ANDERSON BRIDGE

The Anderson Bridge is a very important and useful modification of the Maxwell Wien Bridge as shown in Fig 11.32.

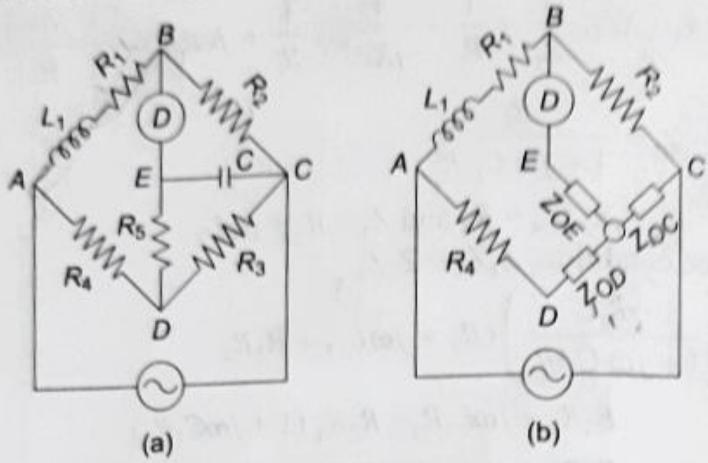

Fig 11.32 Anderson's bridge

The balance condition for this bridge can be easily obtained by converting the mesh impedances C, R_3, R_5 to an equivalent star with the star point 0 as shown in Fig 11.32(b) by using star/delta transformation.

As per delta to star transformation

$$Z_{OD} = \frac{R_3 R_5}{(R_3 + R_5 + 1/j\omega C)} \qquad Z_{OC} = \frac{R_3 / j\omega C}{(R_3 + R_5 + 1/j\omega C)} = Z_3$$

Hence with reference to Fig. 11.32 (b) it can be seen that

$$Z_1 = (R_1 + j\omega L_1), Z_2 = R_2, Z_3 = Z_{OC} = \frac{R_3 / j\omega C}{(R_3 + R_5 + 1/j\omega C)} \text{ and } Z_4 = R_4 + Z_{OD}$$

For balance condition,

$$Z_1 Z_3 = Z_2 Z_4$$

Therefore, $(R_1 + j\omega L_1) \times Z_{OC} = Z_2 \times (Z_4 + Z_{OD})$

$$(R_1 + j\omega L_1) \times \left(\frac{R_3/j\omega C}{(R_3 + R_5 + 1/j\omega C}\right) = R_2\left(R_4 + \frac{R_3 R_5}{(R_3 + R_5 + 1j\omega C}\right)$$

Simplifying,

$$(R_1 + j\omega L_1) \times \frac{R_3/j\omega C}{(R_3 + \cancel{R_5 + 1}/j\omega C} = R_2\left(R_4 (R_3 + R_5 + 1/j\omega C) + \frac{R_3 R_5}{(R_3 + \cancel{R_5 + 1}/j\omega C}\right)$$

$$(R_1 + j\omega L_1) \times \frac{R_3}{j\omega C} = R_2 R_4 (R_3 + R_5 + 1/j\omega C) + R_2 R_3 R_5$$

$$\frac{R_1 R_3}{j\omega C} + \frac{j\omega L_1 R_3}{j\omega C} = R_2 R_3 R_4 + R_2 R_4 R_5 + \frac{R_2 R_4}{j\omega C} + R_2 R_3 R_5$$

$$\frac{-jR_1 R_3}{\omega C} + \frac{L_1 R_3}{C} = R_2 R_3 R_4 + R_2 R_4 R_5 - \frac{jR_2 R_4}{\omega C} + R_2 R_3 R_5$$

Equating the real terms and imaginary terms

$$\frac{L_1 R_3}{C} = R_2 R_3 R_4 + R_2 R_4 R_5 + R_2 R_3 R_5$$

$$L_1 = \frac{C}{R_3}(R_2 R_3 R_4 + R_2 R_4 R_5 + R_2 R_3 R_5)$$

$$L_1 = CR_2\left[R_4 + \frac{R_4 R_5}{R_3} + R_5\right]; \quad L_1 = CR_2\left[R_4 + R_5 + \frac{R_4 R_5}{R_3}\right]$$

$$\frac{-jR_1 R_3}{\omega C} = \frac{-jR_2 R_4}{\omega C}; \quad R_1 R_3 = R_2 R_4, \text{ therefore, } R_1 = \frac{R_2 R_4}{R_3}$$

This method is capable of precise measurement of inductances and a wide range of values from a few μH to several Henries.