approaches in the literature counting for this problem is with Lagrangian multipliers. Meanwhile, as pointed out in [1], a naive choice for Lagrangian multiplier space leads to oscillatory multipliers on the contact surface. This oscillation results from a non-uniform but mesh-dependent inf-sup condition [2]. Lots of effort has been done in the literature to improve this approach by establishing an appropriate Lagrangian multiplier space. Here, we propose an alternative to consider contact problem during crack propagation, combining the algorithms presented in [2] and [3]. By using the classic enrichment functions of GFEM/XFEM [4], the combined algorithm can provide stable Lagrangian multipliers on the crack surface in 2D and 3D. Nevertheless, we observe local oscillation at the crack tip. We show evidences that this oscillation can be considerably reduced via the application of enrichment functions of Stable GFEM(SGFEM) proposed by Gupta et al.[5], which is illustrated in Fig.1. These developments provide scientific and technical bases for the simulation of crack propagation in more complex circumstances e.g. under compressive residual stress.

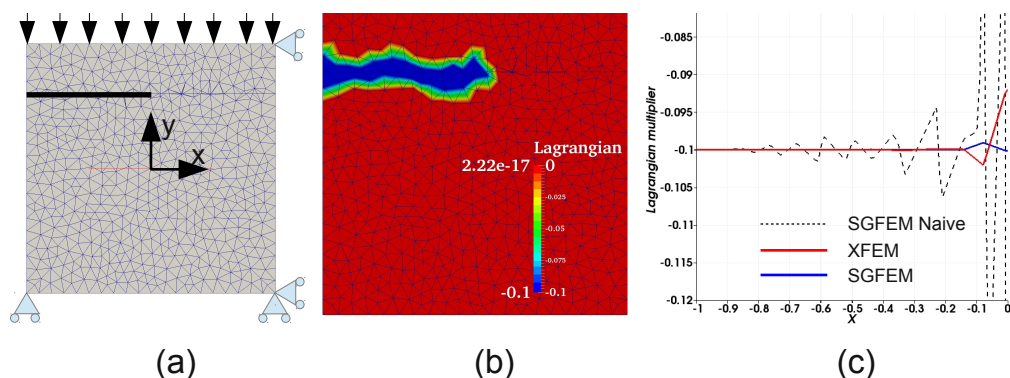


Figure 1: Comparison between XFEM and SGFEM in the context of a contact problem using Lagrangian multipliers; (a) the illustration of a square sample with a crack inside (described by the thick black line) under a uniform compressive load; (b) simulation result of SGFEM; (c) Lagrangian multiplier along the contact surface.

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