

Simulation of Eddy Currents in an Iron Ring Core Using a Multi-Scale Method

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Keywords: *eddy current, multi-scale, nonlinear, network coupling*

ABSTRACT

The nonlinear eddy current problem with network coupling - for a given voltage U find the magnetic vector potential $A(t) \in H(\text{curl})$ and current $I(t) \in \mathbb{R}$ so that

$$\begin{aligned} \int_{\Omega} \nu(A) \operatorname{curl} A \operatorname{curl} v \, d\Omega + \frac{\partial}{\partial t} \int_{\Omega} \sigma A v \, d\Omega &= \int_{\Gamma(\Omega)} K v \, d\Gamma \\ IR + \int_{\Gamma(\Omega)} \frac{\partial A}{\partial t} \tau \, d\Gamma &= U \end{aligned}$$

for every $v \in H(\text{curl})$ - is solved to simulate the eddy currents in an iron ring core. In order to reduce the number of degrees of freedom, cylindrical coordinates are used to model the radially symmetric domain using only two dimensions. Furthermore the single laminates of the iron core are not resolved in the mesh. Instead a multi-scale method is used to recover the local behavior. The quality of the simulation is checked using measurement data provided by the Institute of Electrical Machines of the RWTH Aachen.

REFERENCES

- [1] A. Bensoussan, J. Lions, and G. Papanicolaou. Asymptotic Analysis for Periodic Structures. North-Holland, 2011.
- [2] K. Hollaus and J. Schöberl. Homogenization of the eddy current problem in 2d. *14th Int. IGTE Symp., Graz, Austria*, Sep. 2010, pp. 154–159.