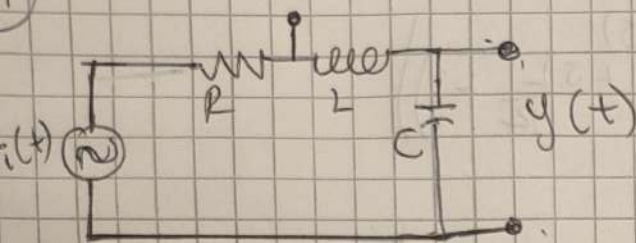


Solución

1)



$$v_i(t) = v_R(t) + v_L(t) + v_C(t)$$

$$I_R = I_L = I_C$$

$$v_i(t) = I_R \cdot Z_R + I_L \cdot Z_L + I_C \cdot Z_C$$

$$Z_R = R ; Z_L = L \cdot s \quad Z_C = \frac{1}{s \cdot C}$$

$$v_i(t) = I_C \cdot R + I_C \cdot L \cdot s + I_C \cdot \frac{1}{s \cdot C}$$

$$v_i(t) = R C s \cdot v_C(t) + L C s^2 v_C(t) + v_C(t)$$

$$v_i(t) = v_C(t) [R C s + L C s^2 + 1]$$

$$I_C(s) = \frac{v_C(s)}{Z_C} = \frac{v_C(s)}{\frac{1}{C \cdot s}}$$

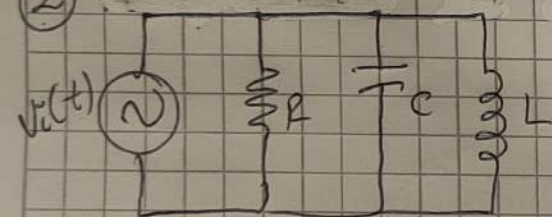
$$I_C(s) = C \cdot s \cdot v_C(s)$$

$$H(s) = \frac{1}{L C s^2 + R C s + 1}$$

$$H_{LC}(s) = \frac{H(s)}{1 + A(s) \cdot H(s)} = \frac{1}{1 + A(s) \left(\frac{1}{L C s^2 + R C s + 1} \right)} = \frac{1}{(L C s^2 + R C s + 1) \left(1 + \frac{A(s)}{L C s^2 + R C s + 1} \right)}$$

$$H_{LC}(s) = \frac{1}{L C s^2 + R C s + 1 + A(s)}$$

2)



$$i(s) = i_R(s) + i_C(s) + i_L(s)$$

$$i(s) = \frac{v_R(s)}{Z_R(s)} + \frac{v_C(s)}{Z_C(s)} + i_L(s)$$

$$v_R(s) = v_C(s)$$

$$v_L(s) = i_L(s) \cdot Z_L(s)$$

$$v_L(s) = i_L(s) \cdot s L$$

Reemplazando en función de $i_L(s)$

$$i(s) = \frac{sL}{R} \cdot i_L(s) + s^2 LC \cdot i_L(s) + \dot{i}_L(s)$$

$$i(s) = i_L(s) \left(\frac{sL}{R} + s^2 LC + 1 \right)$$

$$H = \frac{\dot{i}_L(s)}{i(s)} = \frac{1}{s^2 LC + \frac{sL}{R} + 1}$$

$$H_{LC}(s) = \frac{H(s)}{1+A(s)H(s)}$$

$$H_{LC}(s) = \frac{1}{\left(s^2 LC + \frac{sL}{R} + 1 \right) \left(1 + \frac{A(s)}{\left(s^2 LC + \frac{sL}{R} + 1 \right)} \right)}$$

$$H_{LC}(s) = \frac{1}{s^2 LC + \frac{sL}{R} + 1 + A(s)}$$

Para el punto 1 forma canónica

$$H(s) = \frac{1}{LCs^2 + RCs + 1}$$

$$\left(\frac{1}{LCs^2 + RCs + 1} \right) \frac{\frac{1}{LC}}{\frac{1}{LC}} = \frac{\frac{1}{LC}}{s^2 + \frac{R}{L}s + \frac{1}{LC}} = \frac{W_n^2}{s^2 + 2\zeta W_n + W_n^2}$$

Iguales coeficientes en:

$$W_n^2 = \frac{1}{LC} \Rightarrow W_n = \sqrt{\frac{1}{LC}} \quad ; \quad 2\zeta = \frac{R}{L}$$