# A domain decomposition method with inexact local solvers for isogeometric multi-patch geometries

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Isogeometric Analysis (IgA) is a powerful technique that extends the classical finite element method. IgA allows to make numerical simulations in complex geometries, that are usually described through a multi-patch spline or NURBs parametrization. In this talk we focus on the numerical solution of large isogeometric compressible linear elasticity problems in multi-patch domains, defined as the union of several patches. We present the isogeometric version of the All-Floating Finite Element Tearing and Interconnecting (AF-FETI) method, a non-overlapping domain decomposition method, introduced in [2] as a variant of the classical FETI method. In AF-FETI the computational domain is divided into several non-overlapping subdomains, that in our case coincide with the isogeometric patches, each endowed with a local problem. Both the continuity of the solution through the patches and Dirichlet boundary conditions are weakly imposed by introducing a set of Lagrange multipliers. We consider a saddle point formulation that allows to employ inexact solvers for the local problems. In our approach the local problems are possibly large, but they can be efficiently tackled with an inexact solver based on the Fast Diagonalization (FD) method. Indeed, the AF-FETI formulation yields the Sylvester-like structure that we need to use FD as local solver, even if a $(d-1)$-dimensional face of the patch is not wholly associated with a single kind of boundary condition, or it does not wholly touch the boundary of other patches. To show the potential of our approach, we compare numerically the performance of inexact FD-based local solvers with the performance of their exact version. Our results indicate that the inexact approach requires orders of magnitude less time than the exact one. Moreover, its performance does not deteriorate as the degree $p$ is increased. This presentation is based on [1].

## References

[1] M. Bosy, M. Montardini, G. Sangalli, and M. Tani. *A domain decomposition method for Isogeometric multi-patch problems with inexact local solvers,*, Comput. Math. Appl., 80, (2020), 2604–2621.

[2] C. Pechstein. *Finite and boundary element tearing and interconnecting solvers for multiscale problems*, Springer Science & Business Media, 90, 2012.