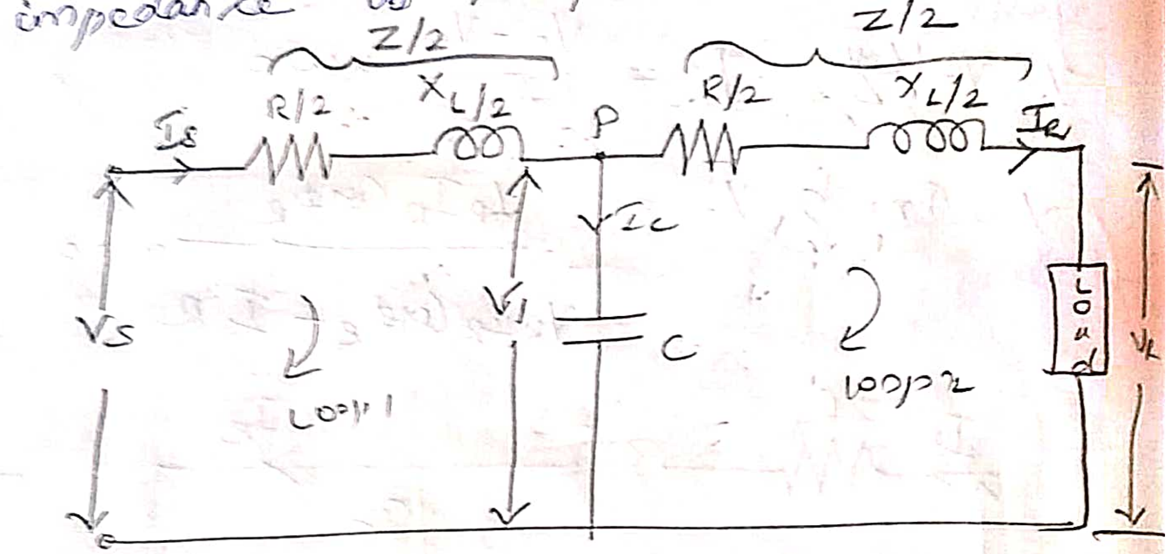
(ii) Nominal T method.

The nominal T method, the line capacitance to be concentrated at the mid point of line and half the line impedance is lumped on its either side.



Let I_R be the load current / phase

R " " resistance / "

X_L " " inductive reactance / "

C " " capacitance / "

V_S " " phase voltage at sending end.

V_R " " receiving end.

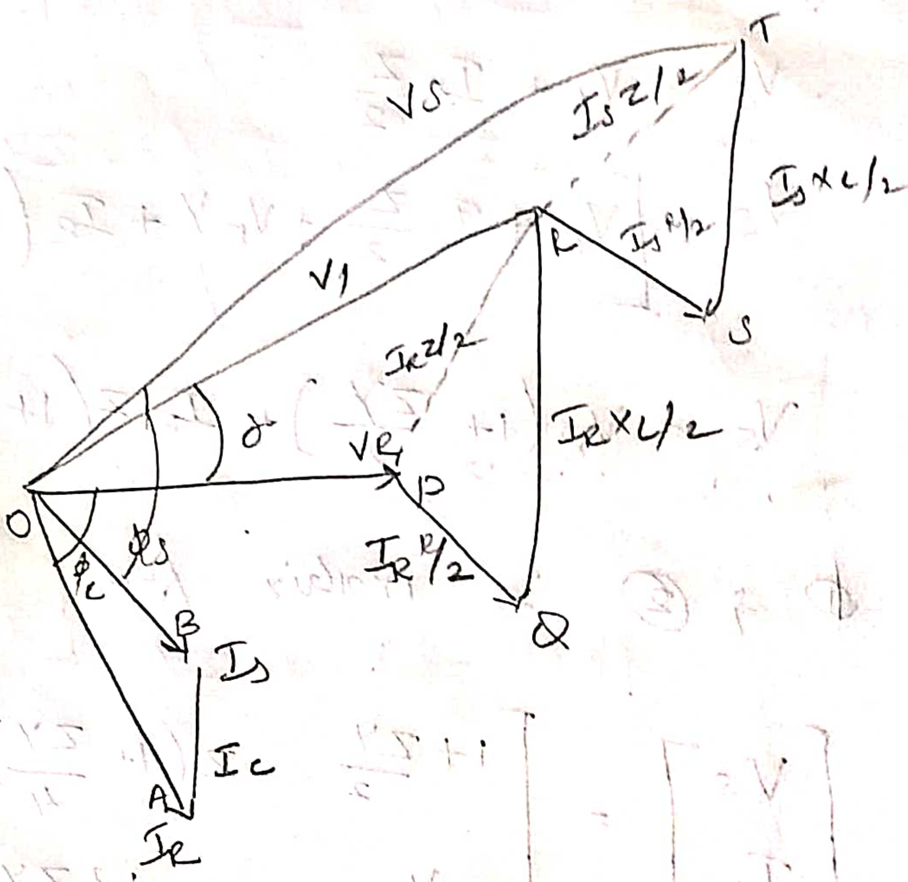
V_1 be the voltage across capacitor.

Total series impedance $Z = R + jX_L$

Shunt admittance $Y = G + j\omega C$

Shunt conductance $G = 0$

$Y = j\omega C$



Apply KVL at loop 2

$$V_1 = V_R + I_R \frac{Z}{2}$$

capacitive current $I_c = V_1 \cdot j\omega C$

$$I_c = Y V_1 = \left(V_R + I_R \frac{Z}{2}\right) Y.$$

Apply KCL at Node P.

$$I_S = I_c + I_R$$

$$I_s = I_R + V_R Y + I_R \frac{Z}{2} Y$$

$$I_s = V_R Y + I_R \left(1 + \frac{ZY}{2}\right) \quad \text{—— } (1)$$

Apply KVL at loop 1.

$$V_S = V_1 + I_S \frac{Z}{2}$$

$$V_S = \left[V_R + I_R \frac{Z}{2} + V_R Y + I_R\left(1+\frac{ZY}{2}\right)\right]\frac{Z}{2}$$

$$V_S = V_R\left(1+\frac{ZY}{2}\right) + I_R Z\left(1+\frac{ZY}{4}\right) \quad (2)$$

eq. (1) & (2) in matrix form

$$\begin{bmatrix} V_S \\ I_S \end{bmatrix} = \begin{bmatrix} 1+\frac{ZY}{2} & Z\left(1+\frac{ZY}{4}\right) \\ Y & 1+\frac{ZY}{2} \end{bmatrix} \begin{bmatrix} V_R \\ I_R \end{bmatrix}$$

Let the receiving end voltage at no load be V_R.

$$\therefore I_R = 0$$

$$I_S = I_C$$

$$V_R' = V_1$$

$$\% \eta = \frac{P_R(3\phi)}{P_R(3\phi) + 3\left[I_R^2 \frac{R}{2} + I_S^2 \frac{R}{2}\right]} \times 100$$