Magnetic Hysteresis Models for Modelica

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Modelica models for transient simulation of magnetic hysteresis are currently being developed at Technische Universität Dresden. This paper gives an overview over the present progress of work. Two hysteresis models have been implemented so far in Modelica and are currently optimised and tested: the rather simple but efficient Tellinen model [1] and the more complex and accurate Preisach model [2]. Utilisation of the Tellinen model in combination with components of the Modelica.Magnetic.FluxTubes library [3] is exemplarily shown by transient simulation of a three-phase autotransformer. Additionally, an efficient implementation of the Preisach model is described and a comparison between the Tellinen and the classical Preisach hystesis model is presented (Figure 1).

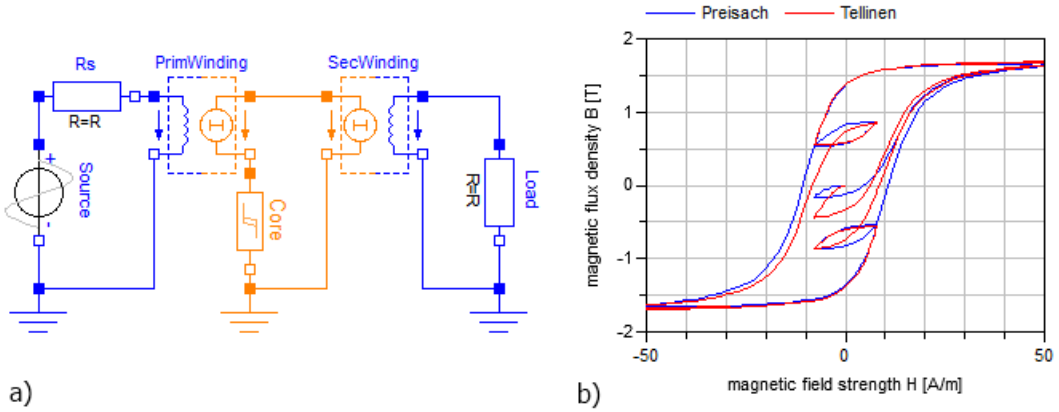

Figure 1: Simple electromagnetic network model of a single-phase transformer with closed ferromagnetic core including hysteresis effects (a) and a comparison between the implemented classical Preisach and the Tellinen hysteresis model.

It is planned to include the developed hysteresis models into the above-mentioned FluxTubes library after their further optimisation and validation with own measurements. These models will especially allow for the estimation of iron losses and for accurate computation of saturation behaviour during Modelica-based design of electromagnetic components and systems. This becomes increasingly important with the growing requirements regarding energy efficiency and mass power densities of such systems.

References

[1] J. Tellinen: A Simple Scalar Model for Magnetic Hysteresis, IEEE Transactions on Magnetics, vol. 24, no. 4, pp. 2200 – 2206, July 1998

[2] F. Preisach: Über die magnetische Nachwirkung, Zeitschrift für Physik A Hadrons and Nuclei, vol. 94, pp. 277–302, 1935

[3] T. Bödrich: Electromagnetic Actuator Modelling with the Extended Modelica Magnetic Library, Proc. of 6th Int. Modelica Conf., Bielefeld, Germany, March 3-4, pp. 221–227, 2008