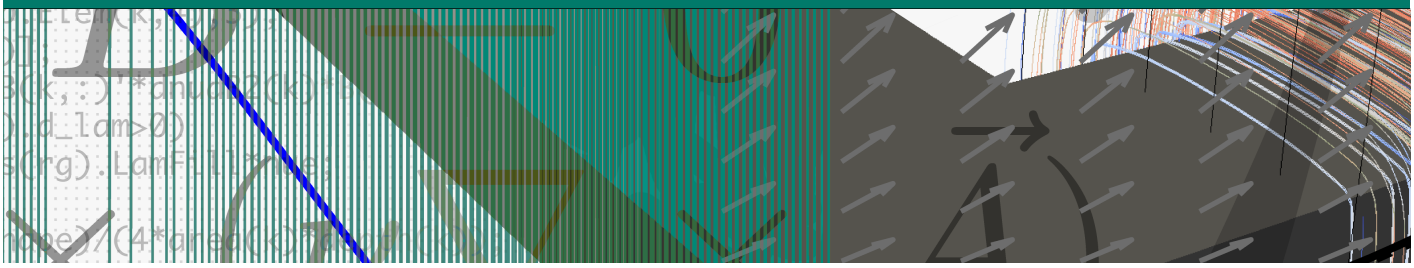
Domain Decomposition Methods for the Helmholtz Equation

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis
Study field: Computational Engineering | Electrical Engineering | Mathematics
March 18, 2026



Description

The thesis aims to explore non-overlapping domain decomposition methods with optimized transmission conditions for high-frequency Helmholtz problems. Students should first derive the Helmholtz formulation and test methods on a simpler model problem. Successful approaches transition to Helmholtz for a prototype proof-of-concept solver in C++ or Python using an FEM library. Model problem experiments analyze convergence behavior; Helmholtz experiments focus on proof-of-concept if performed. Optional: modelling of application examples and/or numerical algorithm analysis.

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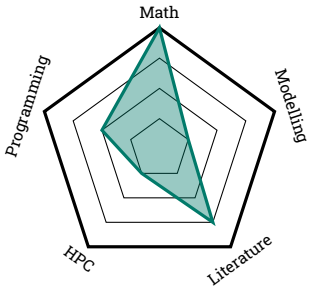

Prerequisites

- Interest in a mathematical topic
- Familiarity with numerical methods for PDEs
- Knowledge in C++ or `Python` and Scientific Computing are beneficial but not required

References

[1] C. Pechstein, "A Unified Theory of Non-overlapping Robin–Schwarz Methods: Continuous and Discrete, Including Cross Points" in 2023, *Journal of Scientific Computing*, DOI: 10.1007/s10915-023-02248-9

[2] A. Modave and T. Chaumont-Frelet, "A hybridizable discontinuous Galerkin method with characteristic variables for Helmholtz problems" in 2023, *Journal of Computational Physics*, DOI: 10.1016/j.jcp.2023.112459

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