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A local/global non-intrusive coupling approach for localized crack growth simulation

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ABSTRACT

The question of the inclusion of a crack and its propagation in a finite element (FE) model initially not intended for this, is a question which is still today the subject of numerous studies. A special effort is dedicated to the development of tools increasingly generic, flexible and simple to implement and to use. In this sense, X-FEM has achieved a first step towards clearly less intrusive simulation of fracture problems.

To reduce further this intrusiveness, a new family of non-intrusive coupling algorithms has recently been intiated by *Gendre et al.* [1]. Theses methods are dedicated to global FE model solved by a blackbox software in which a local phenomena (plasticity (1] or localized loading [2]) appears, that the global model is not able to account for. The idea is to develop a local/global coupling algorithm while avoiding any modification of the industrial code used to simulate the global problem.

These coupling algorithms have been originally based on domain decomposition (DD) solvers [1,2]. Here an alternative algorithm based on a localised multigrid algorithm [3] is proposed for the simulation of mixed-mode crack propagation, while respecting the constraint of non-intrusiveness of the global problem [4]. For the global model, the contribution of the local patch consists in additional nodal efforts near the crack, which makes it compatible with most softwares. The shape of the local model is also adapted automatically during mixed mode propagation.

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