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Memorandum M-1011

Forrester

MASSACHUSETTS INSTITUTE OF TECHNOLOGY
DEPARTMENT OF ELECTRICAL ENGINEERING

Report No. 2

Prepared by: W. N. Papian

PROGRESS REPORT TO THE DEPARTMENT COMMITTEE ON GRADUATE STUDY AND RESEARCH

SUBJECT OF RESEARCH: M.S. Thesis: A Co-Incident Current Magnetic Memory Unit

Period Covered by this Report: March 3, 1950 to March 31, 1950

Student Working on Research:

W. N. Papian

Room Number: Barta Building

Expected Date of Completion:

July 21, 1950

Supervisor: J. W. Forrester

Noted by:
Res. Lab. Office_____
Grad. Comm. _____
Supervisor _____

Detail of Work Currently Active: A numerical integration of the difference equation describing the build-up of flux in a ferromagnetic core with non-constant permeability is being attempted. Only a particular case is being tried; the required computation time is almost prohibitive.

Expected Date of Completion of this Detail: Before April 13, 1950

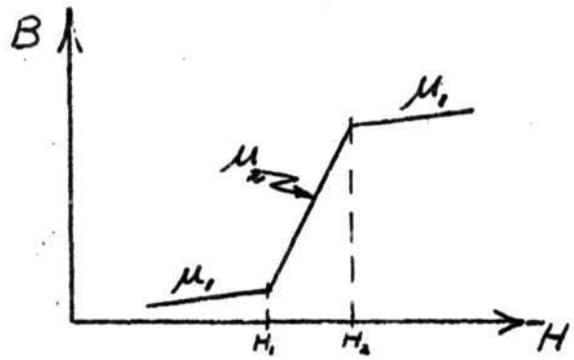
Statement of Progress Since Last Report: Include references, with statements of their usefulness.

Little progress has been made since March 2, 1950, due to vacation.

With the assistance of Professor P. Franklin and Mr. D. Israel, a numerical analysis was begun on the non-linear, eddy-current shielding equation:

$$\frac{\partial^2 H}{\partial x^2} - \sigma\mu\frac{\partial H}{\partial t} - \sigma H\frac{\partial \mu}{\partial t} = 0$$

The permeability, μ, has been allowed to take on only two different values, as shown below on the approximation to the B-H loop used.



The amount of computation involved in arriving at a plot of the total flux, ϕ, versus time, t, is very extensive, and significant results are not yet available. (The problem is one which might profitably be put on an automatic digital computer.)

Work continues on the test setup.

Time Schedule

March 2 to April 13:

Work on the problem of the delayed output pulse with the hypothesis that it is due to eddy-current shielding of the material, and is a function of parameters governing eddy-currents and parameters which describe the extreme non-linearity of the path traversed in the B-H plane.

1. Refine experimental setup to enable taking pertinent data.
2. Attempt some sort of approximate solution (probably by numerical methods) to the non-linear, 2nd-order, partial differential equation of the system.
3. Begin a written discussion of the problem as a start toward the thesis write-up.

April 14 to May 18:

Work on the complete single unit of memory.

1. Test stability of stored information as a function of repeated near-reversing excitation.
2. Test ratio of signal (response to full-reversing excitation) to noise (near-reversing excitation).
3. Other problems involved in operation of a single unit.
4. Begin writing section of thesis devoted to this phase of the problem.

May 19 to June 8:

A. Attempt to build some single units into a small matrix of storage with attendant selecting, sensing and storing circuitry.

B. Complete a draft of thesis covering work to date; have it typed and illustrated.

June 9 to June 29:

A. Run operating tests on storage matrix.

B. Incorporate this information into typed and illustrated draft of thesis which should then be ready for tentative approval by Supervisor.

June 30 to July 20:

Complete conclusions and polishing of thesis draft, to put in final form for approval and typing by July 6.

July 21:

Thesis due date.

Tentative Chapter Heads:

I. Introduction to the Problem
II. Response Times of Cores
III. Reading, Writing, and Storage Stability in the Single Unit
IV. Construction and Operation of a Small Matrix of Storage
V. Conclusions

Signed William N. Papian
W. N. Papian

WNP:adm