

Measurement of Self Inductance by Maxwell Bridge

AIM:

- To determine the self-inductance of an unknown coil.

Introduction:

To determine the self-inductance of an unknown coil.

Theory:

This bridge circuit measures an inductance by comparison with variable standard self-inductance. The connections for balance condition is shown in Fig. 1.

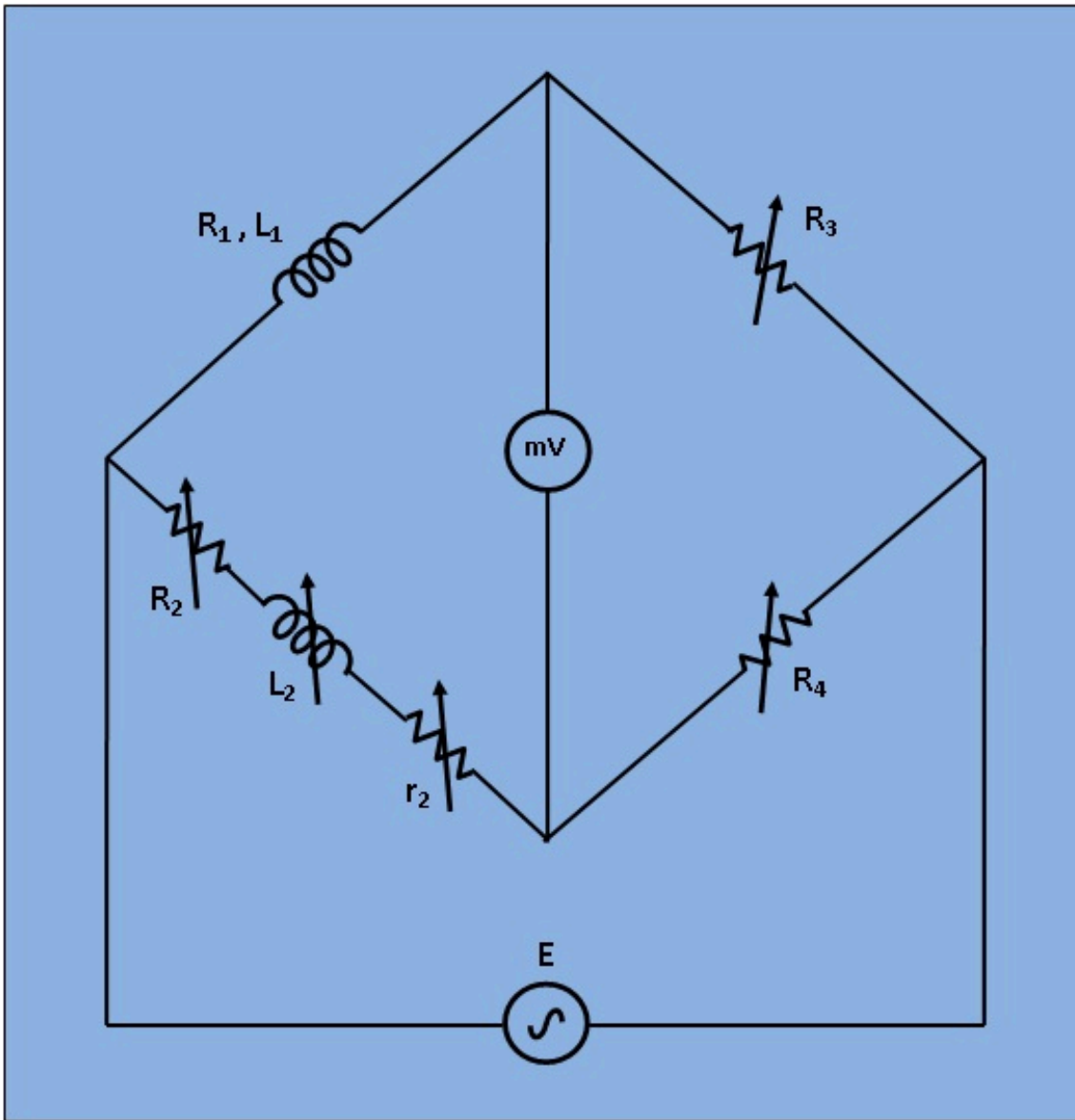


Fig 1: Circuit Diagram for Measurement of Self Inductance by Maxwell Bridge

Let, L_1 = Unknown self-Inductance of resistance R_1 ,

L_2 = variable inductance of fixed resistance r_2 ,

R_2 = variable resistance connected in series with inductor L_2 ,

R_3, R_4 = known non inductive resistances,

At balance condition,

$$(R_1 + j\omega L_1) * R_4 = (R_2 + r_2 + j\omega L_2) * R_3 \dots (1)$$

.. ..

Equating both the real and imaginary parts in eq. (1) and separating them,

$$L_1 = \left(\frac{R_3}{R_4} \right) L_2 \dots (2)$$

$$R_1 = \left(\frac{R_3}{R_4} \right) * (R_2 + r_2) \dots (3)$$

Resistors R_3 and R_4 are normally a selection of values from 10, 100, 1000 and 10,000 Ω . r_2 is a decade resistance box.

Procedure

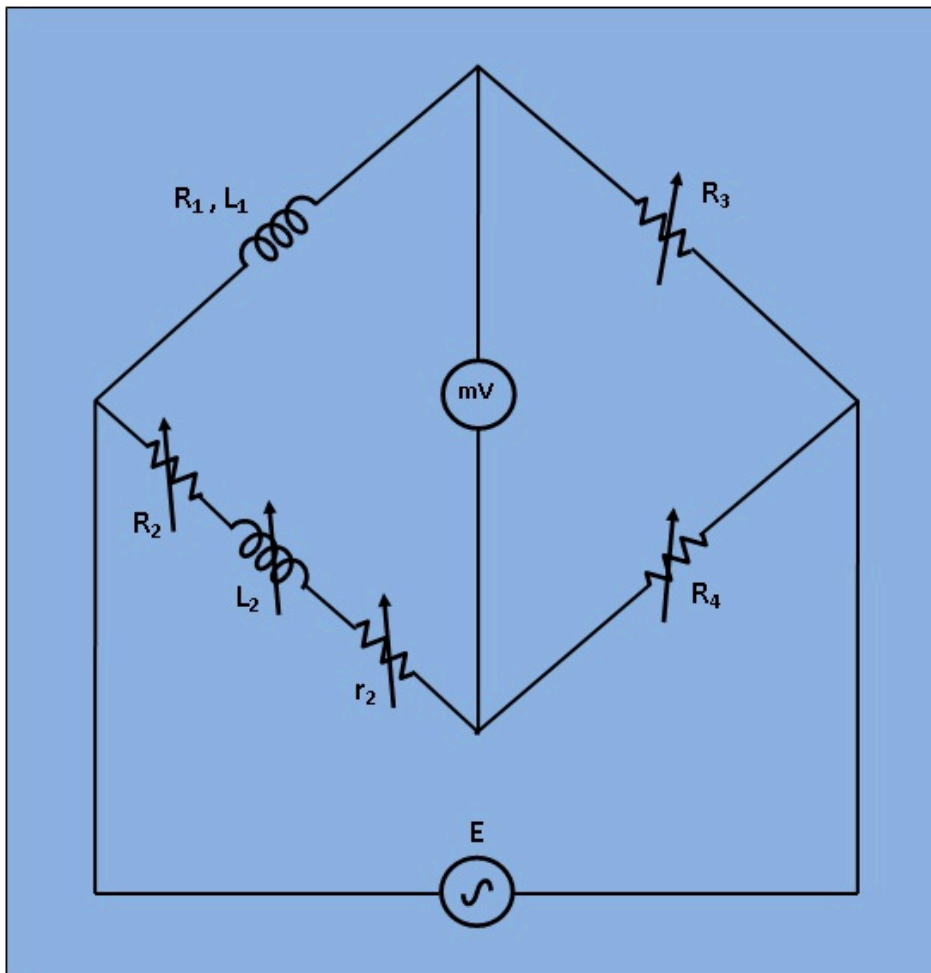


Fig 1: Circuit Diagram for Measurement of Self Inductance by Maxwell Bridge

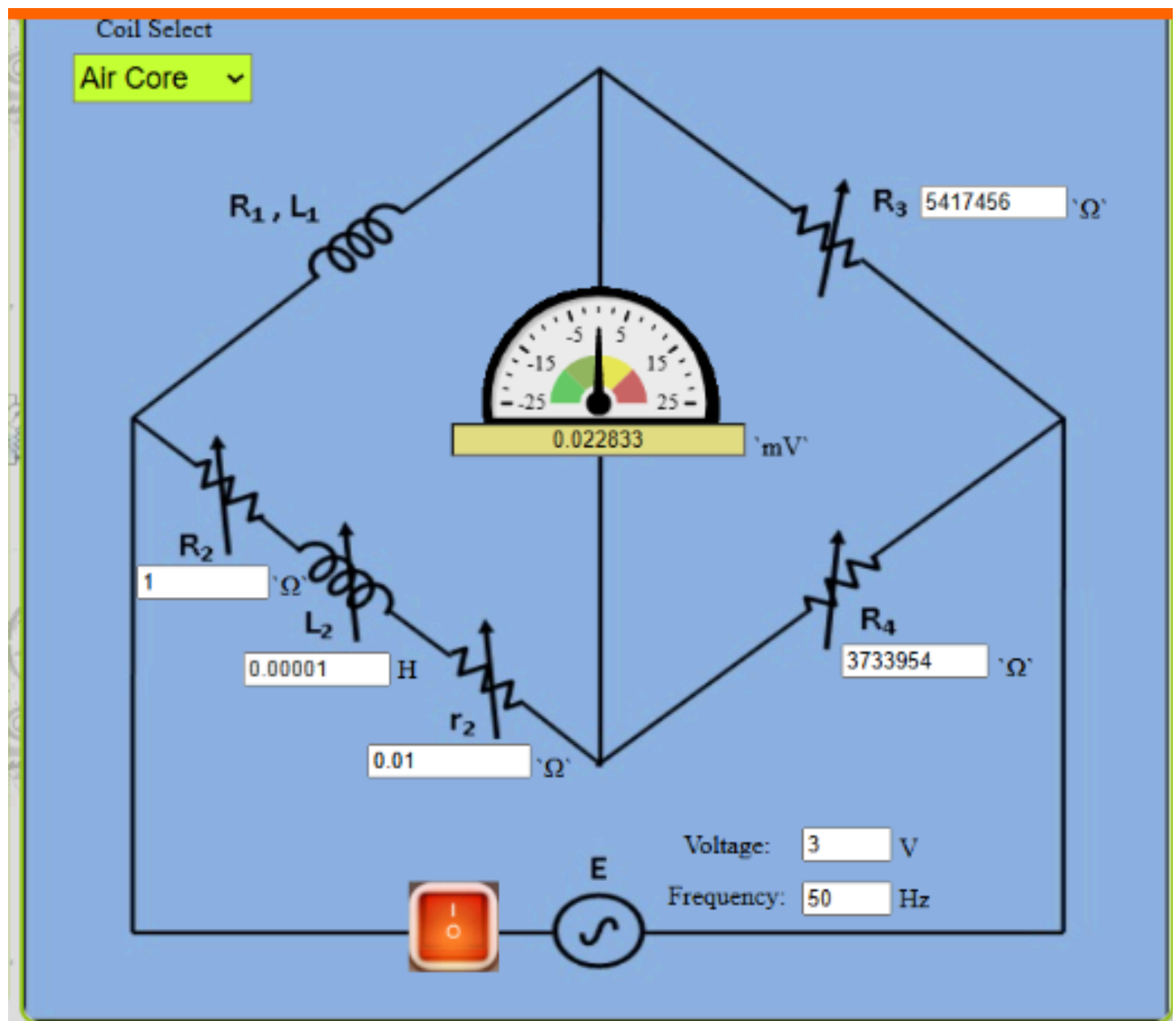
- Apply Supply voltage from the signal generator with arbitrary frequency. ($V = 3V$). Also set the unknown Inductance value from 'Set Inductor Value' tab.
- Then switch on the supply to get millivoltmeter deflection.
- Choose the values of L_2 , r_2 , R_2 , R_3 and R_4 from the inductance and resistance box. Vary the values to some particular values to achieve "NULL".
- Observe the millivoltmeter pointer to achieve "NULL".

-If "NULL" is achieved, switch to 'Measure Inductor Value' tab and click on 'Simulate'. Observe the calculated values of unknown inductance (L_1) and its internal resistance (R_1) of the inductor.

-Also observe the Dissipation factor of the Unknown inductor which is defined as

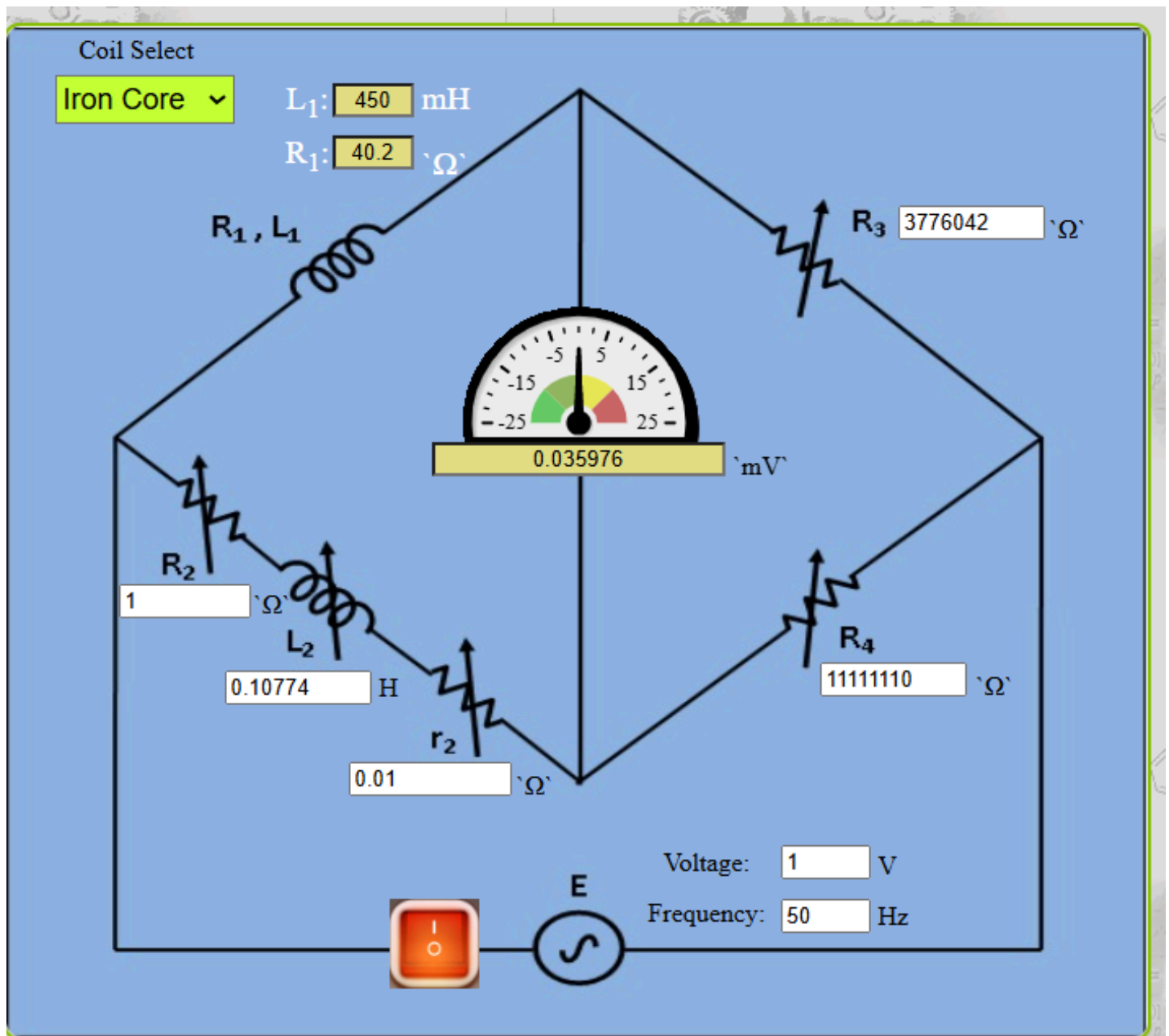
OBSERVATION:

For Air Core



The current voltmeter reading is: 0.022833 mv.		CONTROLS	
Now click on simulate to get:		R2 : 1 Ohm	11.11111 M Ω
Inductor value (in mH): 0.01450863079727		L2 : 10 uH	111.1mH
Resistance value (in Ohm): 1.4653717105245		r2 : 1 Ohm	11.11111 M Ω
Quality Factor: 0.0031089		R3 : 1 Ohm	11.11111 M Ω
Simulate		R4 : 1 Ohm	11.11111 M Ω

For Iron Core



The current voltmeter reading is: 0.035976 mv.

Now click on simulate to get:

Inductor value (in mH): 36.6147725186772

Resistance value (in Ohm): 0.34324225212422

Quality Factor: 33.495

Simulate

CONTROLS

R2 : 1 Ohm \rightarrow 11.11111 M Ω

L2 : 10 uH \rightarrow 111.1mH

r2 : 1 Ohm \rightarrow 11.11111 M Ω

R3 : 1 Ohm \rightarrow 11.11111 M Ω

R4 : 1 Ohm \rightarrow 11.11111 M Ω

RESULT:

Thus, we were able to determine the self-inductance of an unknown coil using a Maxwell Bridge.