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REVIEWER'S REPORT

Manuscript No.: IJAR-50466 Date: 01-03-2025

Title: STUDY OF THE THERMAL BEHAVIOUR OF AN INDUCTOR ON A TORIC MAGNETIC CIRCUIT_MPA_27-02-25

Recommendation:
Accept as it is.................**YES............**
Accept after minor revision.................
Accept after major revision ....
Do not accept (*Reasons below*) ....

Rating	Excel.	Good	Fair	Poor
Originality	√			
Techn. Quality		√		
Clarity		√		
Significance			√	

Reviewer's Name: Mir Tanveer

Reviewer's Decision about Paper: **Recommended for Publication.**

Comments (*Use additional pages, if required*)
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Reviewer's Comment / Report

The article presents an in-depth study of the thermal behavior of an air inductance with a closed toric magnetic circuit (3C90), utilizing simulation and analytical calculations. The study employs COMSOL software to model and analyze the impact of various geometric parameters on the structure's thermal distribution.

Abstract The abstract effectively summarizes the research, highlighting the key methodologies, such as the nodal method and numerical simulations. It concisely outlines the study's aim, which is to examine temperature distribution in different components of the inductance while varying conductor thickness, number of turns, and applied current. The correlation between simulation results and analytical calculations is well noted, ensuring the credibility of the findings.

Introduction The introduction provides a comprehensive background on the significance of thermal behavior in electronic systems, emphasizing the need for efficient heat dissipation to improve component longevity and reliability. Relevant prior research is referenced, particularly regarding electrothermal modeling and loss mechanisms in magnetic components. The discussion on the limitations of existing models and the motivation for this study is well-articulated.

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Background The section effectively discusses the thermal sensitivity of integrated components and the necessity of maintaining controlled operating temperatures. It establishes the foundation for studying the influence of geometric parameters on toric magnetic core inductance. The problem statement and study objectives are clearly outlined, reinforcing the need for optimization in electronic component design.

Description of the Technological Process This section provides a well-structured explanation of the design methodology, detailing the use of COMSOL software for electromagnetic and thermal simulations. The comprehensive description of the software's capabilities and its relevance to the study adds clarity to the research approach.

Geometric Parameters and Material Characteristics The article presents an organized tabulation of the geometric parameters of the inductance, including conductor width, diameters, number of turns, and substrate thickness. The material characteristics of copper, alumina, and 3C90 are effectively compared in terms of thermal and electrical conductivity, density, and permeability. The inclusion of such detailed parameters enhances the study's reproducibility.

Formulas, Models, and Transfer Methods The analytical framework for determining resistance, thermal resistance, thermal capacity, and temperature is well-established. The mathematical expressions are clearly stated, and their relevance to the study is properly justified. The discussion on heat transfer methods, with a focus on conduction and Fourier's law, is well-integrated into the study's context.

Results of Calculations and Simulations The results effectively demonstrate the impact of varying conductor thickness on power losses. The tabulated values provide a clear comparative analysis of the thermal response of inductors with air and MnZn materials. The graphical representation of temperature variation over time further validates the findings, showcasing the improved thermal performance with the inclusion of the magnetic core.

Conclusion The study successfully evaluates the thermal behavior of toric inductors, demonstrating the influence of geometric and material parameters on temperature distribution. The correlation between simulation results and theoretical calculations substantiates the reliability of the methodology. The findings contribute valuable insights to the optimization of electronic components for improved thermal management.

Overall, the article presents a well-structured and detailed investigation, with a strong theoretical foundation and accurate simulation-based validation. The logical flow, clarity in mathematical formulations, and comprehensive discussion of results make this study a significant contribution to the field of thermal analysis in electronic components.