

An Efficient Harmonic Method for Solving Nonlinear Time-Periodic Eddy-Current Problems

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Abstract—An iterative solution to nonlinear problems of time-periodic eddy currents is performed by directly using the time-harmonic content of the field quantities instead of time-domain techniques employing successive time steps. A linear sinusoidal steady-state field problem is solved to determine the magnetization harmonics at each iteration, with the harmonic values corrected in terms of the actual magnetic induction by applying a fixed point procedure. To further improve its efficiency, the solution process can be started by retaining a small number of harmonics, with more harmonics subsequently added as needed to achieve the desired accuracy. The proposed method always yields stable results, even when the characteristic B - H is strongly nonlinear, and has a superior computational efficiency with respect to various time-stepping techniques and to the “harmonic balance method”.

Index Terms—Eddy currents, nonlinear periodic fields, polarization fixed point method.

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