



THE EPSTEIN FRAME: HYSTERESIS AND MAGNETIC PROPERTIES MEASUREMENT METHOD AND THE JILES-ATHERTON MODEL

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Introduction

The research and the presentation are mainly based on a special standardized measurement device, called Epstein frame. This device can be used to test electrical steels. In the first part of the paper this device will be introduced that will be built up in the future.

After introduce the measurement method and the frame itself, we will talk about an important and useful hysteresis model called Jiles-Atherton model.

The Epstein frame

At first, the measurement configurations and the conditions are studied. They are fully defined in an international standard, called *IEC 60404-2:1998, Magnetic Materials – Part 2: Methods of measurement of the magnetic properties of electrical steel sheet and strip by means of an Epstein frame*. The most important parameters of this device, such as the size, the windings and the materials that should be used in the future to build up this frame will be shown in the paper (Fig. 1.). The parameters of the specimen are very important; a specimen with well-defined dimensions and parameters should be used, and it is very important to care the joins at the corners to make correct measurements.

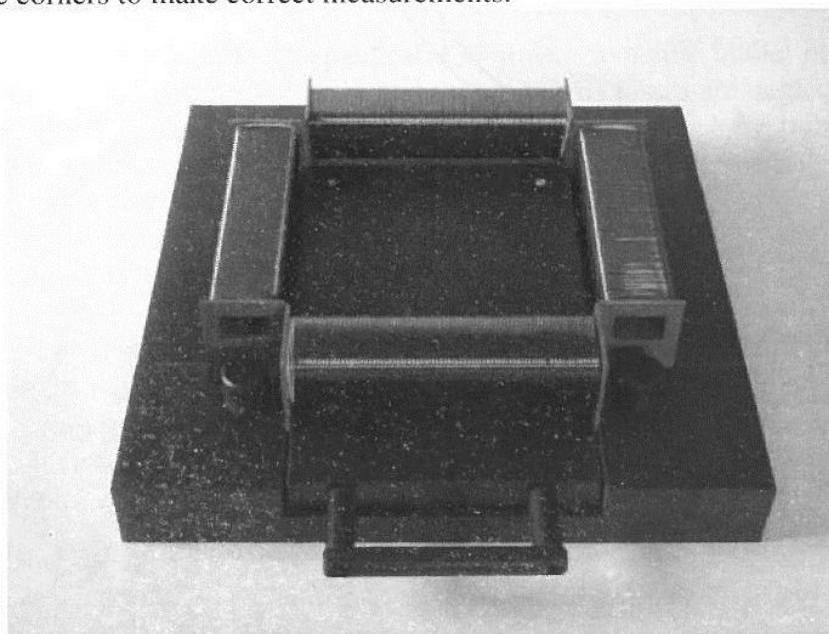


Fig. 1. An Epstein-frame [1].

The measurement method

In the second part of the presentation the measurement method will be defined. At first, the magnetic field strength should have known inside the frame. The frame will be excited by the primary winding with a known current, from which the magnetic field intensity can be measured. The voltage of the secondary winding must be measured, from which the magnetic flux density will be calculated. The most important steps of the measurement will be shown, and will be defined clearly how to retrieve informations during the measurement and how to build up an ordinary B-H curve, which is very important in connection of the hysteresis phenomena.

One of the best ways to measure hysteresis is using the LabVIEW development environment [2]. We will show a theory to calculate the important informations (magnetic induction, magnetic field) from the measured data. After the calculation, the curves with the software will be built easily.

The Jiles-Atherton model

After the measurement we will use one of the models dealing with this nonlinear characteristic. This model and the simulation are important in connection with the Epstein frame, because the measured data will be compared with the simulated data, so a better conclusion can be made with this. This hysteresis model will be introduced in the last part of the presentation. This model is using five parameters [4]. These parameters are mostly depending on the measurement environment and the type of the magnetic material.

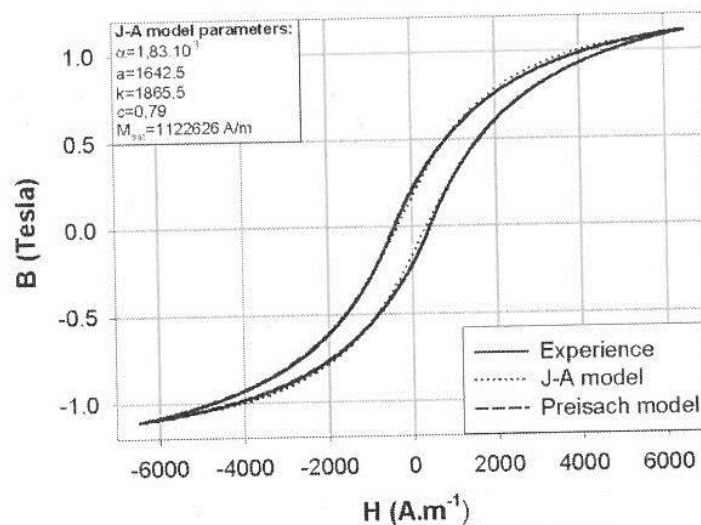


Fig. 2. Different types of hysteresis models [3].

References

- [1] http://www.magnettechnik.de/front_content.php?idart=96
- [2] <http://www.ni.com>
- [3] http://www.emeraldinsight.com/content_images/fig/1740230327020.png
- [4] A. Iványi, *Hysteresis Models in Electromagnetic Computation*, Budapest: Akadémiai Kiadó, 1997.