Multiphysical simulation of High Temperature Superconducting (HTS) coils

TECHNISCHE UNIVERSITÄT DARMSTADT

Proposal for a Bachelor's thesis | Master's thesis
Study field: Computational Engineering | Electrical Engineering
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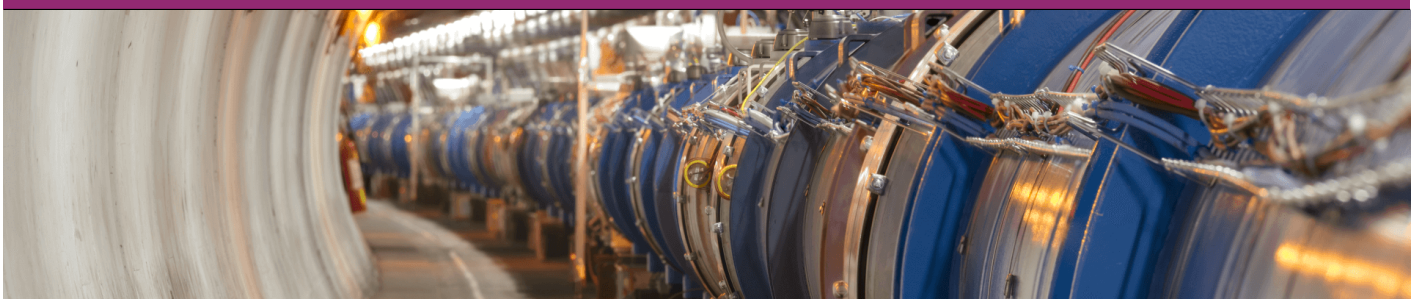

Description

High-temperature superconductors (HTS) are essential for high-field applications like particle accelerators. Their nonlinear material properties and strong dependence on temperature and magnetic fields make simulations challenging. Accurate modeling is crucial for optimizing HTS conductor designs.

This thesis aims to implement an electromagnetic simulation of HTS conductors in COMSOL Multiphysics or CST Studio Suite using the T-A or H-ϕ formulation. The focus is on analyzing magnetic field and current distribution under realistic conditions. Depending on the scope, mechanical stress from Lorentz forces may also be investigated to assess coil stability.

Tasks

- Literature research on the physical properties and numerical modeling of HTS conductors.
- Implementation of a numerical model for HTS conductors in COMSOL or CST utilizing the T-A or H-ϕ formulation.
- Analysis and visualization of the magnetic field and current distributions under operating conditions.

Prerequisites

Joy in programming, interest in numerical methods and field simulation, solid knowledge of the basics of electrodynamics and physics

Contact:
Lennard Langerbein M. Sc.
lennard.langerbein@tu-darmstadt.de
Office: S2|17 217
Schloßgartenstraße 8

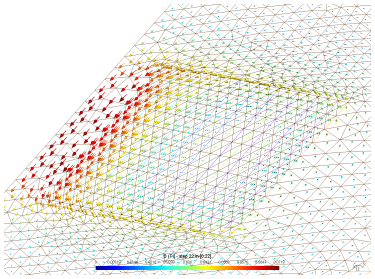

Figure 1: Magnetic field B of a HTS coil consisting of $N = 20$ turns.