physics practical report

Shanil Shah sbs57
Part IB Physics Report

November 27, 2025

Abstract

Abstract Guidance:
1. This is NOT an introduction. It is a summary of the entire report. 2. Structure: - State the question/open problem (1-2 sentences). - Briefly describe what was done and how (method). - Present the MAIN results, including specific numerical values (e.g., power dissipated, permeability) and uncertainties. - Conclude with the implication of the results. 3. Constraints: - No bullet points. - No tables or graphics. - No references usually. - Paragraphs should not be single sentences.

1 Introduction

Transformers form a core part of modern technology, being used for impedance matching within electronics and electricity transmission on the grid. In both systems, the efficiency and performance are determined by how the transformer responds to an applied magnetic field.

This response is described by the relationship between the magnetic flux density B and the magnetising field H, known as the B–H curve. By altering the core of the transformer its properties can be changed. For ferromagnetic materials, the B–H curve is non-linear and exhibits hysteresis (**Figure 1**).

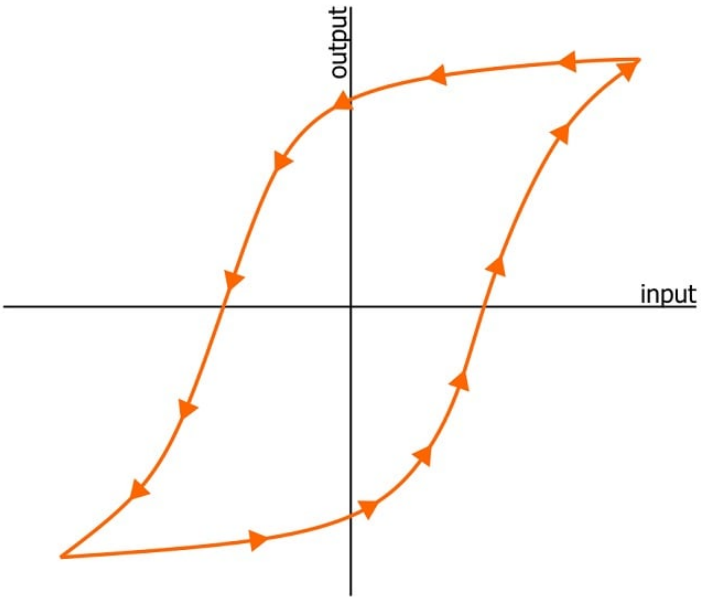

Figure 1: A typical hysteresis curve for a ferromagnetic material, showing the relationship between B and H. [1].

The most efficient transformers are made by having a high magnetic susceptibility (μ_r). In section 2 of this report we will go through the relevant theory. Then the experimental setup in section 3 followed by the results it has yielded in section 4 penultimately the analysis of these and their comparison against theoretical expectations in section 5 and finally the conclusion.

2 Theorhetical background

3 Experimental Setup

Experimental Setup Guidance:

1. General: - Do NOT rewrite the lab manual step-by-step. - Focus on what is relevant for the reader to understand the results. 2. Apparatus: - Include a schematic diagram of the setup (Solenoid, Secondary coil, Integrator, Oscilloscope). - Describe the integrator circuit (R and C values) and why it's used. - Mention the calibration step using the air core (linear B-H). 3. Samples: - List the materials tested: Mild steel, Transformer iron, Cu/Ni alloy. - Mention the temperature variation setup for Cu/Ni.

4 Results

Results Guidance:

1. Graphs (Crucial): - Plot Hysteresis loops (B vs H) for Mild Steel and Transformer Iron. - Plot loops for Cu/Ni above and below 40 deg C. - Ensure axes are labeled (Quantity / Unit). - Include ERROR BARS on graphs. - Use solid data markers. 2. Quantitative Results: - Calculate and report Power dissipated per unit volume (P / V): Area of loop). - Report Relative Permeability (μ_r): Max, Min, and Range. - Compare values for different materials. 3. Presentation: - Figures must have detailed captions describing the features. - Refer to every figure in the text.

5 Discussion

Discussion Guidance:

1. Interpretation: - Do the results match theoretical expectations? (e.g., Does mu_r approach 1 at saturation?) - Discuss the shape of the loops. 2. Comparison: - Compare your results with literature values (cite references). - Compare the materials (Steel vs Iron vs Cu/Ni). 3. Uncertainties: - Critical evaluation of Systematic and Random errors. - Discuss the limitations of the apparatus (e.g., temperature measurement accuracy for Cu/Ni). - How do uncertainties affect your conclusions?

6 Conclusion

Conclusion Guidance:

1. Summary: - Summarize the main findings (Power dissipated, μ_r values). - State whether the aims were achieved. 2. Final Remarks: - Comment on the validity of the method. - No new information should be introduced here. - No bullet points.

References

[1] Robert Keim. What is hysteresis? an introduction for electrical engineers, 2023.