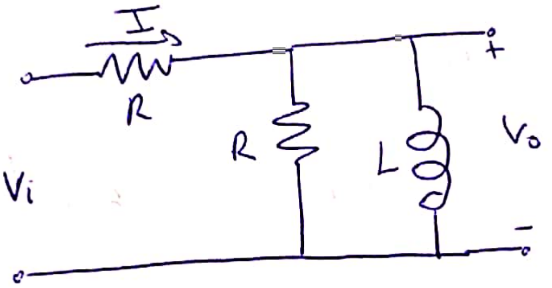
Pablo Cuesta Sierra. 120. Ejercicio 1.



(a) $A_v(j\omega) = \dfrac{V_o(j\omega)}{V_i(j\omega)} = \dfrac{I(R \| Z_L)}{I(R + (R \| Z_L))} = \dfrac{1}{1 + R(R \| Z_L)^{-1}} = \dfrac{1}{1 + R(1/R + 1/Z_L)}$

$= \dfrac{1}{2 - \frac{jR}{\omega L}} = \dfrac{j\omega L}{2j\omega L + R} = \dfrac{j\omega L}{R + j2\omega L}.$

$$\boxed{A_v(j\omega) = \frac{j\omega L}{R + j2\omega L}}$$

(b) $\boxed{|A_v|(\omega) = \dfrac{\omega L}{\sqrt{R^2 + 4\omega^2 L^2}}}$, $\boxed{\varphi(\omega) = \dfrac{\pi}{2} - \arctan\left(\dfrac{2\omega L}{R}\right)}$

(c) $\lim_{\omega \to \infty} |A_v|(\omega) = \dfrac{1}{2}$. $\lim_{\omega \to 0} |A_v|(\omega) = 0 \Rightarrow$ Se trata de un filtro de paso alto.

$|A_v|_{max} = \dfrac{1}{2}$, cuando $\omega \to \infty \rightarrow |A_v|(\omega_c) = \dfrac{1}{2\sqrt{2}} = \dfrac{\omega_c L}{\sqrt{R^2 + 4\omega_c^2 L^2}}$

$\rightarrow R^2 + 4\omega_c^2 L^2 = 8\omega_c^2 L^2 \rightarrow R^2 = 4\omega_c^2 L^2 \Rightarrow \omega_c = +\sqrt{\dfrac{R^2}{4L^2}}$.

$\Rightarrow \boxed{\omega_c = \dfrac{R}{2L}} \leftarrow$ frecuencia de corte $\left(f_c = \dfrac{\omega_c}{2\pi} = \dfrac{R}{4\pi L} \right)$

$|A_v|(\omega) = \dfrac{\omega L}{\sqrt{R^2 + 4\omega^2 L^2}} = \dfrac{\omega L}{R\sqrt{1 + \frac{4\omega^2 L^2}{R^2}}} = \dfrac{\omega (L/R)}{\sqrt{1 + \omega^2 \left(\frac{4L^2}{R^2}\right)}} = \dfrac{\omega/\omega_1}{\sqrt{(\omega^2/\omega_c^2) + 1}}$

donde $\underbrace{\omega_c = \dfrac{R}{2L}}$, la frecuencia de corte, y $\underbrace{\omega_1 = \dfrac{R}{L}}$

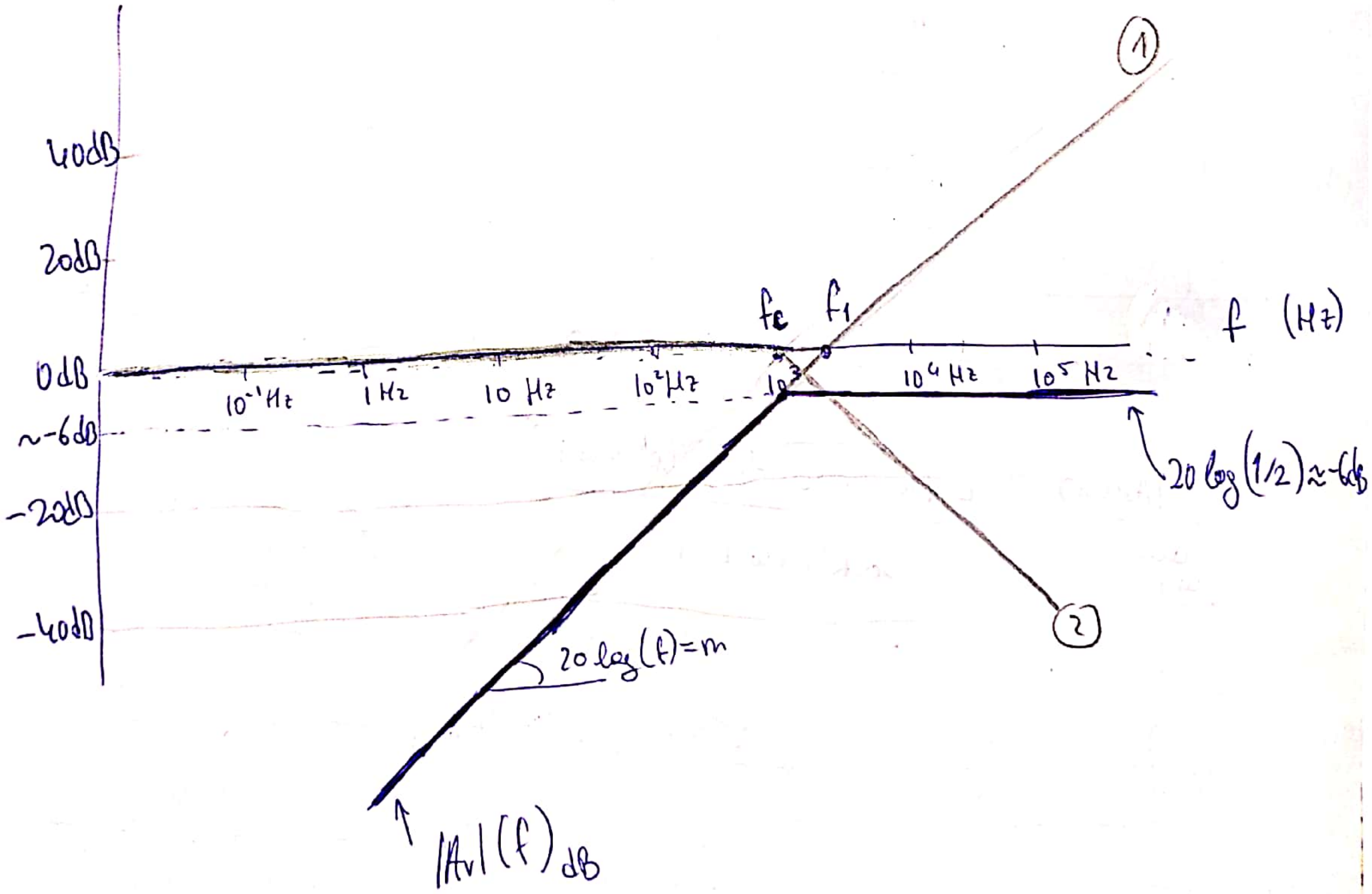
frecuencias de interés

(d) $|A_v|(\omega) = \dfrac{(\omega/\omega_1)}{\sqrt{1+(\omega/\omega_c)^2}} = \dfrac{(f/f_1)}{\sqrt{1+(f/f_c)^2}}$

Donde; $f_1 = \dfrac{\omega_1}{2\pi} = \dfrac{R}{2\pi L} = \dfrac{126\,\Omega}{2\pi\ 10mH} = 2005{,}35\,Hz \approx 10^{3,3}\ s^{-1}$

$f_c = \dfrac{\omega_c}{2\pi} = \dfrac{R}{4\pi L} = \dfrac{126\,\Omega}{4\pi\ 10mH} = 1002{,}68\,Hz \approx 10^{3,0}\ s^{-1}$

$$|A_v|(f)_{dB} = \underbrace{20\cdot\log(f/f_1)}_{①}\ \underbrace{-20\log\sqrt{1+(f/f_c)^2}}_{②}$$



(d) $\varphi(\omega) = \frac{\pi}{2} - \arctan\left(\frac{2\omega L}{R}\right) = \frac{\pi}{2} - \arctan\left(\frac{\omega}{\omega_c}\right)$

$\varphi(f) = \underbrace{\frac{\pi}{2}}_{①} - \underbrace{\arctan\left(\frac{f}{f_c}\right)}_{②}$, $f_c \approx 10^{3,0}\ s^{-1}$