Universität Stuttgart
Institut für Elektrische Energiewandlung

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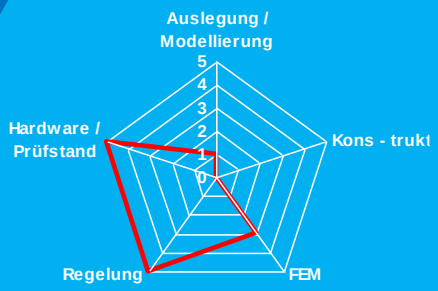

Investigation of Loss Shifting between Stator and Rotor for Inductive Electrically Excited Synchronous Machines

Inductive electrically excited synchronous machines (iEESM) allow a very precise control of losses due to the adjustable rotor flux. This leads to new possibilities in the torque control strategy beyond the well known maximization of the total machine efficiency. Instead, for certain situations in the operation of EESMs in electric vehicles, the copper losses can be shifted between the stator and rotor windings. This could be helpfull when the rotor windings are heating up too quickly: By shifting the losses more to the stator, the rotor winding temperature is limited.

In this work, a detailed study of loss shifting is conducted. Reduced order models of the EESM (existing), the wireless power system and the inverter (exisiting) as well as a thermal network of the EESM (from Ansys MotorCAD) are joint together to a system simulation in Matlab Simulink. With this model, a suitable loss shifting strategy is developed. If there is enough time, the loss shifting strategy is deployed on the testbench, with a real iEESM prototype developed at IEW.

Student profile:

- → Self reliant and high interest in control of electric drives
- → Basic knowledge in torque control strategies of electrical machines (e.g. MTPA)
- → Ideally attended the lectures Electric Machines 1/2

Tasks:

- → Literature research of torque control and loss shifting strategies for EESM
- → Familiarize with MotorCAD thermal simulations and export to Simulink
- → Development of system simulation model of iEESM drive including thermal model
- → Design and analysis of various loss shifting strategies with simulation model
- → If enough time: Deployment and verification of loss shifting strategy at test bench

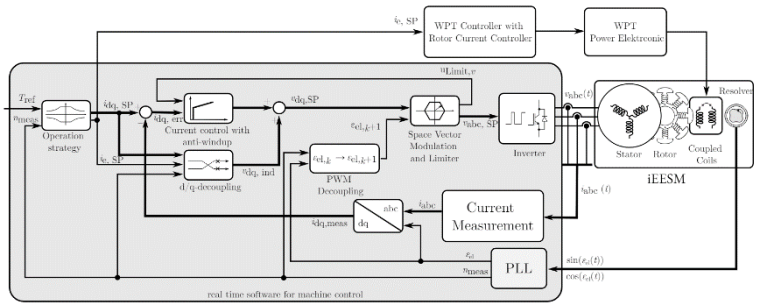

Fig. 1: Exemplary overview of iEESM drive

Ansprechpartner: Andreas Gneiting, Felix Burkard

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