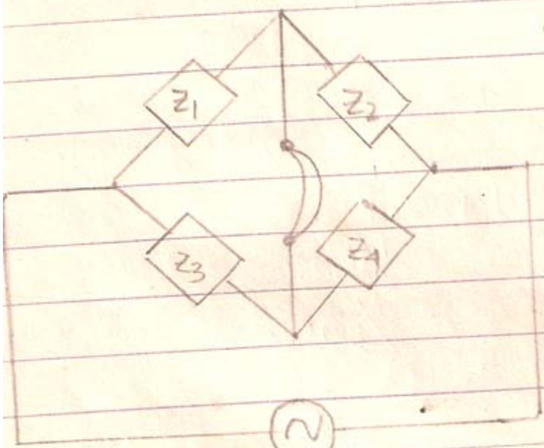
A.C Bridge: Ac bridges are similar to wheatstone bridge in principle. The four resistances are represented by four impedances. The battery is replaced by an A.C Source & the galvanometer is replaced by a headphone detector.



When the bridge is balanced. no current flows through the detector branch, i.e no current (min^m current) flows through the headphone; giving minimum sound in the head phone.

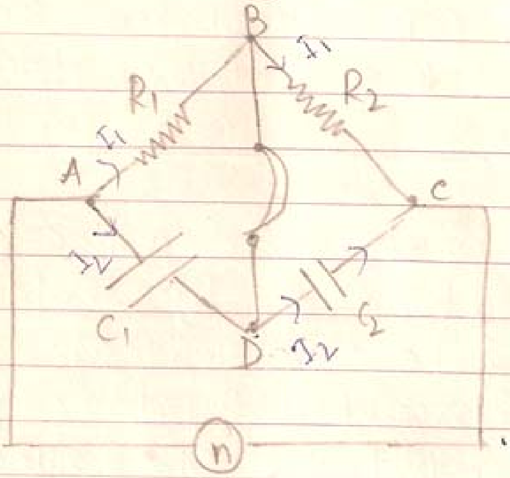
At balanced condition, we can write:

$$\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4}$$

De - Sauty bridge: This bridge is used for comparision of capacitance of two capacitors & if one capacitance is known the other can be calculated.

The circuit connection is made as shown

in the diagram.



The impedance of the four branches are as follows.

$Z_1 = R_1$, $Z_2 = R_2$

$Z_3 = X_{C_1} = \frac{1}{j\omega C_1}$

$Z_4 = X_{C_2} = \frac{1}{j\omega C_2}$

When the bridge is balanced

$$\frac{Z_1}{Z_2} = \frac{Z_3}{Z_4} \quad \text{or} \quad \frac{R_1}{R_2} = \frac{1/j\omega C_1}{1/j\omega C_2}$$

$$\text{Or} \quad \frac{R_1}{R_2} = \frac{C_2}{C_1} \quad \therefore \frac{C_2}{C_1} = \frac{R_1}{R_2} \quad \text{——} \quad (1)$$

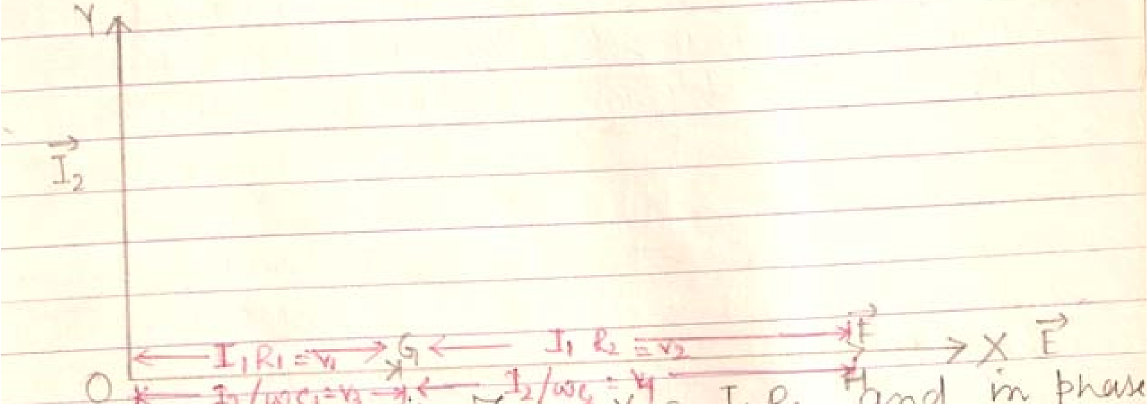
Thus when the bridge is balanced; the ratio of the capacitance of the two capacitors can be calculated using eqⁿ (1).

The vector diagram of de-Sauty bridge:-

Let

(i) $\vec{OF} = \vec{E}$ i.e. $OF = E$ and the direction of $\vec{OF}$ represents the phase of e.m.f

(ii) Let I_1 be the current flowing through R_1 and at balance I_1 must also be the current through R_2 pd across Z_1 $V_1 = I_1 R_1$ and is in phase with current I_1. V_1 can be represente y a vector $\vec{OG}$ of length I_1R_1 and direction along OF.



(iii) P.d. across Z_2, $V_2 = I_1R_2$ and in phase with current I_1. $\therefore$ V_2 can be represented by a vector $\vec{GH}$ of length I_1R_2 and in the same direction as $\vec{OF}$.

$\therefore$ $V_1 + V_2 = OG + GH = OF = E$

(iv) Let OY; 90° anti-clockwise from OX represent the phase of current I_2.

(v) The P.D across Z_3 is $V_3 = I_2 X_{C_1} = I_2 \frac{1}{\omega C_1}$ and this P.D lags the current I_2 by 90°. Hence V_2 can be represented by a vector of length $\frac{I_2}{\omega C_1}$ and direction along OX i.e. $\vec{V_3} = \vec{OG}$ because at balance P.d across Z_1 = P.d across Z_3.

(vi) P.d across Z_4, $V_4 = I_2 X_{C_2} = I_2 \frac{1}{\omega C_2}$ and this P.d lags the current I_2 by 90° and hence V_4 can be represented by a vector $\vec{GH}$ of length $I_2/\omega C_2$ same as length of V_2 along $\vec{OF}$.

$\vec{V_1} + \vec{V_2} = OG + GH = OH = E$

$\vec{V_3} + \vec{V_4} = OG + GH = OH = E$

Also $V_1 = V_3$

$V_2 = V_4$