EXPRRIMENT-5

Measurement of Self Inductance by Maxwell Bridge

AIM

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.

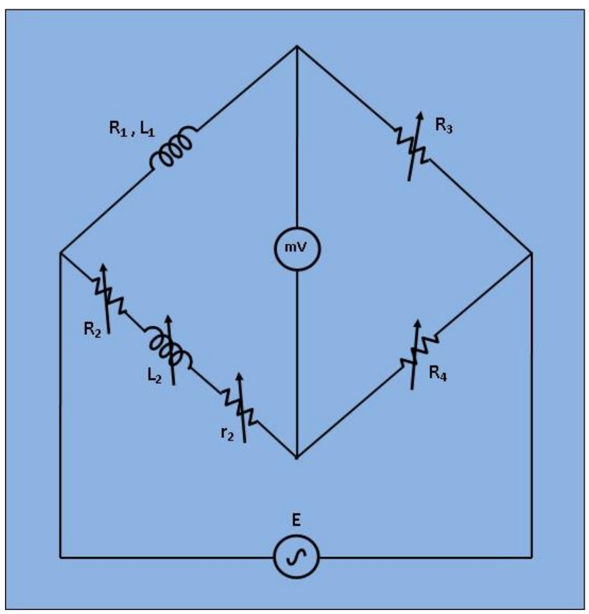


Fig 1: Circuit Diagram for Measurement of Self Inductance by Maxwell Bridge

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,

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

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

$$L_1 = (\frac{R_3}{R_4})L_2 \ldots (2)$$

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

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

Procedure

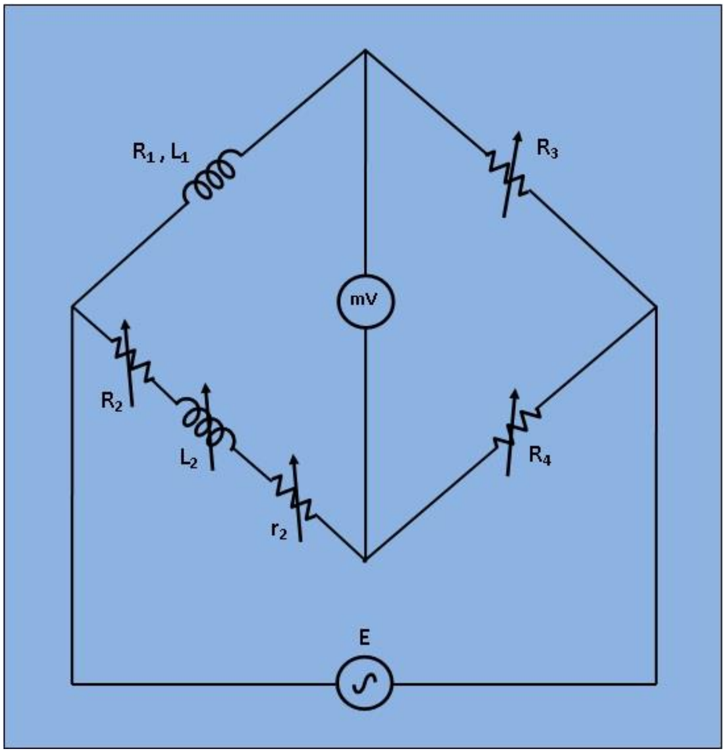


Fig 1: Circuit Diagram for Measurement of Self Inductance by Maxwell Bridge

1. Apply Supply voltage from the signal generator with arbitrary frequency. (V =3v). Also set the unknown Inductance value from 'Set Inductor Value' tab.

2. Then switch on the supply to get millivoltmeter deflection.

3. Choose the values of L_2, r_2, R_2, R_3 and R_4 from the inductance and resistance box. Varry the values to some particular values to achieve "NULL".

4. Observe the millivoltmeter pointer to achieve "NULL".

5. If "NULL" is achieved, switch to 'Measure Inductor Value' tab and click on 'Simulate'. Observe the calculated values of unknown inductance (L_1) and it's

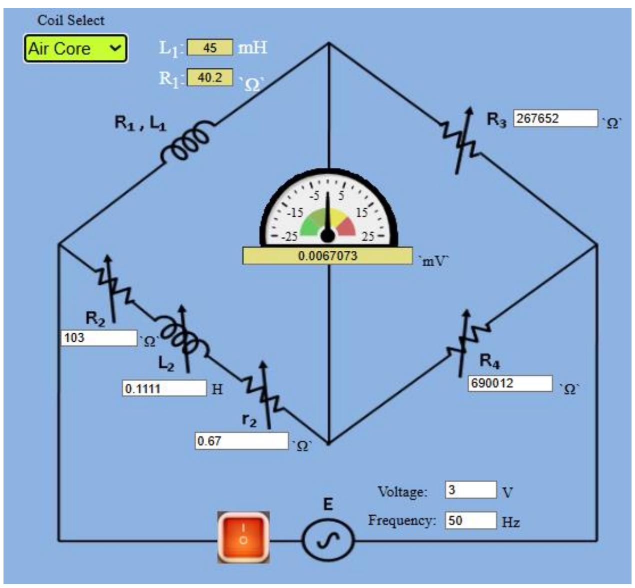
internal resistance (R_1) of the inductor.

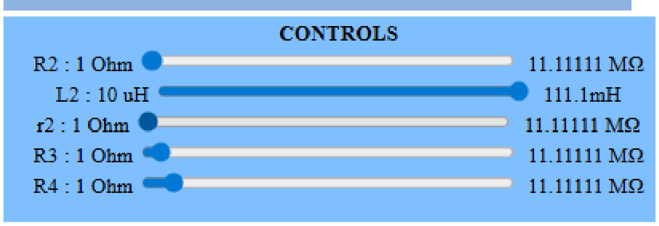
6. Also observe the Dissipation factor of the unknwown inductor which is defined as

$$\frac{\omega L}{R}\ Where, \omega = 2\pi f$$

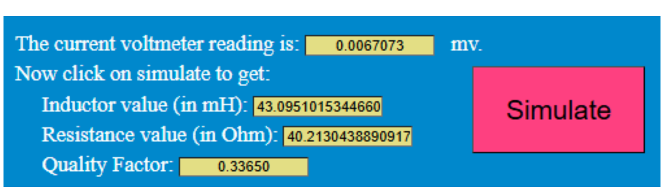
SIMULATION

AIR CORE

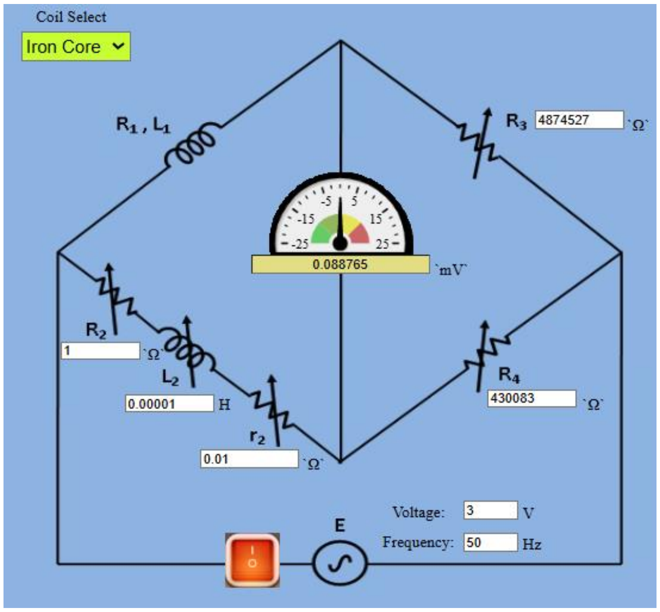


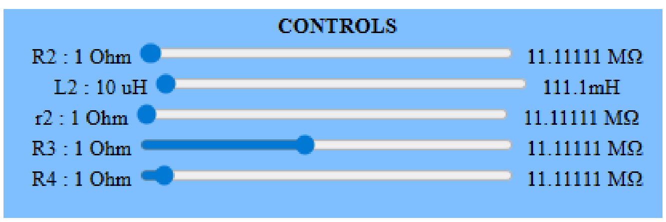


Measure Inductor Value

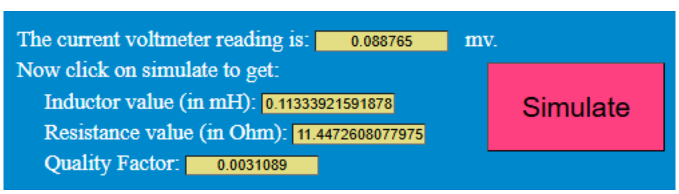


IRON CORE





Measure Inductor Value



RESULT

Thus the unknown inductance is found using maxwell bridge