TO DETERMINE SELF INDUCTANCE OF A COIL BY ANDERSON BRIDGE METHOD

PH:23371539 / 9831450399/9831393369
E Mail:detechkolkata@yahoo.co.in

DE TECH

Manufacturers of Laboratory Instruments & Apparatus

CD 256, SALT LAKE, CALCUTTA 700064, WEST BENGAL.

Aim: To Determine the Self-Inductance of a coil with Anderson's Bridge.

Accessories:

1. An Anderson Bridge trainer kit.
2. Connecting probes.
3. An external inductance coil.

Theory: For low frequencies a practical coil can be represented by a self-Inductance in series with a resistance which accounts for losses in the coil. The self-Inductance of a coil can be measured with the help of Anderson Bridge, illustrated in figure (a).

Let L be the self-Inductance of the coil and s be its resistance. A variable resistance s1 is inserted in the arm CD of the bridge in which the coil is placed.

In figure (a), S=(s+s1) is the total resistance of the arm CD. P, Q, R are non-inductive resistances. m is a variable non-inductive resistance. C is a standard capacitor. D is a detector.

At balance condition, i.e., for no flow of current through the detector, we have

$$S = RQ/P \quad \ldots\ldots (1)$$

And $$L = CR\left[Q + m\left(1 + \frac{P}{Q}\right)\right] \quad \ldots\ldots (2)$$

Equation (1) & (2) are respectively referred to as the DC and the AC balance conditions of the bridge.

If P=Q, Equation (2) reduces to $L = CR(Q + 2m)$ ..... (3)

The AC balance represented by Equation (3) can be achieved only when L > CR Q. Otherwise, the resistance r will be negative. If C is expressed in farad, R, Q and r are expressed in ohms, and then L will be obtained in Henry from Equation (3).

Procedure:

1. Attainment of DC balance:

A. Set up the circuit carefully. Supply source will be DC voltage source.

B. The resistances P, Q, R of the kit are each taken equal.

C. Vary the resistance S and test the balance condition by watching the Null Detector. When the deflection changes in the opposite direction for one ohm variation in S, insert fractional resistances to achieve exact null i.e. 0 in Null Detector. The total resistance in the arm CD of the bridge will then be

(P=Q=R=) S=s+s1.

Therefore, the coil resistance s will be

s = (S-s1) ohm.

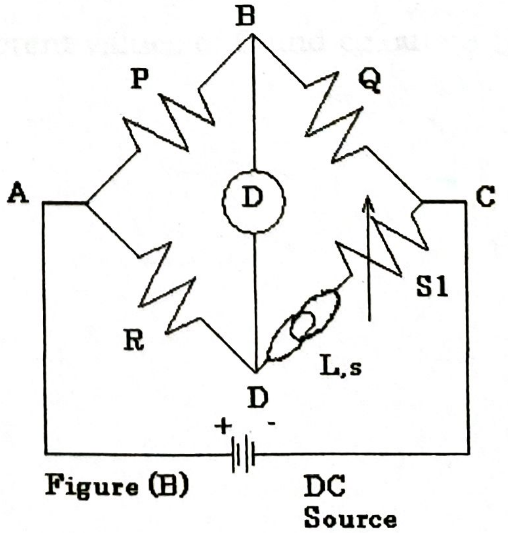

Figure (B)

By this arrangement, the resistances in all the four arms of the Wheatstone bridge are made equal, e.g. 1kΩ. Under this condition the bridge is most sensitive.

2. Attainment of Ac balance:

A. Switch off the kit and *replace the DC source by AC source.* Now, insert the standard capacitor C and resistance m properly to obtain the circuit of the Figure (a). *The resistances P, Q, R and S as obtained for DC balance [operation (1) above], are left unaltered.*

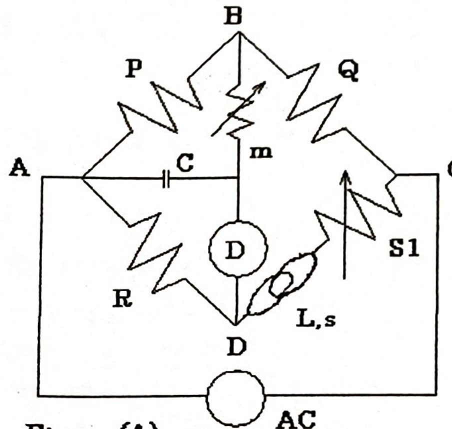

Figure (A)

B. Vary the resistance m until the Null Value will come. Note the corresponding value of m when the Null value will come.

Note: There may be a problem with this null value. In practical field, it is having lots of noise e.g. temperature generated noise, magnetic field and electrical field generated noise, and much more. That's why; the actual null value can not be obtained. *How would you get this null value?* The simple technique is as follows:

Let C be connected at 0.01μF, earlier,'s' obtained, was nearly 960Ω. Known L is also connected unaltered. 's' should not be altered. Now by varying m at around 360Ω we will get 003 in Null Detector. Increase m and we will get 022 in Null Detector. Again we decrease m, and then we will get 006 in Null Detector. So the null value will be in between 600Ω to 200Ω. Therefore we consider we have got the null value when we choose m=360Ω.

C. Calculate L using the Equation (3).

D. Repeat steps (B) & (C) for the different values of C and calculate the mean value of L.

Discussions:

1. The value of C must be such that L>CRQ. Therefore to perform the experiment, the approximate value of L is required beforehand to choose C properly. The experiment then allows an accurate determination of L.
2. Unless the bridge is sensitive, an accurate determination of the AC Null point is difficult. The bridge is made sensitive by choosing equal value of resistances in the four arms.
3. In the beginning, the frequency of the AC source should be varied and a proper value of it should be chosen, so that it suits the ear and an accurate determination of Null point is possible.

Query:

1. What do you mean by self-inductance of a coil? What is its SI unit?
2. What is non-inductive winding?
3. Will the self-inductance of a coil be effective for a DC supply?
4. Is there any condition necessary for obtaining the balance?
5. Is there any advantage in this bridge?
6. What type of oscillator are you using? What is its frequency?
7. Apart from the self-inductance, what other circuit parameters will a coil have?
8. Define self-inductance.
9. Define one Henry.

Accessories supplied:

Item	Qty
Anderson bridge set up with built in AC/DC null detector and Power supply : AC (1kHz) / DC (2V)	1
Inductance coil (10 mH or 20 mH)	1
2 mm connecting probe (6 inchs) jacks on both ends	10
Manual	1
High quality finish wooden box for dust resistance and easy storage	1