Towards Global-Local Separated Representations in Arbitrary Non-Cartesian Domains

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ABSTRACT

The Proper Generalized Decomposition (PGD) framework was proposed in former works by the authors, in order to calculate high-fidelity solutions of 3D models defined in degenerated domains while keeping a computational complexity characteristic of 2D solvers. However the techniques proposed were only valid for cartesian geometries and too intrusive in terms of the software implementation, consequently, difficult to integrate into existing simulation platforms.

In this study, using a FEM mesh as a starting point, the PGD is employed as a solver in order to perform non-intrusive global-local separated representations. This method consists in the particularisation of a local solution (obtained in a generic subdomain) along the whole domain, which can be carried out by enriching this solution on each partition of the domain.

Thus, this approach can be considered as a Non-Intrusive PGD procedure, but also as a Domain Decomposition method. The use of Domain Decomposition techniques involving the PGD reduces considerably the computational cost, as the problem is solved in each subdomain while ensuring the continuity of the solution at the interfaces. Moreover, this new procedure is not associated with geometrical constraints, allowing the performance of separated representations in arbitrary non-cartesians domains to be fulfilled.

Key words: PGD, Separated representations, Model Reduction, Degenerated domains, Iterative solvers

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