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ABSTRACTS

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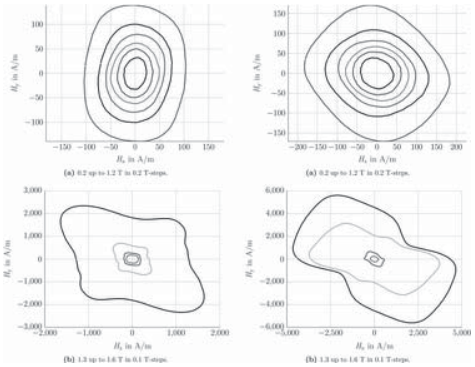
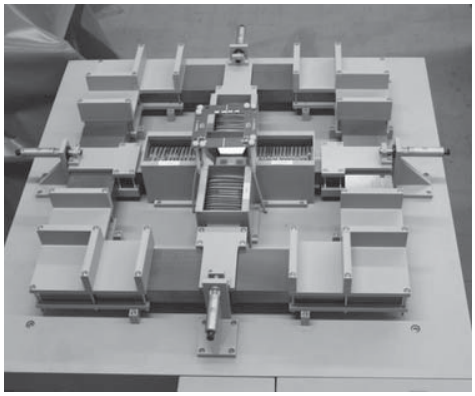
DS-13. Rotating Magnetizations in Electrical Machines: Measurements and Modelling. *A. Thul*[1], S. Steentjes[1], B. Schauerte[1], P. Klimczyk[2], P. Denke[2] and K. Hameyer[1] *1. Institute of Electrical Machines, RWTH Aachen University, Aachen, Germany; 2. Brockhaus Measurements, Lüdenscheid, Germany*

The increasing requirements for modern high performance electrical machines call for suitable loss and magnetization models for the highly utilized soft magnetic materials. Current approaches to this problem aim for a vectorial description of the magnetizing process, which is capable to accurately predict the hysteretic nature of these materials [1, 2]. Although concepts for two-dimensional measurement devices, known as rotational single sheet testers (RSST), are known [3, 4], their usage is not very common compared to unidirectional methods [5]. There are several reasons for this, e.g. that uniaxial methods are standardized, or the more complex control of rotational magnetizations. Therefore, most models are based on unidirectional measurement data and occurring rotating flux in the later application are treated e.g. by introducing correction factors. Only few efforts have been made so far to use RSST measurements, e.g. for model parametrization [6]. In this work, RSST measurements are used for a more comprehensive examination. By analyzing the effects of rotational flux on different materials, a better understanding of the material behavior can be achieved. This knowledge can then be used in the machine design process to take advantage of specific material properties. Due to the complex control of rotational fields, RSST measurement are time consuming. In order to improve the usability, a field oriented control scheme is developed. Quantities are transformed to a coordinate system aligned to the fundamental component of the rotating magnetic flux. Thus, separate controllers can be conveniently implemented for generating the fundamental component and the required harmonics for any given arbitrary rotating reference flux density inside the sample. Field strength and losses measurements are taken for circular and elliptical *B* loci with different axis orientations. The measurements cover rotating frequencies from 10 to 800 Hz and flux densities up to 1.6 T. The magnetic anisotropy is evaluated by analyzing the *B*-*H* lag angle. Fig. 1 shows as an example two measured *H*-loci sets for circular polarizations. The used RSST is shown in fig. 2.

[1] S. Steentjes, F. Henrotte, and K. Hameyer, *Journal of Magnetism and Magnetic Materials*, vol. 425, pp. 20–24, (2017). [2] E. Cardelli and A. Faba, *Physica B: Condensed Matter*, vol. 486, pp. 130–137, (2016). [3] Y. Guo, J. G. Zhu, J. Zhong, H. Lu, and J. X. Jin, *IEEE Trans. Magn.*, vol. 44, no. 2, pp. 279–291, (2008). [4] F. Fiorillo and I. D. Mayergoyz, *Characterization and Measurement of Magnetic Materials*. Burlington: Elsevier, (2004). [5] E. Cardelli, A. Faba, M. Pompei, and S. Quondam Antonio, *AIP Advances*, vol. 7, no. 5, p. 56112, (2017). [6] E. Cardelli, E. Della Torre, A. Faba, and M. Ricci, *IEEE Trans. Magn.*, vol. 46, no. 8, pp. 3465–3468, (2010).



***H* loci for M330-50A (left) and M400-50A (right).**



The used four-pole RSST.