Identification of Parameters to Correctly Adapt Energy-Based Hysteresis Models Regarding Rotational Losses

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The parameter identification of energy-based (EB) hysteresis models is extremely important regarding the accuracy of simulation results of, e.g., electrical machines and transformers. This article aims to propose an extended version to existing parameter identification techniques in order to correctly depict rotational losses up to high saturation levels. On the basis of measurements obtained by a rotational single sheet tester (RSST), the measured magnetic field strength is split into its reversible and irreversible part. Using this information the parameters of an adapted vector hysteresis model are identified by means of a least squares minimization. The model results are compared to the measurements and show a good agreement concerning the vanishing rotational losses at saturation level and the behavior of the magnetic flux density.

***Index Terms*— Energy-based vector hysteresis, hysteresis measurement, rotational losses, rotational magnetization.**

I. Introduction

TO FURTHER improve highly optimized electrical devices such as transformers or electrical machines, the simulation tools used should be able to correctly describe local magnetic properties. Concerning this matter, one main challenge are rotational losses, which can only be determined if the simulation tool can handle local hysteretic effects.

II. RSST Measurements

The measurements are carried out using a rotational single sheet tester (RSST) that is shown in Fig. 1, and the tested material is a 80 × 80 × 1.2 mm non-oriented steel sheet. To measure the $\boldsymbol{h}$-field, a 3-D Hall sensor is employed. For the $\boldsymbol{b}$-field, two coils in x- and y-direction are used. Since the aim is to purely measure losses due to hysteresis, the