Magneto-Mechanical Coupling of an Electric Motor with Isogeometric Finite Elements

TECHNISCHE UNIVERSITÄT DARMSTADT

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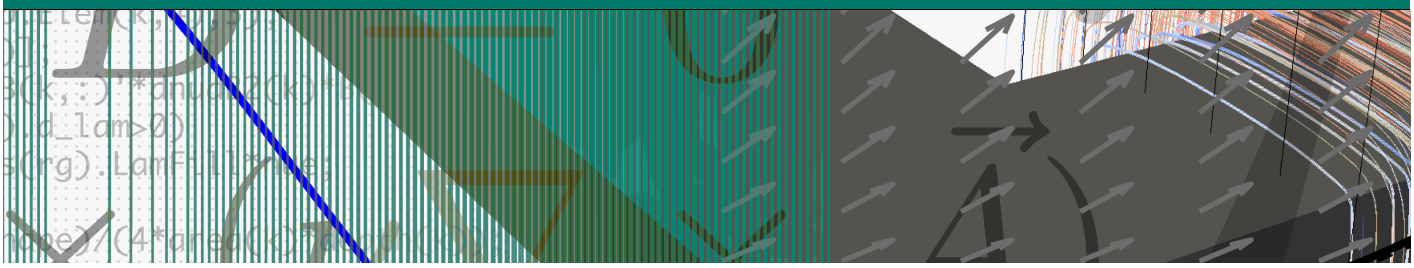

Description

The need for higher energy efficiency and decarbonization give rise to a steadily increasing importance of electric drives. Simulations allow the physical limits to be pushed in order to increase the power density and make motors more cost-efficient.

This work aims to investigate the influence of mechanical stresses in electric motors on the electromagnetic behavior and find out how stress dependent material properties can be mitigated or exploited. Simulations are performed in an Finite Element (FE) framework using Isogeometric Analysis (IGA), which allows to exactly represent the geometry. This enables an efficient coupling of the geometric, magnetic and mechanical systems.

Work plan

- Study of GeoPDEs, Matlab's implementation of Isogeometric Analysis
- Familiarizing with the existing motor implementation
- Coupling of the electromagnetic and mechanical system with stress and field dependent material properties

Prerequisites

- Fundamentals of the Finite Element Method
- Programming experience in Matlab or Python
- Prior knowledge in either mechanics or electromagnetism is helpful

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CREATOR
COMPUTATIONAL ELECTRIC MACHINE LABORATORY

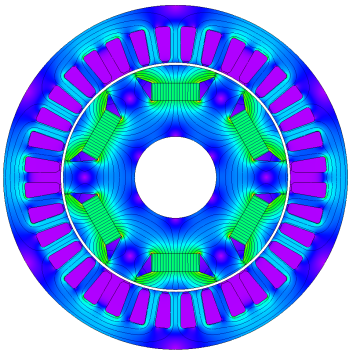

Figure 1: Model of a permanent magnet synchronous motor.

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