Numerical Characterization Method for Magnetic Materials with Hysteresis

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Abstract. The paper presents a numerical method based on Preisach model for the characterization and modelling of hysteretic magnetic materials exhibiting quasi-scalar or vector hysteresis.

1 Introduction

In recent years a renewed interest is observed in the scientific community for the study of materials showing the property of hysteresis which is closely related to a more common application: the process of recording (usually magnetic recording) and the property of memory.

2 Method of modelling of hysteretic magnetic materials

The Mayergoyz-type extensions of the Preisach model [1] represent the optimal solution for phenomenological modeling, especially in view of the practical applicability of the numerical models. The methods belonging to this category offer an optimal balance between the stability of the identification procedure, requirements of experimental data and of computation resources, on one side, and the accuracy of the model, on the other side.
In numerical analysis, it is necessary to solve with acceptable accuracy electromagnetic problems involving scalar and vector hysteresis, based on minimal material measurement data. To be able to ensure this convenience, the identification module heavily relies on the benefit of using the so-called Everett function, in connection with the classical Preisach model, for reducing the strong ill-posedness of the scalar model identification [2]. The vector model is identified based on only two or more scalar data sets on directions inside the rolling-transverse directions plane. The necessary user input data are: the point-by-point H-B description of the initial magnetization curve, and of the upward major branch, for each of the rolling/transverse directions.
In the full paper we will provide more details about proposed methodology for modeling and identification of scalar and vector hysteresis using Preisach model, and numerical results obtained using experimental data.

References

[1] I. D. Mayergoyz, *Mathematical models of hysteresis*, Springer-Verlag, New York, 1991.
[2] Ragusa C., Repetto M., "Anisotropic vector Preisach model and magnetic field solutions", *COMPEL*, vol. 18, no. 3, pp. 458-468, 1999.