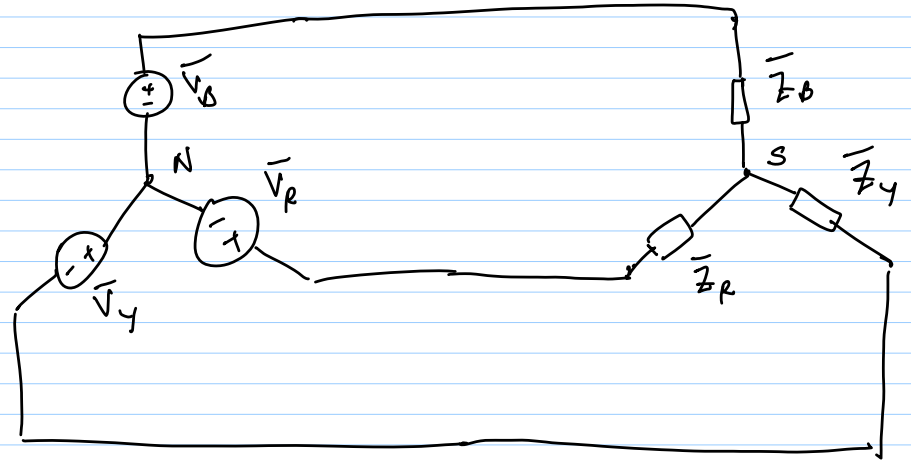
27/4/15

Lec 42

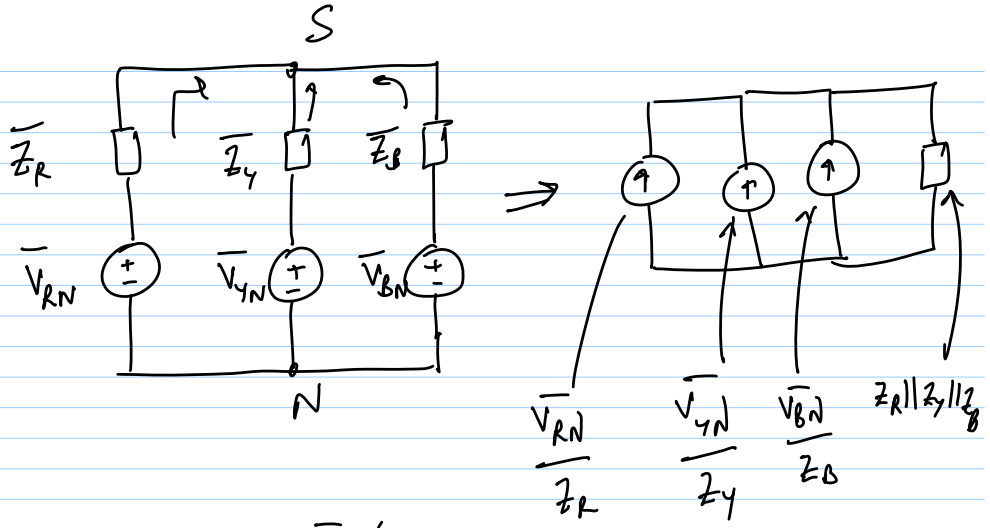
Symmetrical Components



$$Z_{RY} = \frac{\sum Z_R Z_Y}{Z_B} \quad \leftarrow \text{Star to delta conversion}$$

$$Z_R = \frac{Z_{RY} Z_{BR}}{\sum Z_{RY}} \quad \leftarrow \text{delta to star conv.}$$

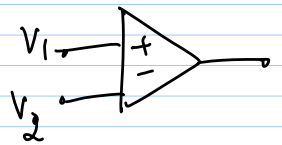
$\bar{V}_{RS}$, $\bar{V}_{YS}$, $\bar{V}_{BS}$ $\Big\} = ?$ $\quad \bar{V}_{SN}$

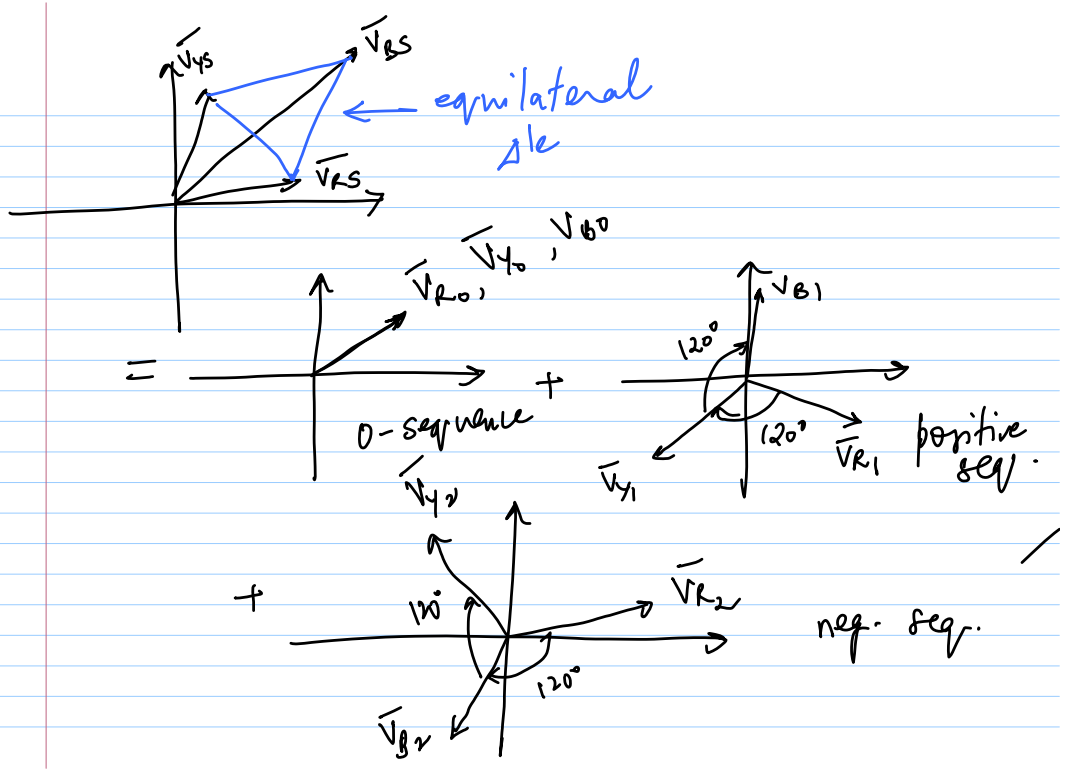


$$\bar{V}_{SN} = \frac{\sum \bar{V}_{RN}/Z_R}{\sum 1/Z_R} \; ; \quad \bar{V}_{RS} = \bar{V}_{RN} - \bar{V}_{GN}$$

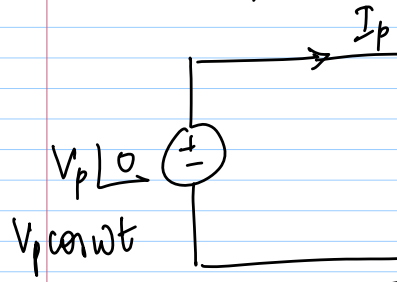
$$V_1 = \frac{V_1 + V_2}{2} + \frac{V_1 - V_2}{2}$$

$$V_2 = \frac{V_1 + V_2}{2} - \frac{V_1 - V_2}{2}$$





AC power measurement



$$p(t) = V_p I_p \cos\omega t \cdot \cos(\omega t + \varphi)$$

$$= \frac{V_p I_p}{2} \cos\varphi + \frac{V_p I_p}{2} \cos(2\omega t + \varphi)$$

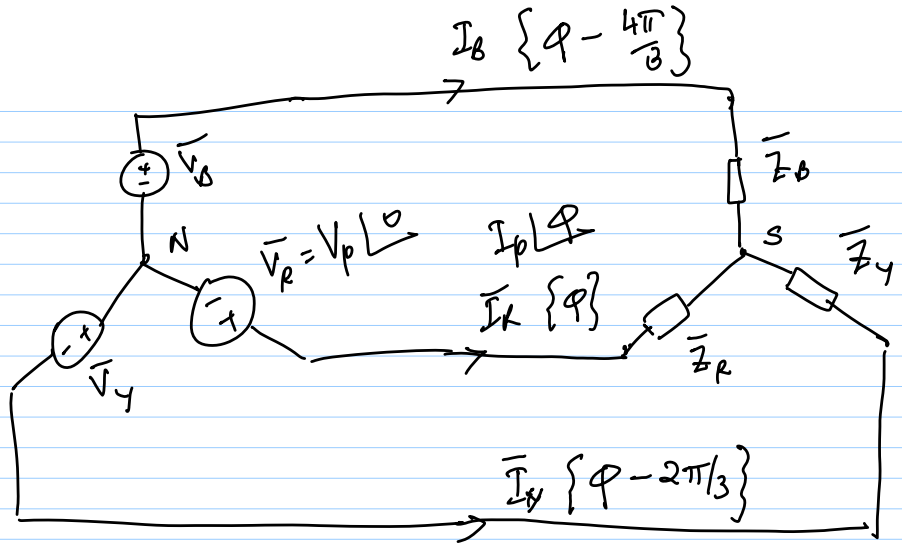
average power; osc. power

$$\bar{P} = \frac{V_p I_p^*}{2}$$

$$pf = \frac{\mathrm{Re}(\bar{P})}{|\bar{P}|}$$

$$= \frac{V_p I_p}{2} \cos\varphi - j \frac{V_p I_p}{2} \sin\varphi$$

avg. power; reactive power



Z_L: $$p(t) = \frac{V_p I_p}{2} \cos\varphi + \frac{V_p I_p}{2} \cos 2\omega t \cos\varphi - \frac{V_p I_p}{2} \sin(2\omega t) \sin\varphi$$

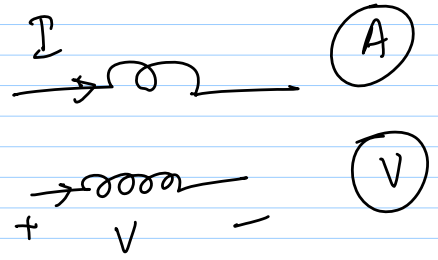
Z_Y: $$p(t) = \frac{V_p I_p}{2} \cos\varphi + \frac{V_p I_p}{2} \cos\varphi \cdot \cos(2\omega t - 4\pi/3) - \frac{V_p I_p}{2} \sin\varphi \sin(2\omega t - 4\pi/3)$$

$\bar{Z}_\Delta$ = . . .

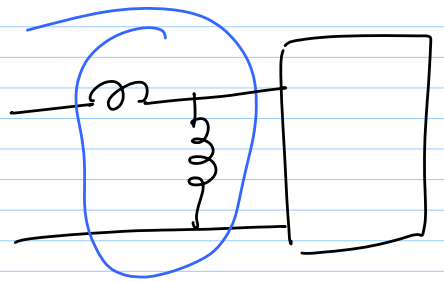
$$P_{avg.} = \frac{3 V_p I_p}{2} \cos\varphi$$

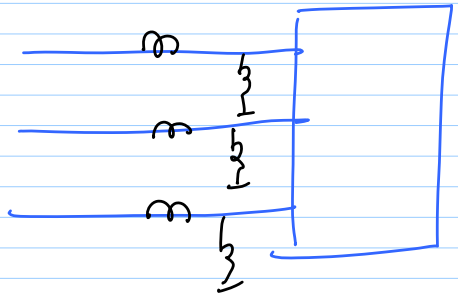
$$PF\Big|_{\text{per phase}} = \frac{V_p I_{p/2} \cos\varphi}{\left| \overline{P}_{\text{per phase}} \right|}$$

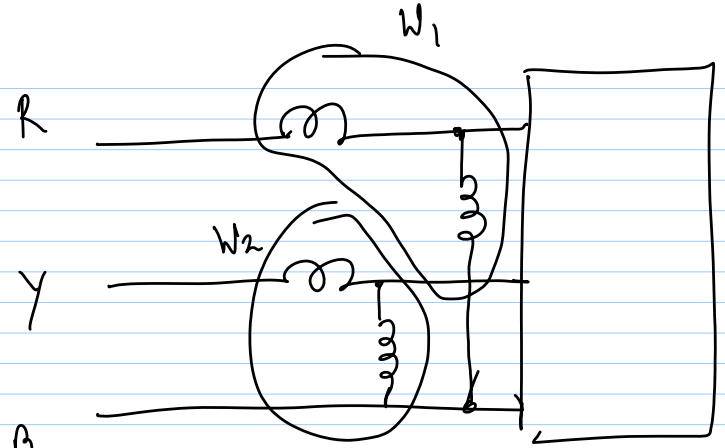
Wattmeter



Wattmeter







$$\sum V_k I_k$$