Dual-Primal Tearing and Interconnecting of Domains in Comparison to All-floating Approach

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Master's thesis
Study field: Computational Engineering | Computer Science | Electrical Engineering | Mathematics
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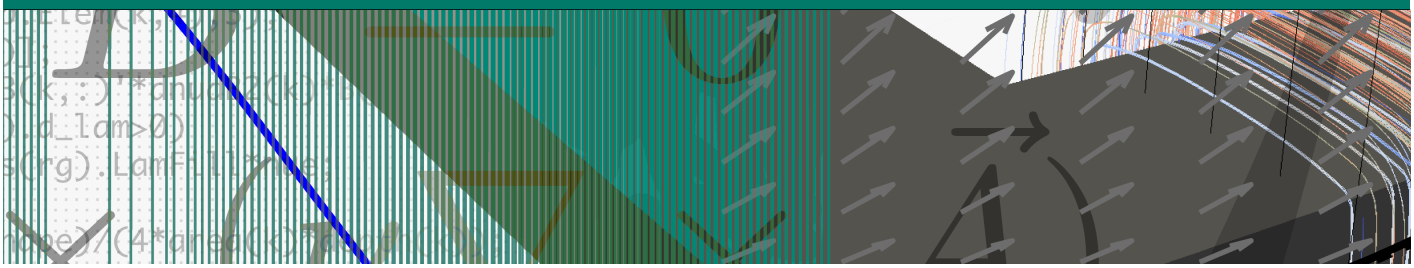

Description

CREATOR
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Parallelizable domain decomposition approaches gain attention due to an increase in parallel computation power. Hence, it is interesting to expand the well-established Finite Element Tearing and Interconnecting (FETI) method by different basis functions and more general coupling settings. Currently, we want to apply a variant based on IsoGeometric Analysis (IGA) and mortaring to efficiently simulate electrical machines in 3D. This thesis contributes to the goal by exploring different approaches to crosspoint modification, solver structures and preconditioning. In this context, we want to differentiate between dual-primal and all-floating methods.

In the all-floating (or total) approach, Dirichlet boundary boundary conditions are enforced weakly in addition to the coupling constraints. One additionally requires coupling modifications as in Fig. 1 to obtain a solvable discrete system.

For dual-primal FETI, one enforces the coupling conditions in a strong sense at crosspoints and Dirichlet boundaries (see Fig. 2). Additionally, boundary conditions are considered in a more usual way.

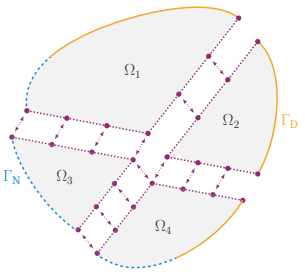

Fig. 1: Coupling in all-floating setting.

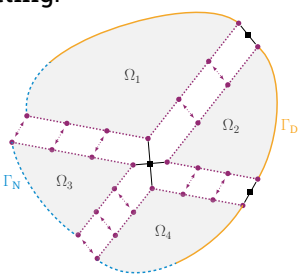

Fig. 2: Coupling in dual-primal setting.

Work plan

- Explore both approaches analytically and in literature
- Implement corresponding modifications (general system is provided)
- Compare both approaches numerically (with suitable solvers)

Prerequisites

Programming experience (`Matlab/Python`), interest in and experience with numerical methods for PDEs, interest in numerical analysis

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