Universität Stuttgart
Institut für Elektrische Energiewandlung

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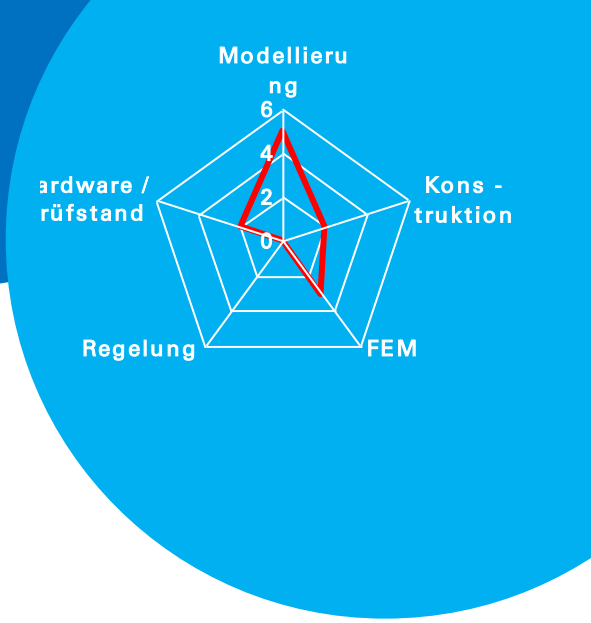

Development of a Lumped Parameter Thermal Network for a Transverse Flux Permanent Magnet Synchronous Machine

The TFPMSM under study is characterized by its transverse flux path, which allows for a low copper loss at higher torques compared to conventional machines. To quantify this advantage, the effects on the motor temperatures will be investigated.

The Lumped Parameter Thermal Network (LPTN) model accurately predicts temperatures with less computational effort than FEA. The machine's geometry is discretized into a network of thermal resistances and capacitances, with each parameter representing parts like the stator, rotor, windings, and magnets. Heat sources such as copper, iron, and magnet losses are included.

This work aims to develop a LPTN for a transverse flux permanent magnet synchronous machine to enhance thermal management and performance prediction during an optimization routine. The LPTN model, validated through experimental data or finite element analysis (FEA), offers a practical tool for predicting temperature distributions and optimizing machine design for improved efficiency and reliability.

Student profile:

- Basic knowledge in the field of electrical machines
- Experience with Matlab / Simulink / PLECS / COMSOL is a plus
- Structured, independent and thorough way of working

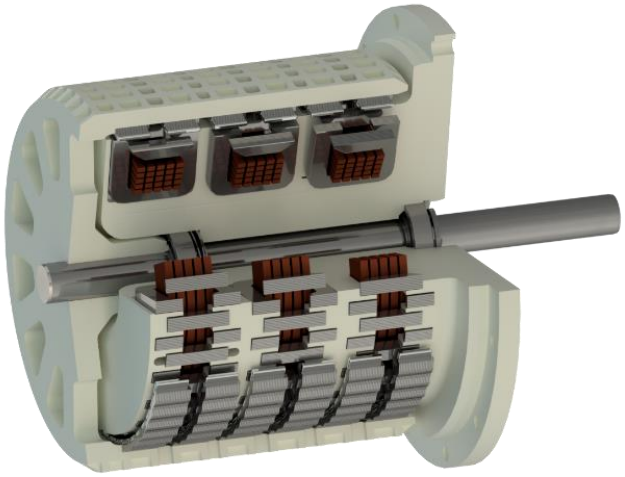

Fig. 1: Sectional view of the investigated Transverse Flux Machine

Potential work packages:

- Familiarization with the topic, software, and literature
- Creation of loss maps in dependence of operating points
- Development of the LPTN with parametric geometric input
- Model validation and fitting either by
  - FEA model or
  - Measurements (depending on status of prototype)
- Sensitivity analysis and derivation of guidelines for an optimal design
- Detailed, orderly documentation and code preparation

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