A localized multigrid non-intrusive coupling approach for mixed mode crack propagation.

Jean-Charles PASSIEUX, ICA, Univ. de TOULOUSE

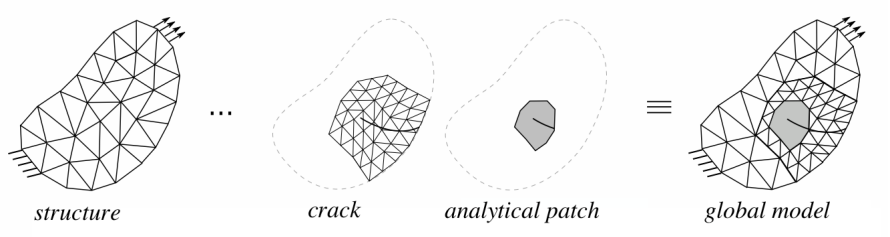
Anthony GRAVOUIL, LaMCoS, INSA de LYON, IUF

Julien RÉTHORÉ, LaMCoS, INSA de LYON

Marie-Christine BAIETTO, LaMCoS, INSA de LYON

Mots-clés : Williams series expansion, localized multigrid, mixed mode crack propagation, eXtended Finite Element Method

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 initiated by Gendre et al. [1]. The idea is to develop a local/global coupling algorithm while avoiding any modification of the industrial code used to simulate the global problem [2].



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 and it allows a direct extraction of fracture parameters from a truncated Williams serie. Extension to the three-dimensional case is in progress [5].

Références

[1] L. Gendre, O. Allix, P. Gosselet, *Non-intrusive and exact global/local techniques for structural problems with local plasticity*, Computational Mechanics, Vol. **199**, 1287–1296, 2010.

[2] A. Lozinski, O. Pironneau, *Numerical zoom for localized multiscales*, Numerical Methods for Partial Differential Equations, Vol. **27**, 197–207, 2011.

[3] J.-C. Passieux, A. Gravouil, J. Réthoré, M.-C. Baietto, *Direct estimation of generalized stress intensity factors using a three-scale concurrent multigrid X-FEM*, Int. J. Numer. Meth. Engrg., Vol. **85**, 1648–1666, 2011.

[4] J.-C. Passieux, A. Gravouil, J. Réthoré, M.-C. Baietto, *Local/global non-intrusive crack propagation simulation using a multigrid X-FEM solver*, Computational Mechanics, 2013.

[5] C. Roux, A. Gravouil, J. Réthoré, M.-C. Baietto, *3D Direct Estimation of stress intensity factors (Ki) Finite Element Method : DEK-FEM*, ECCOMAS International Thematic Conference, XFEM 2013 , Lyon, France, 11-13 September 2013.

Jean-Charles PASSIEUX, Université de Toulouse, Institut Clément Ader (ICA), 135 av. Rangueil, 31077 Toulouse Cedex, France
passieux@insa-toulouse.fr