## DP02

# Analyses Leakage Magnetic Field of DC Biased Transformer with Magnetic Circuit Method

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Power transformer which under DC bias are always in over saturated, so the leakage magnetic flux will increase greatly. For the purpose of analyzing the leakage magnetic field of DC biased transformer, the article use the magnetic circuit network method to build the transformer main leakage loop's magnetic circuit model, and use this model analyze the power transformer 's leakage field which under different level of DC bias.

In the approach, we can make the DC biased transformers as the equivalent magnetic circuit network, we can see the network model as follow:

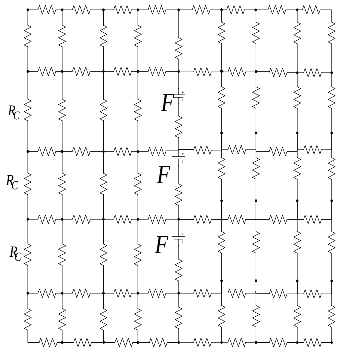


**Fig. 1.** DC biased transformer's leakage circuit model.

The results are in good agreement with the FEM calculate result which proves the approach could be a simple and accurate numerical method.

The simulation results imply that the leakage flux density increase with the DC amplitude and the gap between primary coil and secondary coil contain the biggest leakage flux density. The approach which the article present may set a fund to analyze local overheat and abnormal vibrate of the DC biased transformer, and extend the application scope of the magnetic circuit method.

## DP03

# Effect of Perpendicular Field on Resonant Motion of Magnetization Vortex Induced by AC Current

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A direct injection of an electrical current to a magnet generates a torque through the transfer of spin angular momentum, i.e. spin-transfer torque [1-2]. The spin-transfer torque causes the precession motion of a local magnetization. As a consequence of the current-induced precession, a magnetization vortex core can be excited by an electrical current. An alternating current can induce a resonant motion of a magnetization vortex core [3-4]. The resonant motion is the gyroscopic motion of a vortex core which is affected by the magnetic field and the spin-transfer torque in the framework of the extended Thiele's equation where the core is considered as a point topological charge [5-6]. The magnetic field changes the potential landscape which the vortex core experiences. In this work, we investigate the effect of a perpendicular magnetic field on the resonant motion induced by an ac current. We perform micromagnetic simulations using the Landau-Lifshitz-Gilbert equation with the adiabatic and non-adiabatic spin torque terms. The model system is a Permalloy square disk with the length of 200 nm and the thickness of 20 nm. When the ac current is injected, the vortex core shows the resonant motion, but its detailed trajectory is staggered due to the perpendicular field (Fig. 1). The staggered motion is affected by the non-adiabatic spin torque term. We attribute this strange motion to the broadening of the vortex core. In the presentation, results for various perpendicular fields will be discussed.

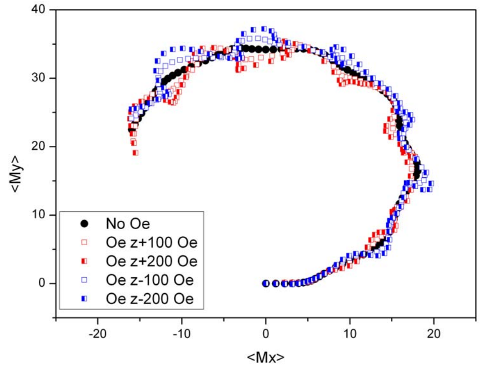


**Fig. 1.** The trajectory of the vortex core.

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## REFERENCES

[1] J. C. Slonczewski, J. Magn. Magn. Mater. **159**, L1 (1996).
[2] L. Berger, J. Appl. Phys. **55**, 1954 (1984); ibid **71**, 2721 (1992).
[3] S. Kasai et al. Phys. Rev. Lett. **97**, 107204 (2006).
[4] R. Moriya et al. Nature physics **4**, 368 (2008).
[5] A. A. Thiele, Phys. Rev. Lett. **30**, 230 (1973).
[6] J. Shibata et al., Phys. Rev. B **73**, 020403 (2006).