

A non-intrusive multi-scale strategy for a mixed domain decomposition method for contact problems

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ABSTRACT

Non-overlapping domain decomposition methods have been developed for more than 20 years to tackle with huge models resulting in large number of degrees of freedom. Methods based on the primal [1] or dual [2] Schur complements lead to powerful linear iterative solvers which can be embedded inside nonlinear solvers. In the presence of contact either the DD-interface must avoid the contact zone [6] or the DD formulation must be reworked [4]. Mixed approaches, and in particular the latin method [3], offer the opportunity of a much more intimate handling of the nonlinearity within the DD formulation.

However the implementations of domain decomposition in commercial software are still limited due to the intrusive nature of these methods. The objective of our study is to propose a derivation of the Latin approach suited to commercial software. In practice, the method is implemented within a python script driving instances of Code_Aster.

The Latin formalism is especially adapted to deal with the non-linearities [3]. The equations are separated in two groups : one with the linear equation, the other one with non-linear equations. It permits to compute iteratively solutions respectively within the two groups of equations by the definition of search direction to move from a group to the other. At the end of the algorithm the solution verified the two groups of equations and therefore the global problem.

In our presentation a non-intrusive formulation of the Latin domain decomposition with contact problem on interfaces will be described. In particular, we propose a new implementation of the mixed condition which is adapted to commercial software without Robin conditions. Moreover a new interpretation of the multi-scale approach [5] is proposed. This multi-scale approach is now seen as a natural correction of the mono-scale one. This multi-scale approach is also coupled with a quasi-static formulation permitting to treat contact problems and assemblies. First numerical results for 2D and 3D assemblies with contact will be presented.

References

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