INVESTIGATION OF TOROIDAL INDUCTORS BASED ON NON-GRAIN ORIENTED SILICON STEEL: COMPARATIVE STUDY

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(07/8314)

Degree of Master of Science

Department of Electrical Engineering

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DECLARATION OF THE CANDIDATE & SUPERVISOR

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Name of the Supervisor : Dr. J.P. Karunadasa

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ABSTRACT

Inductor or reactor or sometimes called as 'Choke' as per its intended situational assignment, is a basic magnetic component which is very useful for many fields and particularly in the fields of Electrical and Electronics Engineering. Amongst its endless applications in the fields, inductors functions in the low frequency range such as the power system frequencies (i.e. 50Hz, 60Hz) are considered mainly in this research.

Main concern of this paper is to popularize toroidal steel core inductor construction which is advantages in many aspects over the common other types of inductors such as EI laminated and C-Core constructions.

Conventionally for toroidal silicon steel core inductors, cores are constructed with magnetically Grain Oriented Silicon Steel (GOSS). This paper describes a methodological approach to find out the suitability of magnetically Non Grain Oriented Silicon Steel (NGOSS) for the inductor core material. A comparative study is carried out selecting inductor designs made with Grain Oriented Silicon Steel (GOSS) and their corresponding Non grain oriented silicon steel (NGOSS) ones. Comparisons of the designs with regards to their electrical, thermal characteristics are primarily carried out and the economical viability of these inductors with proposed steel type is also verified in this dissertation.

Analyzed results shows the advantages of using Non Grain Oriented Silicon Steel (NGOSS) for inductor designs over its cost considerations and at the same time matching performances of the conversional grain oriented types.

To have the best optimized outcome from the proposed new steel type for inductor manufacturing, it is necessary to incorporate characteristics of non grain electrical silicon steel to inductor design programs and such program is proposed and developed towards the end of this dissertation.

Key Words: Toroidal Inductor, Grain Oriented Silicon Steel, Non grain oriented silicon steel, inductor manufacturing and inductor design program.

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LIST OF ABBREVIATIONS

Abbreviation	Description
A	Ampere
AC	Alternative Current
A_C	Cross sectional area
AISI	American Iron and Steel Institute
BOM	Bill of Material
DC	Direct Current
EMF	Electro Motive Force
GOSS	Grain Oriented Silicon Steel
Hz	Hertz
I	Current
JIS	Japanese Industrial Standards
JSA	Japanese Standards Association
kW	Kilo Watt
mA	Milli Amperes
mH	Milli Hendry
min	Minutes
MPL	Magnetic Path Length
NGOSS	Non Grain Oriented Silicon Steel
PWM	Pulse Width Modulation
R	Reluctance
RMS	Root Mean Square
USD	United States Dollars
V	Voltage
VA	Volt-Ampere
VB	Visual Basic
W	Watt
ºC	Degree Celsius
Ω	Ohm

SMPS	Switch Mode Power Supply
μ	Permeability

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