A dual Domain Decomposition solver for analyzing non-conforming multipatch Kirchhoff–Love models based on Mortar coupling

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ABSTRACT

Geometric modeling inevitably generates models with multiple patches that intersect in a non-conforming way. The generation of analysis suitable models with, for example, matching parametrization can be a cumbersome task. Thus, instead of spending a lot of effort to generate matching meshes, one can use advanced numerical tools to perform directly the analysis on non-conforming multipatch models. Regarding the imposition of the interface coupling conditions, efficient methods enable now to analyze elaborate shell structures with multiple non-conforming patches [1, 2]. Especially, we apply in this work a Mortar method for the coupling of non-conforming Kirchhoff–Love shells [3]. Interestingly, there exist a close link between the Mortar coupling and an efficient class of solvers for large-scale systems, namely the non-overlapping Domain Decomposition Methods. The additional degrees of freedom coming from the Lagrange multiplier field enable to formulate an interface problem, known as the one-level FETI problem [4, 5]. The interface problem is solved using an iterative solver where, at each iteration, only local quantities defined at the patch level (i.e. per sub-domain) are involved which makes the overall algorithm naturally parallelizable. We study the preconditioning step in order to get an algorithm which is numerically scalable. Several examples ranging from simple benchmark cases to semi-industrial shell problems highlight the great potential of this developed dual Domain Decomposition solver.

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