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Effect of eddy current in shielding plate and electron gun on flux distribution in CRT

Norio Takahashi* Koji Shimada† H. Wakasono‡

*Okayama University

†Matsushita Electric Industrial Corporation, Limited

‡Matsushita Electric Industrial Corporation, Limited

MODELING THE FREQUENCY RESPONSE OF MAGNETIC COMPONENTS

Jorge Pleite, Emilio Olías, Andrés Barrado, Antonio Lázaro, Juan Vázquez
Universidad Carlos III de Madrid, Avda. de la Universidad 30, Leganés-28911, Madrid, SPAIN.
Tl.: +34 91 624 9195, Fax: +34 91 624 9430, e-mail: pleite@ing.uc3m.es

Introduction

The magnetic components (transformers and inductors) are widely used, from high frequency switching power supplies to low frequency electric grid. There are different electromagnetic effects inside the magnetic components (such as the leakage inductances, parasitic capacitances, skin and proximity effects, etc.) which make that its frequency response is quite complex. There are several applications for which the modeling of the frequency response is quite usefull. The F.R.A. (Frequency Response Analysis) techniques for advanced maintenance of big transformers of the electric grid are a good example of them.

A full procedure of modeling the frequency response of magnetic components is presented in this paper. Some diagnosis of power transformers based on this modeling will be also presented at the full paper.

The Modeling Tool

The Modelling Tool proposed in this work is composed of both the model topology and the mathematical algorithms required to obtain the values of the parameters of the model (both of them will be full explained at the full paper). The model topology is composed of a set of basic cells in which the basic electromagnetic field effects are included (power losses represented by R parameters, magnetic field energy storage represented by L parameters and electric field energy storage represented by C parameters). The mathematical algorithms are based on minimization of error functions.

Experimental Results

In Fig.1 is presented as an example the frequency response of a commercial distribution transformer compared with the model response, in terms of the impedance magnitude (ohm.) in a bandwidth of 100Hz-300kHz. The accuracy is quite acceptable (the average relative error in this case is 4,18% and graphically both the resonant and antiresonant points are well reproduced).

At the full paper, not only more modeling results will be presented (obtaining in some cases a 2% error) but also an application of this modeling for transformers advanced manteinance.

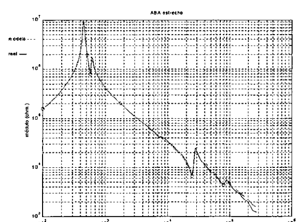

Figure 1. *Frequency response of the actual transformer compared with the model.*

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[2] James L. Buchanan y Peter R. Turner. *"Numerical Methods and Analysis"*. Mcgraw-Hill, Inc.1992.

EFFECT OF EDDY CURRENT IN SHIELDING PLATE AND ELECTRON GUN ON FLUX DISTRIBUTION IN CRT

N. Takahashi,
Dept. Electrical and Electronic Eng., Okayama Univ., Okayama
700-8530, Japan
K. Shimada,H.Wakasono
Display Devices Company, Matsushita Electric Industrial Co. Ltd., Takatsuki,
569-1193, Japan

An inner magnetic shield (IMS) is set inside a cathode ray tube (CRT) to reduce a disturbance from outside of CRT, such as geomagnetism. The eddy current induced in IMS due to the changing current in deflection coil may affect the flux distribution in CRT. The eddy current is also induced in the electron gun when coils for velocity modulation (VM) are set near the gun. Although the effect of these eddy current is important, the report about the analysis of this phenomenon is few. In this paper, the effect of eddy current in IMS and electron gun on flux distribution in CRT is analyzed by using the 3-D finite element method.

Fig.1 shows the analyzed model of IMS. The saw current waveform is impressed in the deflection coil. Fig. 2 illustrates the waveform of flux density at a point near IMS. The peak value of flux density in the case with IMS is almost twice of that without IMS. This will cause the disturbance of scanning lines in the upper and lower region of screen.

The effect of eddy current in electron gun shown in Fig. 3 on flux distribution in CRT is investigated. Fig. 4 suggests that the eddy current induced in the electron gun can be reduced by the slit.

The detailed effect of the eddy current on the behaviour of flux distribution in CRT will be shown in the full paper.

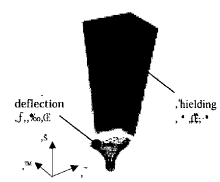

Fig.1 ...

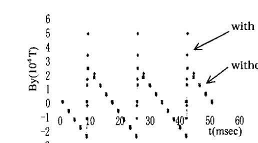

Fig.2 ...

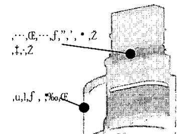

Fig.3 ...

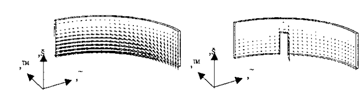

Fig.4 ...

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