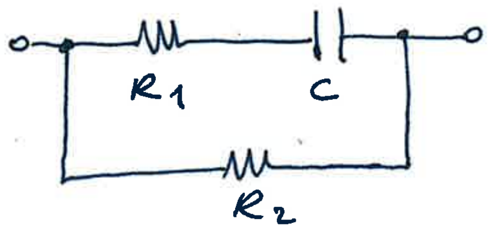
IMPEDENZE

1



Z ?

$$Z_1 = R_1 + \frac{1}{j\omega C} = \frac{1 + j\omega C R_1}{j\omega C}$$

$$Z = \frac{Z_1 R_2}{Z_1 + R_2} = \frac{R_2 \frac{1 + j\omega C R_1}{j\omega C}}{R_2 + \frac{1 + j\omega C R_1}{j\omega C}} =$$

$$= \frac{R_2(1 + j\omega C R_1)}{j\omega C R_2 + 1 + j\omega C R_1} = \frac{R_2(1 + j\omega C R_1)}{1 + j\omega C(R_1 + R_2)}$$

$$\omega = 0 \Rightarrow Z \to R_2$$

$$\omega = \infty \Rightarrow Z \to \frac{R_1 R_2}{R_1 + R_2}$$

PONENDO :

$$\omega = 2\pi f = 314 \text{ rad/s}$$

$$R_1 = 5\,\Omega$$

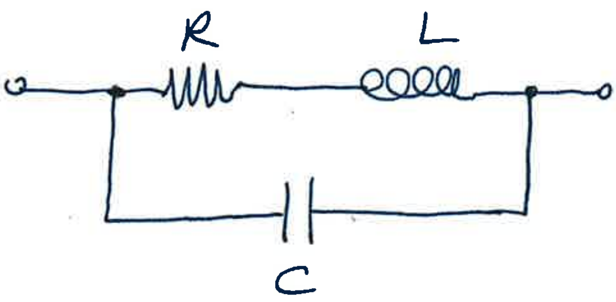
$$R_2 = 10\,\Omega$$

$$C = 1\,mF$$

$$Z_C = -j\frac{1}{\omega C} = -j\,3.18\,\Omega$$

$$Z_1 = 5 - j\,3.18\,\Omega$$

$$Z_2 = 0.92 - j\,2.9\,\Omega$$



ω_0 ?

$$Z_{RL} = R + j\omega L$$

$$Z = \frac{Z_{RL} \cdot Z_C}{Z_{RL} + Z_C} = \frac{(R+j\omega L)\frac{1}{j\omega C}}{(R+j\omega L) + \frac{1}{j\omega C}} =$$

$$= \frac{R + j\omega L}{1 + j\omega RC + (j\omega)^2 LC} =$$

$$= \frac{R + j\omega L}{(1-\omega^2 LC) + j\omega RC} =$$

$$= \frac{(R+j\omega L)\left[(1-\omega^2 LC) - j\omega RC\right]}{(1-\omega^2 LC)^2 + (\omega^2 R^2 C^2)} =$$

$$= \frac{R(1-\omega^2 LC) + \omega^2 R LC}{[\quad DEN \quad]} + j\,\frac{\omega L(1-\omega^2 LC) - \omega R^2 C}{[\quad DEN \quad]}$$

$$X = \frac{\omega L(1-\omega^2 LC) - \omega R^2 C}{[\quad DEN \quad]} = 0$$

$$L(1-\omega^2 LC) = R^2 C$$

$$L - \omega^2 L^2 C = R^2 C$$

$$\omega^2 = \frac{L - R^2 C}{L^2 C} \qquad \omega_0 = \sqrt{\frac{L - R^2 C}{L^2 C}}$$

se $R < \sqrt{\frac{L}{C}} \Rightarrow \omega_0 > 0$

$\omega \to 0 \Rightarrow Z \to R$; $\omega \to \infty \Rightarrow Z \to 0$

$$L - \omega^2 L^2 C - R^2 C = 0$$

$$\omega^2 L^2 C = L - R^2 C$$

$$\omega^2 = \sqrt{\frac{L - R^2 C}{L^2 C}}$$

$$L - R^2 C > 0$$

$$R^2 C < L$$

$$R < \sqrt{\frac{L}{C}}$$

$$R = \sqrt{\frac{L}{C}} \qquad L - \omega^2 L^2 C - \frac{L}{C} C =$$

$$= -\omega^2 L^2 C < 0$$

$X = 0$ se $L - \omega^2 L^2 C - R^2 C = 0$

$$-\omega^2 L^2 C + \underbrace{(L - R^2 C)}_{\text{se } R > \sqrt{\frac{L}{C}} \Rightarrow < 0}$$

$$L - R^2 C < 0$$

$$\Rightarrow R^2 C > L$$

$$R > \sqrt{\frac{L}{C}}$$

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% X di una impedenza risonante (R in serie con L)//(C)
close all;
R = 7;
C = 1e-3;
L = 0.1;

z0 = sqrt(L/C)
omega0 = sqrt((L-R*R*C)/(L*L*C))
omega = linspace(0, 1000, 1000);

zL = R + 1i*omega*L;
zC = 1 ./ (1i * omega * C);
zTotal = (zL.*zC)./(zL+zC);
plot(imag(zTotal))
grid;
xlabel('\omega [rad/s]');
ylabel('X [\Omega]');
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