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Talk announcement

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Model Order Reduction for the Simulation of Electrical Machines with Multi-Strand Windings

The demand to electrify mobility requires efficient and suitable hardware to meet certain requirements such as high-power output with respect to the size and weight, sustainability, etc.. One trend to meet those requirements is to supply electrical machines with high frequency. Despite the benefits of an increased frequency, this can also cause higher losses, in particular in windings. To keep the losses at a low level and in order to construct power dense electrical machines it is important to know already in the design stage where the losses occur, how high they are and how they are distributed across the conductors the winding is made of.

In the mid-frequency range, litz wires provide many benefits and are therefore a common choice nowadays to construct windings. To circumvent the computational burden due to a very dense mesh, we develop an efficient model order reduction method for the finite element simulation of an electrical machine with a multi-strand stator winding. The reduced model is independent of the connection of the strands. Therefore, simulation results of only a single slot are sufficient to compute a reduced basis which can be used for different winding configurations for every slot in a machine. Numerical simulations of a high-speed induction motor in time-harmonic and time-dependent regimes show significant savings in terms of memory and solving time of the proposed method compared to a standard finite element approach.