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LEAKAGE INDUCTANCE CALCULATION OF TOROIDAL TRANSFORMER USING FINITE ELEMENET ANALYSIS

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Thesis submitted in partial fulfillment of the requirements for the degree Master of
Science in *Electrical Eng*

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The above candidate has carried out research for the Masters under my supervision.

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Prof. J.R. Lucas

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Abstract

The researches done on calculating leakage inductance of a toroidal transformer were rare. In this research it is attempted to fill this gap by formulating a method to calculate leakage inductance of a toroidal transformer.

Finite Element Method analysis is used to calculate the leakage inductance value for the horizontal plane of the toroidal toroidal transformer and estimate the leakage inductance of toroidal transformer. Open source magnetic finite element method software FEMM is used to implement the calculation model. The calculated values are compared against different winding methods used in toroidal transformer. Output of the model did show good correlation with normal toroidal transformer winding method which is being used in almost all the toroidal transformers with few exceptions of special winding methods. After introducing a correction factor it was able to achieve maximum error percentage of +/- 20% for the calculated values compared to the values measured from prototype samples. This is a good approximation when considering in a production batch of same transformer design, about +/- 10% variation is observed in measured leakage inductance values due production variations.

Keywords: Toroidal Transformer; Leakage Inductance; FEMM; finite element method



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List of Abbreviations

FEMM Finite Element Methods Magnetics®, Version 4.2 .

FEM Finite Element Method

HV High Voltage

LV Low Voltage

I Leakage Inductance

M Mutual Inductance

L Self Inductance

B Magnetic Flux Density

Φ Magnetic Flux

N_1 No. of turns in Primary Winding

N_2 No. of turns in Secondary Winding

R Resistance

S Reluctance

L_m Magnetizing Inductance

V_1 Input Voltage

V_2 Output Voltage

I_1 Input Current

I_2 Output Current.



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