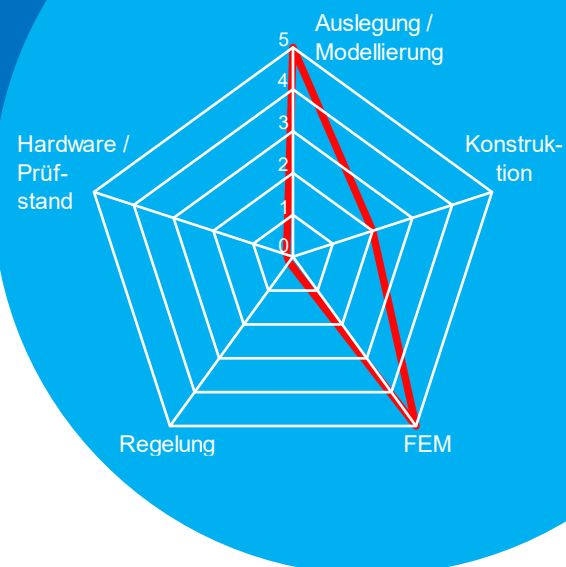




Investigation and extension of multi-layer models for axial flux machines

The simulation of the magnetic field in axial flux machines (AFM) using magnetic 3D finite element analysis (3D FEA) is computationally intensive. For this reason, different multi-layer approaches already exist to reduce the computational effort of the simulation. In these approaches, several cross-sections of the AFM are derived along cylindrical surfaces for different radii and simulated using 2D FEA. The overall behavior of the AFM is obtained by cumulating the results of these partial simulations.

With these multi-layer approaches, the simulation time can be significantly reduced. Although the AFM is simulated at different radii, not all 3D effects can be reproduced. Depending on the specific design of the AFM, deviations from the 3D FEA can occur.

For this reason, existing single-layer and multi-layer approaches for the 2D FEA of AFMs are to be researched and evaluated with regard to their suitability for mapping 3D effects. Finally, an extended approach will be developed to take additional 3D effects into account.

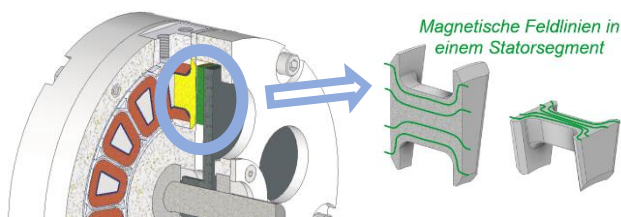


Fig. 1: 3D field lines in the stator segments of an AFM

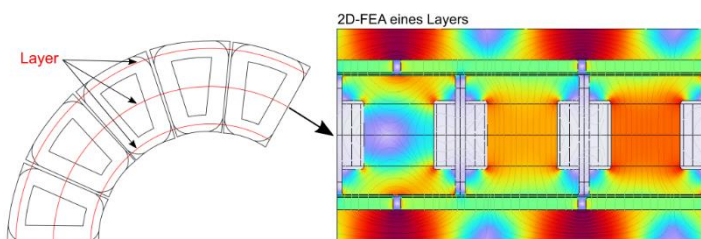


Fig. 2: Multi-layer approach for an AFM

Your profile

- Interest and experience in axial flux machines and the simulation of magnetic fields
- Experience in FEA (preferably magnetic FEA in COMSOL)
- Experience in Matlab and Simulink
- Very good study performance, high level of commitment as well as structured, independent and careful way of working

Working packages

- Literature research on existing 2D FEA and multi-layer approaches
- Identification of all 3D effects in AFMs
- Evaluation of the found approaches
- Development of concepts to extend the multi-layer approaches
- Implementation of one concept
- Comparison with 3D FEA
- Evaluation of the results

Research project



This task is part of a research project within the framework of the „InnovationsCampus Mobilität der Zukunft“:

<https://www.icm-bw.de/>