

Adaptive Simultaneous-FETI: scalability results, robustness assessments and application to finite displacement problems

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ABSTRACT

Classic Domain Decomposition methods like FETI are known to slowly converge when applied to real engineering problems involving for instance, automatic partitioning, quasi-incompressible materials or large heterogeneities. To ensure robustness in those cases, the Simultaneous-FETI (S-FETI) algorithm was recently proposed [1] as an alternative to GENE0 approaches [2] where an augmentation space is preprocessed by solving a generalized eigenvalue problem.

The S-FETI method is essentially a multi preconditioned conjugate gradient that exploits the additive structure of the preconditioner. At each iteration, the S-FETI algorithm generates as many search directions as there are domains in the decomposition.

In this contribution, the parallel scalability and the robustness of the S-FETI method are assessed. Then, observing that the search space may be oversized in some cases, an adaptive variant is introduced. At each iteration, the Adaptive Simultaneous-FETI (AS-FETI) tries to compose the smallest search space which ensures a sufficient decrease of the residual. The theoretical result driving the adaptivity process was lately proven by one of the authors [3]. Finally, slight modifications allowing SFETI to deal with large displacement finite element problems are proposed, and we present the application of these methods to real engineering tests cases.

References

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