Esercitazione Metodo dei Fasori

18 May 2017 01:51

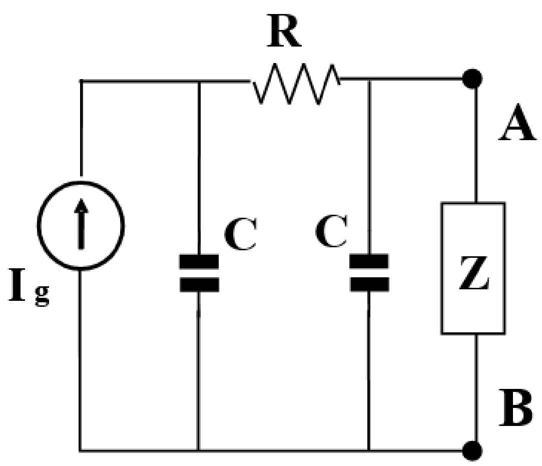
Il circuito in figura si trova in regime permanente sinusoidale.

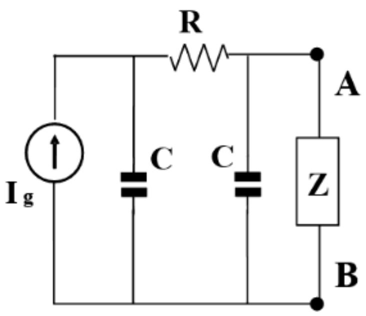
Siano $I_g(t) = 2\cos(t)$, $R = 1\ \Omega$, $C = 1F$, $Z = (2 + jX)\ \Omega$

DOMANDE:

1 utilizzando il circuito equivalente di Thevenin ai capi del bipolo AB, determinare per quale valore di X si ha il massimo trasferimento di potenza attiva dal generatore verso il bipolo AB

Valutazione didattica J9LBX5





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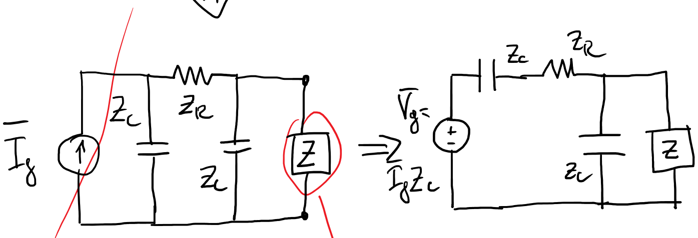
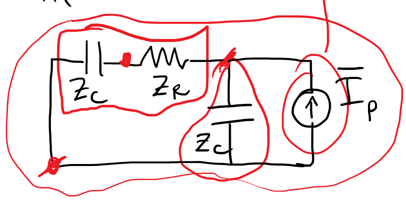


→ CALCOLO Z_{TH}

→ CALCOLO V_{TH}

$Z_{TH} =$



$$Z_{TH} = Z_C \,//\, (Z_R + Z_C) = \frac{\left(\frac{1}{j\omega C}\right)\left(R + \frac{1}{j\omega C}\right)}{R + \frac{2}{j\omega C}} =$$

$$= \frac{Z_R Z_C + Z_C^2}{Z_R + 2Z_C} =$$

$\omega = 1\,[rad/s]$

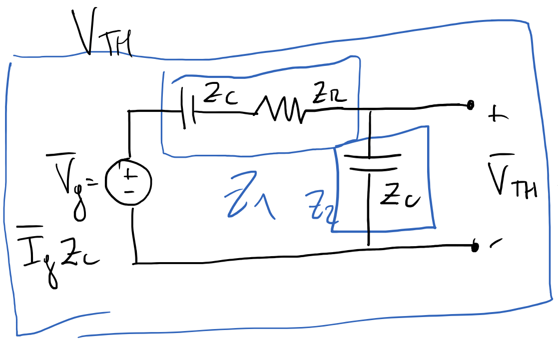
$R = 1\,[\Omega]$ $= Z_R = 1$

$C = 1\,[F]$ $Z_C = -j$

$$= \frac{-\frac{jR}{\omega C} - \frac{1}{\omega^2 C^2}}{\frac{2 + jR\omega C}{j\omega C}} = \frac{R - j\frac{1}{\omega C}}{2 + j\omega RC}$$

$$Z_{TH} = \frac{1 - j}{2 + j} = \frac{(1-j)(2-j)}{5} = \boxed{\frac{1 - 3j}{5}}\ [\Omega]$$ $\boxed{0.2 - 0.6j}$

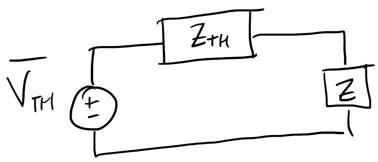
V_{TH}



$$= \frac{\bar{V}_g \cdot Z_C}{Z_R + 2Z_C} = \frac{\bar{I}_g Z_C^2}{Z_R + 2Z_C} = \frac{2(-j)^2}{1 - 2j} = -\frac{2}{1-2j}$$

$$\bar{V}_{Z_2} = \bar{V}_g \frac{Z_2}{Z_1 + Z_2}$$

$$= \boxed{\frac{-2 - 4j}{5}}$$ $-0.4 - 0.8j$ $[V]$



$$P_Z = \frac{1}{2}\,\mathrm{Re}\{Z\} \cdot |\bar{I}_Z|^2 = \frac{1}{2} \cdot 2 \cdot |\bar{I}_Z|^2$$ $P_Z \overset{\circ}{=} |\bar{I}_Z|^2$

$$\bar{I}_Z = \frac{V_{TH}}{Z_{TH} + Z} = \frac{-2-4j}{5} \cdot \frac{1}{\frac{1-3j}{5} + 2 + jX}$$

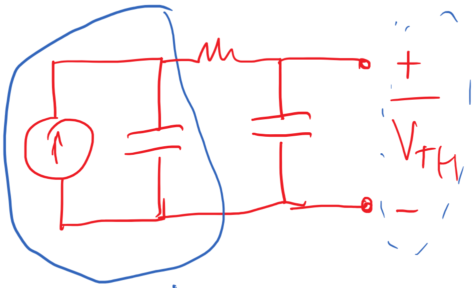
$$= \frac{-2-4j}{\ }$$

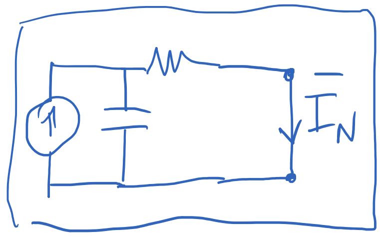
$$I_Z = \frac{-2-4J}{5}\cdot\frac{1}{\frac{1-3J+10+5xJ}{5}} = \boxed{\frac{-2-4J}{11+J(5x-3)}} = \frac{|V_{TH}|^2}{|Z_{TH}+Z_L|^2}$$

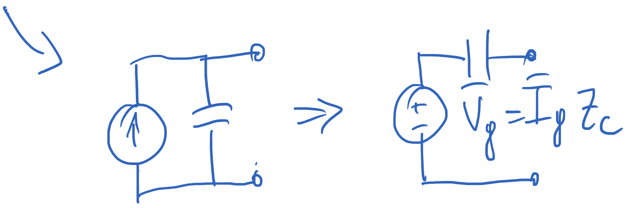
$$|I_Z|^2 = \frac{20}{\boxed{121+(5x-3)^2}} \Rightarrow P_Z = \frac{[20]}{121+(5x-3)^2}$$

P_Z è massima per $121+(5x-3)^2$ minimo ovvero per

$5x = 3 \quad x = \boxed{\frac{3}{5}} \quad X = 0.6$







$$\bar{I}_N = \frac{\bar{I}_g \cdot Z_C}{Z_C + Z_R}$$

$$\bar{V}_{TH} = \bar{I}_N \cdot Z_{TH} = \frac{I_g \cdot Z_C}{\cancel{Z_C+Z_R}} \cdot \frac{Z_C \cdot \cancel{(Z_C+Z_R)}}{Z_R + 2Z_C}$$

$$= \frac{I_g Z_C^2}{Z_R + 2Z_C}$$

$$S_Z \quad X=0.6 \quad = \frac{1}{2}\left(2+J\frac{3}{5}\right)|\bar{I}|^2$$

$$= \frac{1}{2}\,\frac{\cancel{20}^{\,10}}{}\left(2+J\frac{3}{\cdot}\right) \simeq 0.16 + J0.05$$

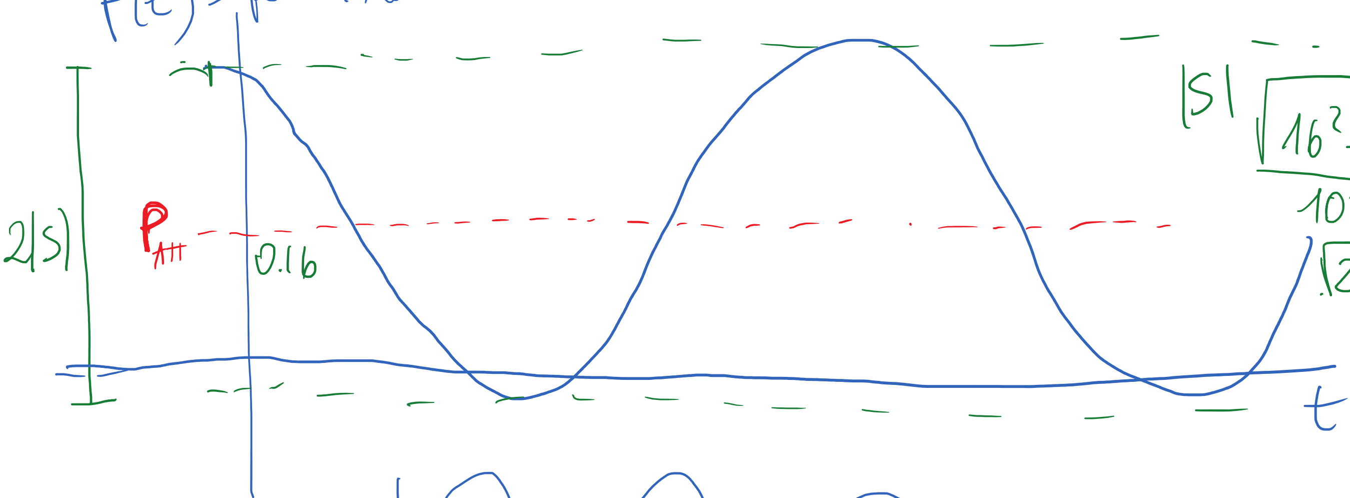
$$= \frac{1}{\cancel{2}} \frac{\cancel{20}^{10}}{121} \left(2 + J\frac{3}{5}\right) \simeq 0.16 + J0.05$$

[W] [VAR]

$$p(t) = \underbrace{\frac{1}{2}|\bar{S}|\cos(\phi)}_{P} + \frac{1}{2}|\bar{S}|\cos(2\omega t + \phi)$$

$\phi = tg^{-1}\left(\frac{5}{16}\right)$ $\phi = tg^{-1}\left(\frac{Q}{P}\right)$

$p(t)$ = pot. istantanea



$|S|$ $\frac{\sqrt{16^2+5^2}}{100}$

$\sqrt{281}$

16.76