FAST STRUCTURE-DYNAMIC SIMULATION OF ELECTRICAL MACHINES USING 2D-3D-COUPLING

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Abstract

Structure-dynamic finite-element simulations of electrical machines allow for vibration analysis concerning geometric variants of the regarded motor without prototyping. The huge disadvantage of these types of simulations is their long computing times ever since. In this paper a novel method for the transformation of the surface-force density from the electromagnetic to the mechanical model of the machine is introduced leading to an enormous speed up and more accurate results by far.
The idea behind the novel method is to avoid expensive 3-dimensional, electromagnetic simulations of the regarded electric machine if possible, which is state of the art. Classic machines without 3-dimensional flux paths can be simulated by 2-dimensional models as well as skewed machines when applying the Multi-Slice Method. Next to the speed up the new transformation method benefits from the higher accuracy of the 2D electromagnetic FEM models in general, although the end effects are neglected. The surface-force density on the stator teeth is represented with higher precision as well in space as in time domain.
For any electric machine whose physical conditions allow for 2-dimensional electromagnetic simulation these advantages can be taken as the results of an induction machine with squirrel-cage rotor show exemplarily.