

## Simulative Analysis of Actively Rectified Inductive Power Transfer Systems for Inductive Electrically Excited Synchronous Machines

The electrically excited synchronous machine (EESM) is gaining increasing importance compared to the permanent magnet excited synchronous machine (PMSM), primarily due to the elimination of rare earth materials and greater flexibility in field control. Traditional electrically excited synchronous machines use slip rings for energy transmission to the rotor excitation, which has so far been the main disadvantage of this machine type. A solution to this problem is contactless inductive power transmission. In the topologies implemented so far, an inverter is located on the stator side, and a passive rectifier is used on the rotor shaft for rectification.

This work aims to investigate to what extent a new topology with active rectification on the rotor shaft (Dual-Active Bridge DAB) offers advantages in terms of machine efficiency and the transmission path. For this purpose, a loss model in Plecs will be used to examine and compare passive and active rectification through drive cycle simulations. Due to the additional degree of freedom in the DAB topology, various operating strategies will be analyzed and compared.

## **Student-Profile:**

- Basic knowledge in the field of electric machines, power electronics, and control engineering
- Ideally, experience with Matlab, Simulink, and Plecs
- Structured, independent, and meticulous working style



Abb. 1: Electrical equivalent circuit diagram of a Dual Active Full Bridge WPT system

## Work Packages:

- Familiarization with the topic and literature, particularly on inductive power transfer and DAB with low coupling
- Implementation of optimized control methods for the DAB to maximize efficiency, considering the additional degree of freedom
- Use of existing loss models for the WPT system with active rectification for drive cycle simulation in Matlab Simulink + Plecs
- Comparison of the efficiency of passive and active rectifier topologies as well as different operating strategies
- Comprehensive, well-organized documentation and code preparation

