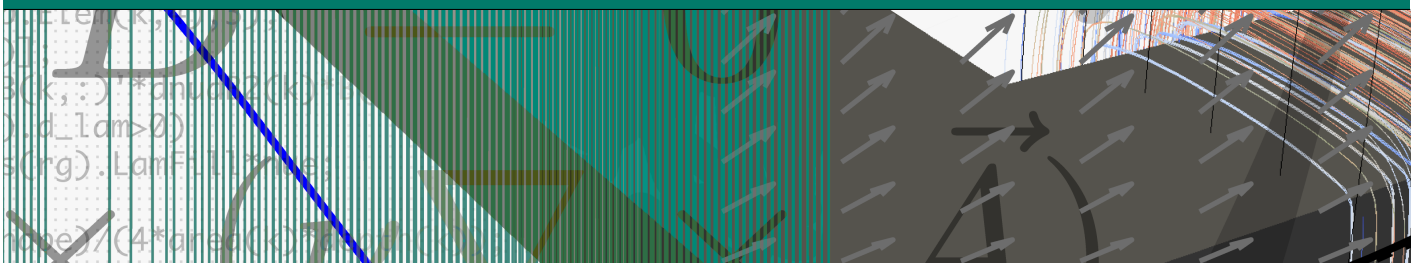
Parallel-in-Time Simulation of Electromagnetic Energy Converters

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis | Seminar topic
Study field: Computational Engineering | Electrical engineering | Mathematics



Description

Time domain simulations of electromagnetic energy converters using the standard sequential time integration approach are often quite computationally expensive due to the need of a very fine resolution along the time axis. Parallelization methods such as the Parareal algorithm have recently become a powerful acceleration tool because of their capability to distribute the workload among several processing units. This work aims at the exploitation of Parareal within the magnetoquasistatic computations, e.g., for simulation of induction motors in the time domain.

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Work plan

- Literature study on time parallelization using Parareal
- Implementation of the considered numerical algorithms
- Evaluation of the obtained results compared to the existing approaches

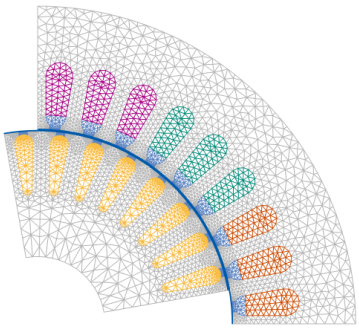

Figure 1: Finite element model of an induction motor

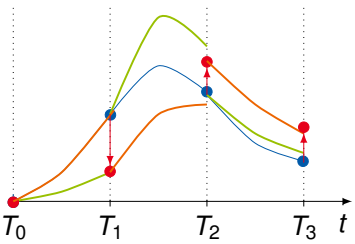

Figure 2: Parallel-in-time solution using Parareal

Prerequisites

Basic knowledge of the finite element method and numerical time integration, good programming skills in MATLAB, interest in computational electromagnetism

References

[1] M. J. Gander and S. Vandewalle, *Analysis of the Parareal Time-Parallel Time-Integration Method*, SIAM J. Sci. Comput., 29 (2007).

[2] S. Schöps, I. Niyonzima and M. Clemens, *Parallel-in-Time Simulation of Eddy Current Problems using Parareal*, IEEE Trans. Magn., 54 (2018).

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