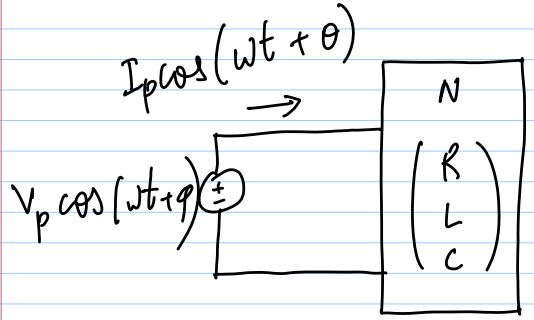
1/1/15

Lec 34



$\bar{V} = V_p \angle\varphi = V_p\exp(j\varphi)$

$\bar{I} = I_p \angle\theta \rightarrow I_p\exp(j\theta)$

$\bar{P} = \bar{V}\,\bar{I} = V_p I_p \angle\varphi+\theta$ X

$\bar{P} = \bar{V}\cdot\bar{I} = V_p I_p \angle\varphi-\theta$ X

$\bar{P} = \dfrac{\bar{V}\cdot\bar{I}^*}{2} \rightarrow \dfrac{[V_p I_p/2][\cos(\varphi-\theta)}{\text{complex power } +j\sin(\varphi-\theta)]}$

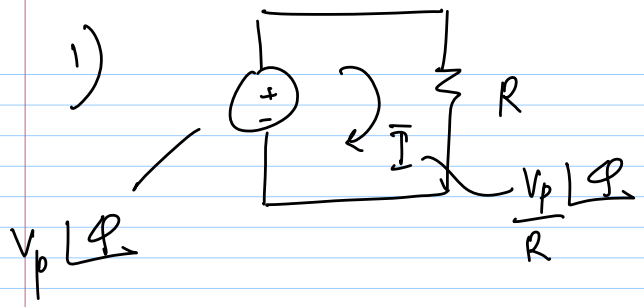
Average power $= \dfrac{V_p I_p}{2}\cos(\varphi-\theta)$

$= \mathrm{Re}[\bar{P}]$

$\bar{P} = P_r + jP_i$

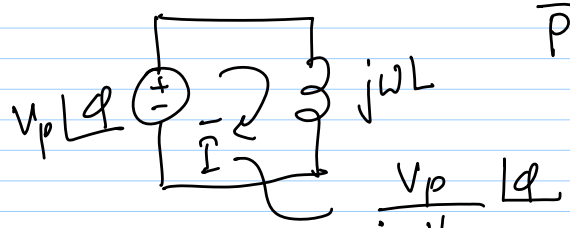
P_r: real or average power

1)



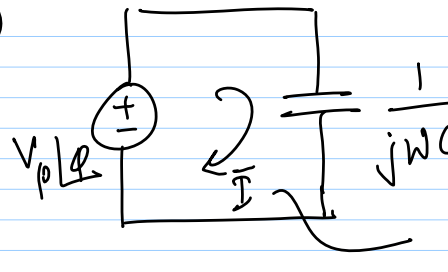
$\bar{P} = \dfrac{V_p^2}{2R}$

2)

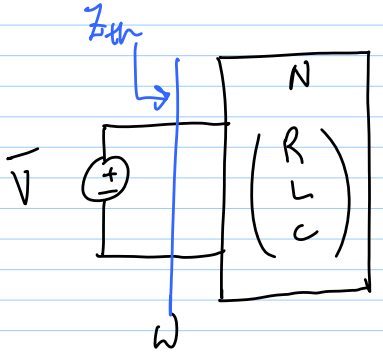


$\bar{P} = j\dfrac{V_p^2}{2\omega L} = j\cdot\dfrac{V_p^2}{2X_L}$

3)



$\bar{P} = -j\omega C\cdot\dfrac{V_p^2}{2} = +j\dfrac{V_p^2}{2X_C}$



$\bar{P} = P_r + jP_i$

complex power: VA

real power: W

reactive power: VAr

$$\bar{V} = V_p \exp(j\varphi) \qquad \bar{I} = I_p \exp(j\theta)$$

$$\bar{P} = \frac{V_p I_p}{2} \exp[j(\varphi-\theta)]$$

$$= \frac{V_p I_p}{2}\left[\cos(\varphi-\theta) + j\sin(\varphi-\theta)\right]$$

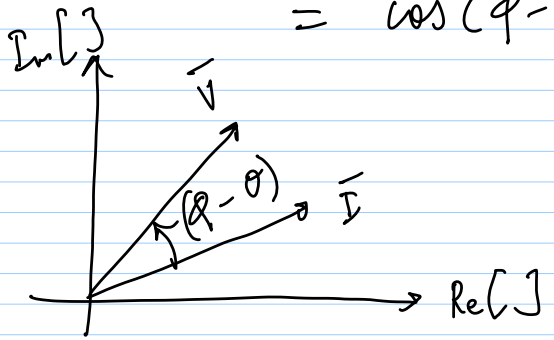
$$|\bar{P}| = \frac{V_p I_p}{2} \quad [\text{VA, apparent power}]$$

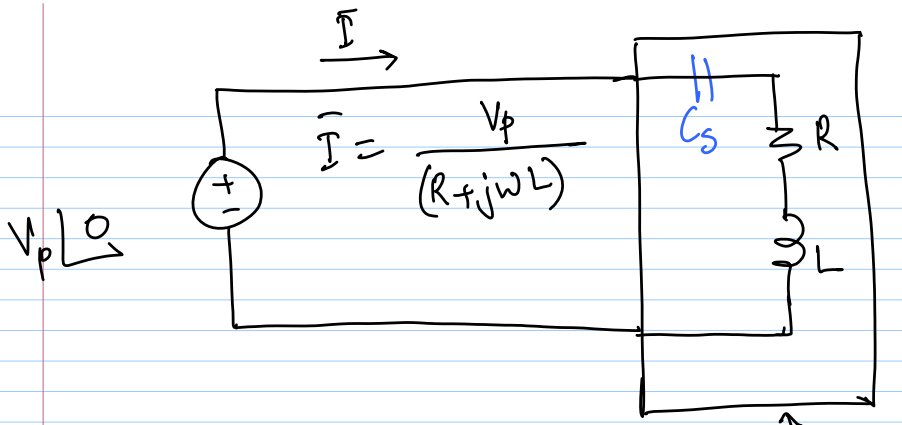
$$\mathrm{Re}[\bar{P}] = \frac{V_p I_p}{2}\cos(\varphi-\theta) \quad [\text{W, real power}]$$

$$\mathrm{Im}[\bar{P}] = \frac{V_p I_p}{2}\sin(\varphi-\theta) \quad [\text{VAr, reactive power}]$$

"power factor" PF $= \dfrac{\text{Real power}}{\text{Apparent power}} = \dfrac{\mathrm{Re}[\bar{P}]}{|P|}$

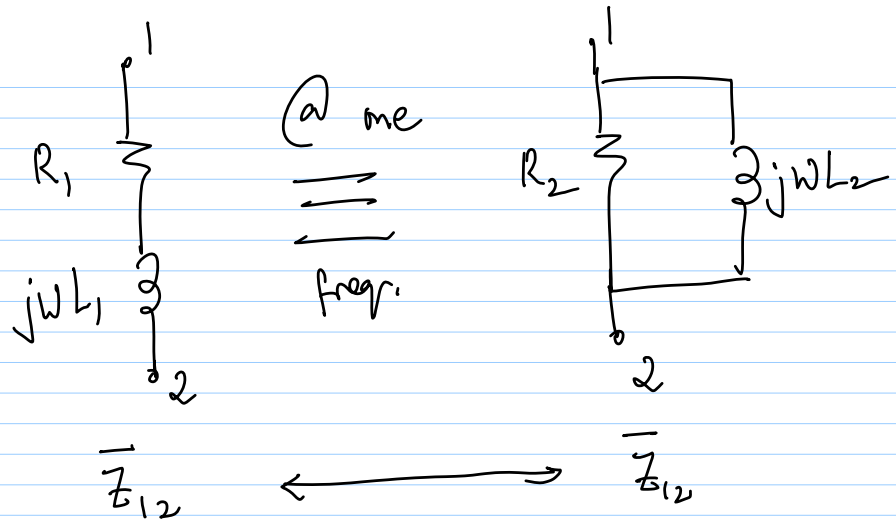
$= \cos(\varphi-\theta)$





$$\bar{P} = \frac{\bar{V}\cdot\bar{I}^*}{2} = \frac{V_p^2}{2(R-jwL)}$$

$$= \frac{V_p^2}{2}\left[\frac{R}{R^2+w^2L^2} + \frac{jwL}{R^2+w^2L^2}\right]$$

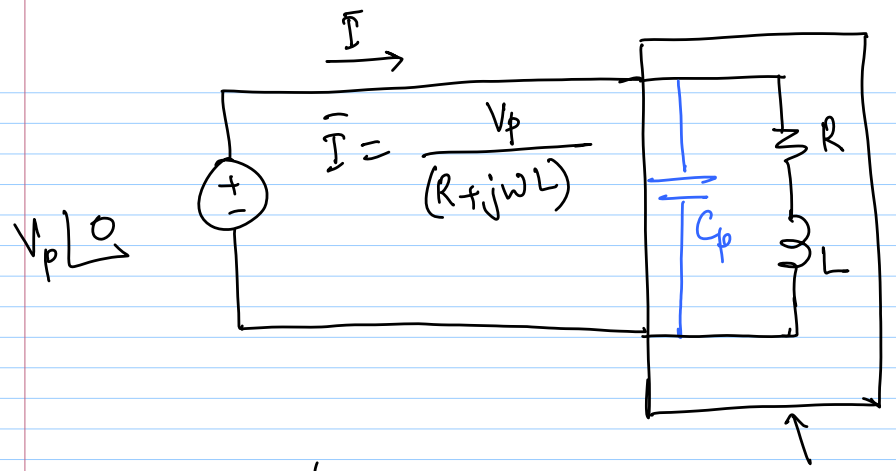


Power delivered to $R = I_{rms}^2 \cdot R$

$= \frac{I_p^2}{2} R$

$$\bar{I} = \frac{V_p}{R + j\omega L}$$

$PF = 1 \Rightarrow C_s = \frac{1}{\omega^2 L}$



$$C_p = \frac{L}{R^2 + \omega^2 L^2}$$