Matías Cassino

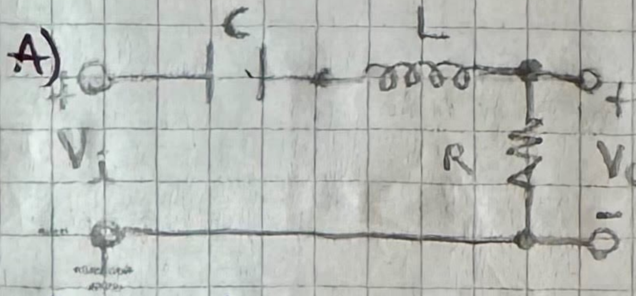
HOJA N° 1

FECHA

"TS 2: Respuesta en frecuencia de filtros pasivos RLC"

1. Hallar analíticamente la función transferencia $H(s) = V_o(s)/V_i(s)$

A)



• $V_o(s) = Z_R$; $V_i(s) = Z_R + Z_C + Z_L$

Con $Z_R = R$, $Z_C = \frac{1}{sC}$ y $Z_L = sL$

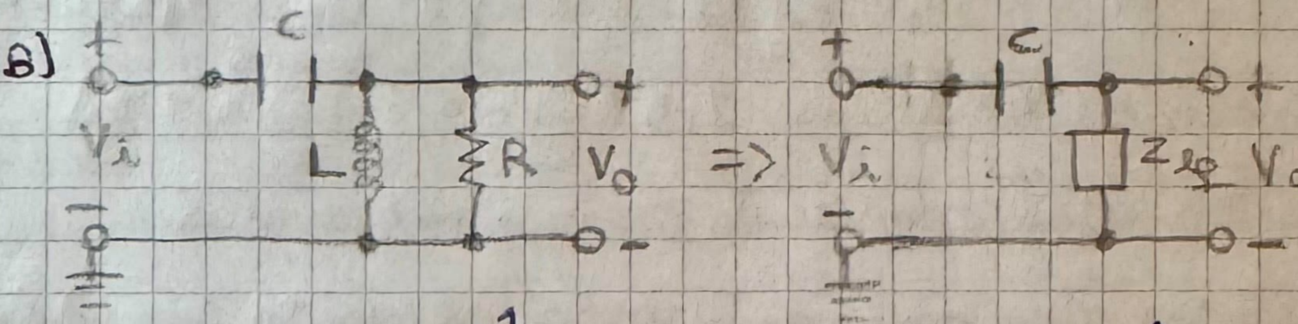
Luego:

$$* \; H(s) = \frac{Z_R}{Z_R + Z_L + Z_C} = \frac{R}{R + sL + \frac{1}{sC}} \Rightarrow \frac{R}{\frac{RsC + s^2LC + 1}{sC}} = \frac{RsC}{RsC + s^2LC + 1} \Rightarrow$$

$$\frac{RsC/LC}{\frac{RsC}{LC} + \frac{s^2LC}{LC} + \frac{1}{LC}} = \frac{sR/L}{\frac{Rs}{L} + s^2 + \frac{1}{LC}} = \frac{s\omega_0/Q}{s^2 + \frac{s\omega_0}{Q} + \omega_0^2}$$ donde $\omega_0^2 = \frac{1}{LC}$ y $\frac{\omega_0}{Q} = \frac{R}{L}$

Δ En dominio de frecuencias: $s = j\omega \Rightarrow H(j\omega) = \frac{j\omega\omega_0/Q}{-\omega^2 + j\omega\frac{\omega_0}{Q} + \omega_0^2}$

B)



$$Z_{eq} = (Z_L^{-1} + Z_R^{-1})^{-1} = \left(\frac{1}{Ls} + \frac{1}{R}\right)^{-1} = \left(\frac{R + Ls}{LsR}\right)^{-1} = \frac{LsR}{R + Ls}$$

Con

$V_i = Z_{eq} + Z_C$, $V_o = Z_{eq}$. De esta forma:

$H(s) = \frac{Z_{eq}}{Z_{eq} + Z_C}$ y considerando admitancias: $H(s) = \frac{Y_C}{Y_C + Y_{eq}}$

Con $Y_C = \frac{1}{Z_C}$, $Y_{eq} = \frac{1}{Z_{eq}} \Rightarrow H(s) = \frac{1/Z_C}{\frac{1}{Z_C} + \frac{1}{Z_{eq}}} = \frac{sC}{sC + \frac{R + Ls}{LsR}} = \frac{sC}{\frac{s^2CRL + R + Ls}{LsR}} \Rightarrow$

$$\frac{s^2CRL}{s^2CRL + R + Ls} \Rightarrow \frac{s^2CRL/CRL}{\frac{s^2CRL}{CRL} + \frac{R}{CRL} + \frac{Ls}{CRL}} = \frac{s^2}{s^2 + \frac{1}{CL} + \frac{s}{CR}} = \frac{s^2}{s^2 + \omega_0^2 + \omega_0 Q s}$$

Δ En dominio de frecuencias: $H(j\omega) = \frac{-\omega^2}{-\omega^2 + \omega_0^2 + j\omega\omega_0 Q}$