Contribution ID: **8** Type: **not specified**

Determination of nonlinear local Material Properties using an Inverse Scheme

Wednesday, 5 July 2023 16:35 (25 minutes)

The precise knowledge of the material properties is of utmost importance for motor manufacturers to design and develop highly efficient machines. However, due to different manufacturing processes, these material properties can vary greatly locally and the assumption of homogenized global material parameters is no longer feasible for the development process. The goal of our research project is to precisely determine these local magnetic material properties using a combined approach of measurements, numerical simulations and the applications of inverse methods. In this work, we focus on the identification of the local nonlinear permeabilities of electrical sheets considering cutting edge effects. In doing so, the electrical sheets are divided into subregions, each assigned with a nonlinear magnetic material model. Furthermore, we generate the measured data by forward simulations solving the magnetic field for the magneto-static case by applying the finite element (FE) method and overlay these data with a Gaussian white noise. Based on the generated data, we apply our inverse scheme on the simulation model to determine the parameters of the nonlinear material model. To ensure solvability, a Tikhonov regularization with a prior information for the parameter is considered. The accuracy and convergency of our approach is investigated.

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