Southern Polytechnic State University **ECET 2111 Laboratory No. 12**
Electrical and Computer Engineering Technology **Mutual Inductance Pt. B**

Name: ____________________ **Date __________** **Lab Section _______**

Introduction

In this exercise you will determine the mutual inductance between a pair of mutually coupled coils.

Procedure

1. Connect the circuit shown in Figure 1.
2. Leaving the output terminals open-circuited (I_2 = 0A), using an oscilloscope, take the necessary measurements to calculate the impedance Z_{ABO} as seen by the source. Verify this impedance using the LCR meter by converting the results of the LCR measurement to impedance form. (You must disconnect the source and scope when taking the LCR measurements.) Repeat this procedure with the output short-circuited (E_2 = 0V) to determine Z_{ABS}.
   Be sure to attach a sheet containing all your measurements and calculations to the back of the lab.

   $\mathbf{Z_{ABO}}_{(Osc)}$ = ____________________________Ω $\mathbf{Z_{ABO}}_{(LCR)}$ = ____________________________Ω

   $\mathbf{Z_{ABS}}_{(Osc)}$ = ____________________________Ω $\mathbf{Z_{ABS}}_{(LCR)}$ = ____________________________Ω

3. Move the voltage source to the output terminals. Make the necessary accommodations and repeat step 2 to determine $\mathbf{Z_{CDO}}$.

   $\mathbf{Z_{CDO(Osc)}}$ = ____________________________Ω $\mathbf{Z_{CDO(LCR)}}$ = ____________________________Ω

4. Use these measurements from steps 2 and 3 to determine the mutual inductance M from both the oscilloscope measurements and the LCR measurements.

   $\mathbf{M_{(Osc)}}$ = ______________________H $\mathbf{M_{(LCR)}}$ = ______________________H

5. Compare the oscilloscope determined inductance to the LCR meter determined inductance.

   $\mathbf{R_d}$ = _________________ %

This part of the procedure will use only the LCR meter and the mutually linked inductors.

6. Connect terminal 2 to terminal 3. Measure and record $\mathbf{L_{T(+)}}$ (the total effective inductance between terminals 1 and 4) with the LCR meter. Note that L_1 and L_2 are now connected in a ***series-aiding*** configuration (confirm connection by the Dot Notation method).

   $\mathbf{L_{T(+)}}$ = _________________ H

7. Disconnect terminal 2 from terminal 3.

8. Connect terminal 2 to terminal 4. Measure and record $\mathbf{L_{T(-)}}$ (the total effective inductance between terminals 1 and 3) with the LCR meter. Note that L_1 and L_2 are now connected in a ***series-opposing*** configuration (confirm connection by the Dot Notation method).

$\mathbf{L_{T(-)}}$ = _________________ H

9. Using the equation: $M_{12} = \frac{(L_{T(+)} - L_{T(-)})}{4}$, calculate the mutual inductance term M_{12}.

$\mathbf{M_{12}}$ = ________________ H

10. Compare this M_{12} value with the oscilloscope determined mutual inductance value found in step 4.

$\mathbf{R_d}$ = _________________ %

11. Compare this M_{12} value with the LCR meter determined mutual inductance value found in step 4.

$\mathbf{R_d}$ = _________________ %

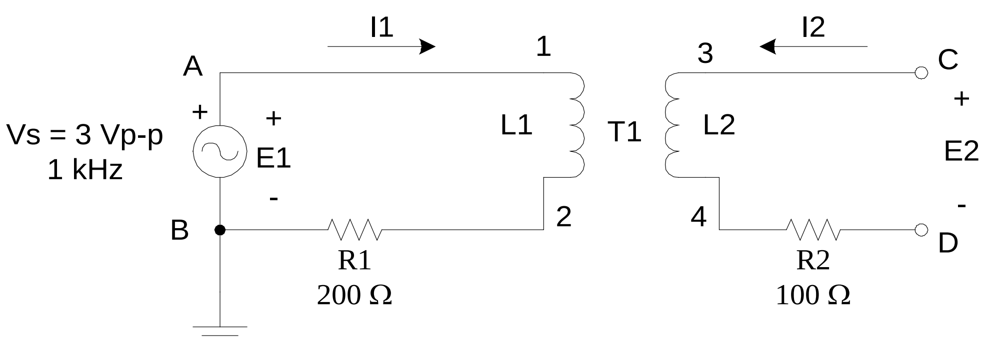

Figure 1 - Mutually Coupled Coils

Notes: $\mathbf{Z_{ABO} = Z_{Pri}}$
$\mathbf{Z_{CDO} = Z_{Sec}}$
$\mathbf{Z_{ABS} = Z_{IN(sc)}}$
$\mathbf{Z_{IN(sc)} = Z_{Pri} + (wM)^2/Z_{Sec}}$

Results

1. Mutual inductance (as defined in the notes above) is a real number. Is this confirmed by the values obtained in step 4 and step 9 of the procedure? Explain any discrepancies.

Approved by (Instructor): ______________________________ Date: _________________