POTENZA IN REGIME PERMANENTE SINUSOIDALE

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$$v(t) = V_m \cos(\omega t + \theta_v) \Rightarrow \bar{V} = V_m e^{j\theta_v}$$

$$i(t) = I_m \cos(\omega t + \theta_i) \Rightarrow \bar{I} = I_m e^{j\theta_i}$$

$$p(t) = p(t, \bar{V}, \bar{I})$$

$$v(t) = \frac{V_m e^{j(\omega t + \theta_v)} + V_m e^{-j(\omega t + \theta_v)}}{2}$$

$$v(t) = \frac{\bar{V} e^{j\omega t} + \bar{V}^* e^{-j\omega t}}{2}$$

$$i(t) = \frac{\bar{I} e^{j\omega t} + \bar{I}^* e^{-j\omega t}}{2}$$

non dipende dal tempo

$$p(t, \bar{V}, \bar{I}) = \frac{1}{4}\{\underbrace{\bar{V}\bar{I}^*}_{a} + \underbrace{\bar{V}^*\bar{I}}_{a^*}\} +$$

dipende dal tempo

$$\frac{1}{4}\{\underbrace{\bar{V}\bar{I} e^{j2\omega t}}_{b} + \underbrace{\bar{V}^*\bar{I}^* e^{-j2\omega t}}_{b^*}\}$$

POTENZA MEDIA

$$p(t, \bar{V}, \bar{I}) = \frac{1}{2}\operatorname{Re}\{\bar{V}\bar{I}^*\} +$$

$$+ \frac{1}{2}\operatorname{Re}\{\bar{V}\bar{I} e^{j2\omega t}\}$$

$$\bar{I}^* = \bar{I} e^{-j2\theta_i} \Rightarrow \bar{I} = \bar{I}^* e^{j2\theta_i}$$

$$\bar{I} = I_m e^{j\theta_i}$$

$$p(t) = \frac{1}{2} Re\{\bar{V}\bar{I}^*\} + \frac{1}{2} Re\{\bar{V}\bar{I}^* e^{j(2\omega t + 2\theta_i)}\}$$

$$\bar{S} = \frac{1}{2}\bar{V}\bar{I}^*$$

$\frac{1}{2} Re\{\bar{V}\bar{I}^*\}$ = POT. MEDIA = POT. ATTIVA

$$Re\{a \cdot b\} \quad a \in \mathbb{C},\ b \in \mathbb{C}$$

$$\frac{1}{2}|\bar{V}||\bar{I}|\cos(\theta_v - \theta_i)$$

$$\frac{1}{2}V_m I_m \cos(\theta_v - \theta_i) \qquad + \frac{1}{2} Re\{\bar{V}\bar{I}^*\}\cos(2\omega t + 2\theta_i)$$

$$\frac{1}{2}V_m I_m \underbrace{\cos(\phi)}_{\text{fattore di potenza}} \qquad - \frac{1}{2} Im\{\bar{V}\bar{I}^*\} sen(2\omega t + 2\theta_i)$$

$$p(t) = \frac{1}{2} Re\{\bar{V}\bar{I}^*\} + \frac{1}{2} Re\{\bar{V}\bar{I}^*\}\cos(2\omega t + 2\theta_i) - \frac{1}{2} Im\{\bar{V}\bar{I}^*\} sen(2\omega t + 2\theta_i)$$

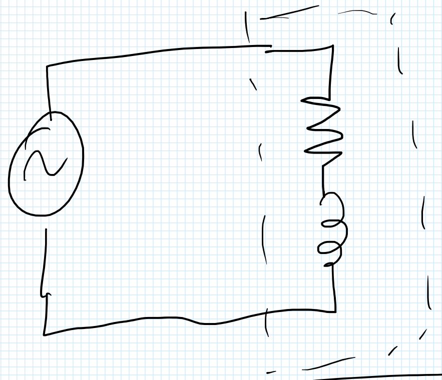
$$\underbrace{Re\{\bar{S}\} + Re\{\bar{S}\}\cos(2\omega t + 2\theta_i)}_{\text{RESISTIVA}} - \underbrace{Im\{\bar{S}\} sen(2\omega t + 2\theta_i)}_{\text{REATTIVA}}$$

$$\bar{S} = \frac{1}{2} V_m I_m e^{j(\theta_v - \theta_i)}$$

se $\theta_v = \theta_i$ $\quad \bar{S} \in \mathbb{R}$ se il carico è resistivo

θ_i)

se $\theta_v - \theta_i = \pm \frac{\pi}{2}$ $\quad \bar{S} = \pm J \frac{V_m I_m}{2}$



CARICO

$p = R i^2 \qquad p = \frac{v^2}{R} \qquad\qquad R \rightarrow Z, Y$

$\bar{V} = Z \cdot \bar{I} \qquad \bar{S} = \frac{1}{2} Z \cdot \bar{I} \cdot \bar{I}^* = \frac{1}{2} Z |\bar{I}|^2 = \frac{1}{2} Z I_m^2$

$\bar{I} = Y \cdot \bar{V} \qquad \bar{S} = \frac{1}{2} \bar{V} \cdot Y^* \bar{V}^* = \frac{1}{2} Y^* |\bar{V}|^2 = \underbrace{\frac{1}{2} Y^* V_m^2}$

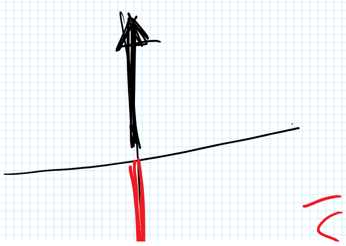
$\bar{S}_R = \frac{1}{2} R I_m^2 = +\frac{1}{2} \frac{V_m^2}{R} \in \mathbb{R}$

$\bar{S}_L = \frac{1}{2} J\omega L I_m^2 = J \frac{\omega L}{2} I_m^2$ $\qquad Y_C = J\omega C$

$Y_C^* = -J\omega C$

$\bar{S}_C = \frac{1}{2} - J\omega C V_m^2 = -J \frac{\omega C}{2} V_m^2$

$\bar{S}_L$



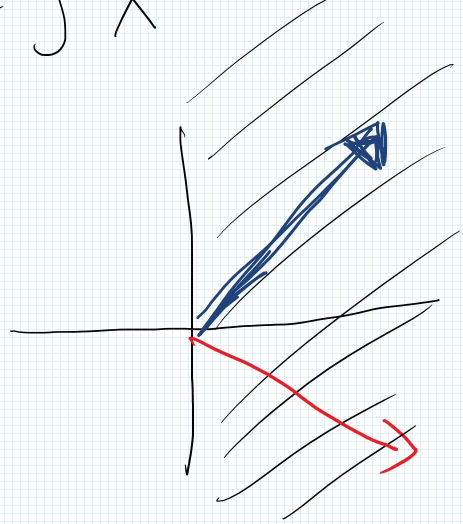
$\bar{C}$

S_L $\bar{S}_C$

$X \gtrless 0$

$Z_{Bip} = R + jX$

$\bar{S}_{Bip} =$



CARICO CON COMP. INDUTTIVA

CARICO CON COMP. CAPACITIVA

$$\sum_\alpha \bar{S} = 0 \qquad \sum_\alpha Re\{\bar{S}\} = 0 \qquad \sum_\alpha Im\{\bar{S}\} = 0$$

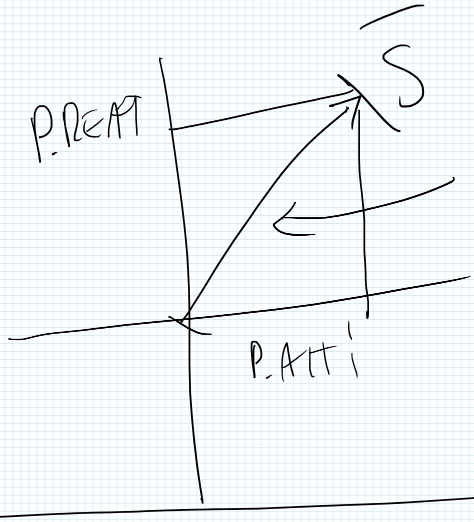
$$\sum_\alpha \text{pot. medie} = 0 \qquad \sum_\alpha \text{pot. reattive}$$

$$Im\{\bar{S}\} = Im\left\{\frac{1}{2}\bar{V}\bar{I}^*\right\} = \text{Pot. reattive}$$

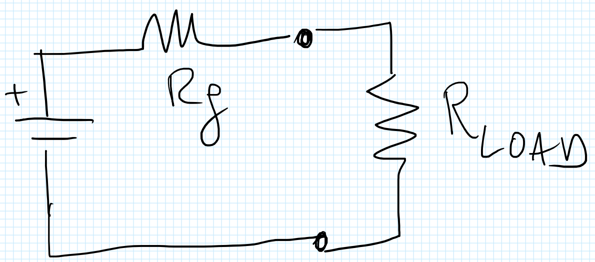
$$P_R = R i^2 \qquad \bar{S}_R = \frac{1}{2} R I_m^2 \rightarrow$$ VALORE DI PICCO

$$\frac{1}{T}\int^T \cos^2(\omega t)\, dt = \frac{1}{2}$$

$$\frac{1}{T}\int_0 \sin^2(\omega t)\, dt = \frac{1}{2}$$



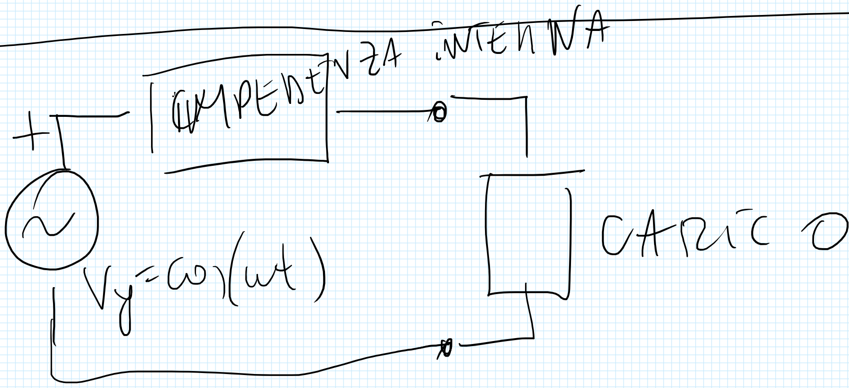
MAX TRASF DI POTENZA ATTIVA



$P_{R_{LOAD}}$ è massima

quando $R_{LOAD} = R_g$

$\doteq R_{TH}$



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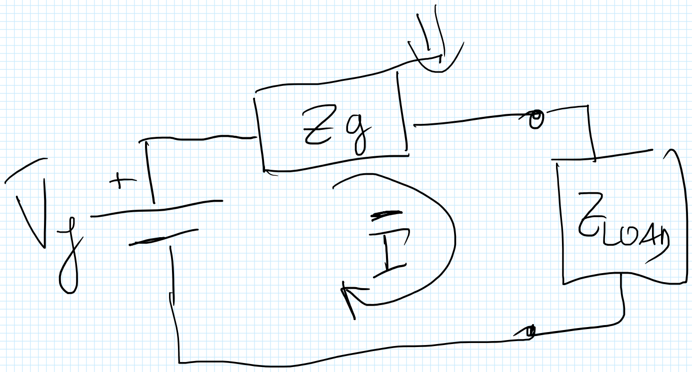


P_{Att}^{LOAD} è MAX?

$$\bar{I} = \frac{\bar{V}_g}{Z_g + Z_L}$$

$$P_{Attiva} = Re\{\bar{S}\} = Re\left\{\frac{1}{2} Z_{LOAD} \cdot |\bar{I}|^2\right\}$$

$$= \frac{1}{2} |\bar{I}|^2 \, Re\{Z_{LOAD}\}$$

$$P_{Attiva}^{LOAD} = \frac{1}{2} \frac{|\bar{V}_g|^2}{|Z_g + Z_L|^2} \cdot \underbrace{Re\{Z_L\}}_{R_{LOAD}}$$

$$Z_g = R_g + jX_g \qquad Z_{LOAD} = R_{LOAD} + jX_{LOAD}$$

$$P_{Att}^{LOAD} = \frac{|V_g|^2}{2} \cdot \frac{R_{LOAD}}{\left[(R_g + R_{LOAD})^2 + (X_g + X_{LOAD})^2\right]}$$

$$P_{Att} = \frac{|V_g|^2}{2} \cdot \frac{\quad}{\left[(R_g+R_{LOAD})^2+(X_g+X_{LOAD})^2\right]}$$

$$\frac{\partial P_{Att}^{LOAD}}{\partial R_{LOAD}} = \frac{1 \cdot [(R_g+R_L)^2 \qquad] - 2R_{LOAD} \cdot (R_g+R_{LOAD})}{[\qquad]^2}$$

$$\frac{\partial P_{Att}^{LOAD}}{\partial X_{LOAD}} = \frac{|V_g|^2}{2} \cdot R_{LOAD} \cdot \frac{-2(X_g+X_{LOAD})}{[\qquad]^2} \overset{?}{=} 0$$

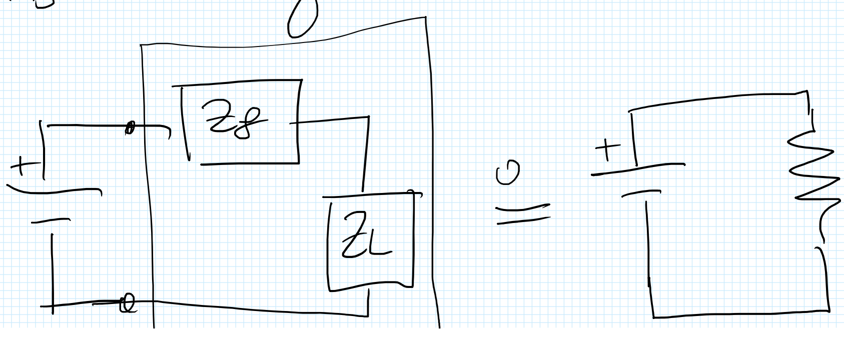
$$\frac{\partial P_{Att}}{\partial X_{LOAD}} = 0 \qquad X_{LOAD} = -X_g$$

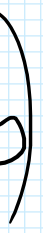
$$R_g^2 + \underbrace{R_L^2}_{} + \cancel{2R_gR_L} - \cancel{2R_gR_L} - \underbrace{2R_L^2}_{}$$

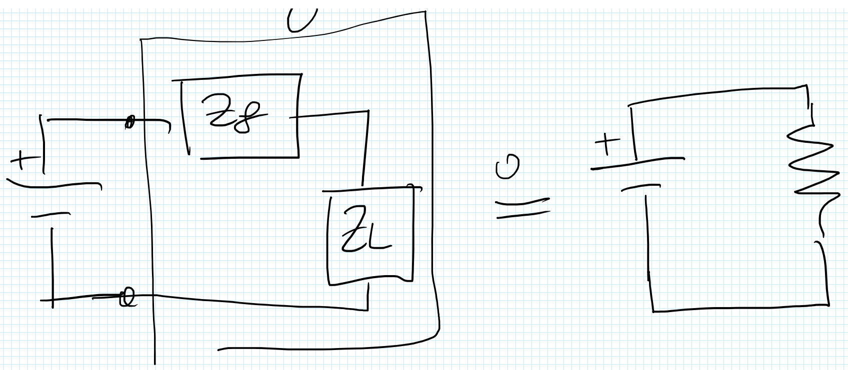
$$R_g^2 - R_L^2 = 0$$

$$R_g = R_L$$

$$Z_{LOAD} = Z_g^*$$







+
Z_g
Z_L
+