ECE 3354 – Power Systems Laboratory

Experiment Magnetics:

Faraday's Law in Coils with Permanent Magnet, DC and AC Excitation

Date of Experiment

Month/Day/Year

Prepared By:

Author's Name
Partner's Name

Prepared For:

Instructor's Name

Experiment Introduction and Objective

(Less than 5 lines. Refer to the lab manual and re-write in your own words in bullets or numbering format)

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- ……

Part I –Faraday's Law in Coils with Permanent Magnet

This test allowed us to find…… (Continue expanding in your own words briefly, say what you did in the experiment. Put all equations, table, data and plots saved for this part here). Including:

- V, Φ plots for different moving speeds of the magnet.
- V, Φ plots for different polarities of the magnet.
- Calculation of the approximate frequency from one of the plots recorded.

Part II – Electromagnetic Forces under DC Excitation

This test allowed us to find…… (Continue expanding in your own words briefly, say what you did in the experiment. put all equations, table, data and plots for this part here). Including:

- Observations of Electromagnetic Forces with different magnets end.
- Observations of Electromagnetic Forces when changing the DC coil current from 3A to 1A.
- Explain how to determine magnet's polarity by using the Electromagnetic Forces experiment, and your observations.

Part III – Mutual Coupling Phenomena between Two Coils

Explain the Mutual Coupling Phenomena with Faraday's law briefly in your own words. And,

- By varying the number of the iron straps inserted in the coil windows, (constant AC voltage at the coil terminals), the mutual coupling between two coils …… (Continue expanding in your own words, say what you observed and explain why it happened. Include all equations, table, data, plots here)
- Show the waveform you recorded in X-Y mode, and your observation of the shape of the Φ versus I curve for air and various numbers of steel strips (1, 2, 3 strips respectively) while keeping the coil terminal voltage constant.
- Show the plots recorded and your observation of the changes in the hysterisis loop when varying the terminal voltages, and biasing the hysterisis loop with a permanent magnet.

Part IV –Answers to Questions

(Short answers, be brief and <5 lines)

Problem 1

Explain the observations made in Part 1 in terms of Faraday's Law. Answer:

- What is the relationship between voltage and the flux signal measured?
- Which factors will affect the polarity of the voltage signal measured? And Why?
- Which factors will affect the magnitude of the voltage signal measured? And Why?
- Which factors will affect the shape (duration) of the voltage signal measured? And Why?

Problem 2

Explain the results of Part 2 in terms of magnetic polarities, current magnitudes, and the general concepts of electromagnetic forces. Answer:

- What is the relationship between the characteristic of the electromagnetic forces (attractive, repulsive) and the polarities of the magnet? Why?
- What is the relationship between the intensity of the electromagnetic forces and the DC current magnitudes? Why?

Problem 3

Explain the observations of Part 3 in terms of mutual coupling and permeability. Answer:

- Why is the terminal voltage across the coil held constant?
- What happened to the current as iron strap was added or subtracted? And what happened to the fluxes? Why?
- Verify that the permeability of saturated iron is the same as the permeability of air with your measurement, and explain why? (Describe the final observation in terms of Figure 3.)
- If you are designing an electromechanical (not an air core) device that requires linear operation, what parameters need to be considered?
- How can you modify your design to minimize eddy currents, and in return, how does this modification affect your device?

Problem 4

- Using your knowledge of electromechanical devices and the results of this experiment, what are some physical entities that affect saturation?
- Also, what design parameters can be altered to prevent saturation?