Physics Colloquium
University of Missouri-Kansas City
Department of Physics

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A Non-Time-Domain Ferrimagnetic Hysteresis Model and Parameter Identification Technique for Automated Magnetic Component Design

Population-based algorithms (e.g., genetic algorithms, particle swarm optimization, Monte Carlo techniques) are becoming increasingly popular in the design process of magnetic components. When using these algorithms, it is common to require the analysis of 10^4–10^6 design candidates. When performing such a procedure to minimize magnetic losses or maximize energy-density, the fields within the device are different in each candidate design. Thus, computationally efficient and accurate methods of predicting magnetic hysteresis inside ferrimagnetic components are desired.

Time domain and history-dependent hysteresis models, in particular the Jiles-Atherton and Preisach models, have been shown to accurately predict magnetic hysteresis losses and behavior. However, the computational time required by these models is inconvenient for automated design.

In this presentation, a computationally efficient approach for modeling magnetic hysteresis in high-frequency ferrimagnetic materials is presented. The approach relies on a novel parameter extraction technique for determining the anyhysteretic flux vs. field intensity characteristic, and a novel hysteresis loss model and parameter identification procedure. An application is presented wherein a genetic algorithm is used with the hysteresis model to obtain an optimized design of a ferrite inductor.

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****Coffee at 3:10: Colloquium at 3:30 in Room 310****