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Talk announcement

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Tuesday, March 10, 2020
15:30, S2 416-1

A Discontinuous Galerkin Dual-Primal Isogeometric Tearing and Interconnecting Method with Inexact Local Solvers

Isogeometric discretizations of partial differential equations often lead to large-scale linear systems. A class of methods that provide efficient solution strategies for those systems are iterative substructuring methods. We propose a Dual-Primal Isogeometric Tearing and Interconnecting (IETI-DP) method which was introduced in [1] and further analyzed, e.g., in [2]. Usually, the local subproblems in IETI-DP are solved with sparse direct solvers. If the local subproblems are very large or if a high polynomial degree is used single processors could run out of memory. In such a case iterative solvers are superior to sparse direct solvers regarding the memory requirement. To obtain fast solvers for Isogeometric Analysis (IgA) the tensor product structure of the involved spaces should be exploited. For continuous Galerkin discretizations the local problems have tensor product structure and fast tensor product based preconditioning techniques can be used, cf. [3]. In case of discontinuous Galerkin discretizations in IgA the local problems do not have tensor product structure. To circumvent this issue, we propose a preconditioner that is based on an additive Schwarz approach by splitting the local spaces into two subspaces. One subspace corresponds to the inner degrees of freedom were the tensor product structure can be exploited using the fast diagonalization method. In the second subspace we solve a small problem which corresponds to an edge in 2D. We investigate the solvability of the local problems with inexact solvers and we provide numerical examples.

References

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[2] Hofer, C., and Langer, U. Dual-Primal Isogeometric Tearing and Interconnecting Methods. In Contributions to Partial Differential Equations and Applications, ed. by B. N. Chetverushkin et al., Springer-ECCOMAS series "Computational Methods in Applied Sciences", vol. 47 (2019), pp. 273–296.

[3] Hofer, C., Langer, U. and Takacs, S. Inexact Dual-Primal Isogeometric Tearing and Interconnecting Methods. In: Domain Decomposition Methods in Science and Engineering XXIV, ed by Bjørstad P. et al., DD 2017. Lecture Notes in Computational Science and Engineering, vol. 125 (2018), pp. 393–403, Springer, Cham