

面向工程的计算电磁学研究和应用

Engineering-Oriented Research and Application of Computational Electromagnetics

Z.Cheng*, L.Liu, Y.Fan, T.Liu, J.Zhang, L. Wang, and X. Wang

R & D Center, Baoding Tianwei Group Co., Ltd

Tianwei West Road 2399, Baoding 071056

Email: emlabzcheng@yahoo.com

Key Words:

Computational electromagnetics, industrial application, electric power energy, large power transformer, electromagnetic field, finite element method, benchmarking, TEAM Problem 21 Family.

ABSTRACT

The talk focuses attention on some important aspects on the engineering-oriented research of the computational electromagnetics (CEM) and industrial application, involving with the finite element analysis of the three-dimensional electromagnetic fields and the performance prediction inside the solid and laminated configurations, the validation of the electromagnetic numerical computation based on benchmark models, and the electromagnetic property modeling of materials used in electrical equipments.

Also, the power transformer-based TEAM(Testing Electromagnetic Analysis Methods) Problem 21 family is overviewed, which was proposed by the authors and approved by the international Compumag society (ICS). The updated definition and the new developments of Problem 21, including 5 sets of benchmark models (see www.compumag.org), and some valuable benchmarking results are presented.

The talk-related author's IEEE papers

- [1] N.Takahashi, T. Sakura and Z. Cheng, "Nonlinear analysis of eddy current and hysteresis losses of 3-D stray field loss model (Problem 21)," *IEEE Trans. on Magn.*, vol.37, no.5, pp.3672-3675, 2001.
- [2] Z.Cheng, R. Hao, N. Takahashi, Q. Hu and C. Fan, "Engineering-oriented benchmarking of Problem 21 family and experimental verification," *IEEE Trans. on Magn.*, vol. 40, no.2, pp.1394-1397, 2004.
- [3] Z.Cheng, N. Takahashi, S. Yang, T. Asano, Q. Hu, S. Gao, X. Ren, H. Yang, L. Liu, L. Gou, "Loss spectrum and electromagnetic behavior of Problem 21 family" , *IEEE Trans. on Magn.*, vol.42, no.4, pp.1467-1470, 2006.
- [4] Z.Cheng, N. Takahashi, S. Yang, C. Fan, M. Guo, L. Liu, J. Zhang and S. Gao, "Eddy current and loss analysis of multi-steel configuration and validation," *IEEE Trans. on Magn.*, vol.43, no.4, pp.1737-1740, 2007.
- [5] Z.Cheng, N. Takahashi, B. Forghani, G. Gilbert, J. Zhang, L. Liu, Y. Fan, X. Zhang, Y. Du, J. Wang, and C. Jiao, "Analysis and measurements of iron loss and flux inside silicon steel laminations," *IEEE Trans. on Magn.*, vo.45, no.3, pp.1222-1225, 2009.
- [6] T.Nakata, N. Takahashi, K. Fujiwara, K. Muramatsu, and Z. Cheng, "Comparison of various methods for 3-D eddy current analysis," *IEEE Trans. on Magn.*, vo.24, no.6, pp.3159-3161, 1988.
- [7] Z.Cheng, N.Takahashi, B.Forghani, et al, "Effect of excitation patterns on both iron loss and flux in solid and laminated steel configurations," *IEEE Trans. on Magn.*, vol.46, no.8, pp.3185-3188, 2010
- [8] Y.Du, Z.Cheng, et al, "Magnetic Flux and Iron Loss Modeling at Laminated Core Joints in Power Transformers," *IEEE Trans. on Applied Superconductivity*, vol.20, no.3, pp.1878-1882, 2010.
- [9] X.Zhao, J.Lu, L.Li, Z.Cheng, and T.Lu, "Analysis of the DC Bias Phenomenon by the Harmonic Balance Finite Element Method," *IEEE Trans. on Power Delivery*, vol.26. no.1, pp.475-485, 2011.
- [10] Z.Cheng, N.Takahashi, B.Forghani, et al, "Effect of variation of B-H properties on loss and flux inside silicon steel lamination," *IEEE Trans. on Magn.*, vol.47, no.5, 2011.

*程志光 (Z.Cheng, Ph.D., SM IEEE, Vice chief engineer, R & D Center, Baoding Tianwei Group, 保定天威集团技术中心)
Tel: 0312-3308363(O)/13933258321; Email: emlabzcheng@yahoo.com; emlab@btw.cn