5. $T(s)$ con $s = j\omega$ en régimen estacionario: $T(j\omega) = \dfrac{k\left(-\omega^2 + j\omega \cdot \frac{\omega_{oz}}{\xi_z} + \omega_{oz}^2\right)}{-\omega^2 + j\omega \cdot \frac{\omega_{op}}{\xi_p} + \omega_{op}^2} \Rightarrow$

Por un lado, $$|T(j\omega)| = |k| \frac{\sqrt{(\omega_{oz}^2 - \omega^2)^2 + \omega^2 \left(\frac{\omega_{oz}}{\xi_z}\right)^2}}{\sqrt{(\omega_{op}^2 - \omega^2)^2 + \omega^2 \left(\frac{\omega_{op}}{\xi_p}\right)^2}}$$

A. $|T_1(j\omega)| = 1 \cdot \dfrac{\sqrt{(9-\omega^2)^2 + \cancel{\omega^2 \frac{9}{\infty}}}}{\sqrt{(1-\omega^2)^2 + \omega^2 \frac{1}{(1/\sqrt{2})^2}}}$; $\bullet \lim\limits_{\omega \to 0} |T| = 9$; $\bullet \lim\limits_{\omega \to \infty} |T| = \left|\lim\limits_{\omega \to \infty} T(j\omega)\right| = \left|\frac{1}{1}\right| = 1$

$\bullet \lim\limits_{\omega \to \omega_{op}=1} |T| = \dfrac{8}{\sqrt{2}} = 4\sqrt{2}$; $\bullet \lim\limits_{\omega \to \omega_{oz}=3} |T| = 0$

B. $|T_2(j\omega)| = 1 \cdot \dfrac{\sqrt{(\frac{1}{9}-\omega^2)^2 + \cancel{\omega^2 \frac{(1/9)}{\infty}}}}{\sqrt{(1-\omega^2)^2 + \omega^2 \frac{1}{(5)^2}}}$; $\bullet \lim\limits_{\omega \to 0} |T| = \frac{1}{9}$; $\bullet \lim\limits_{\omega \to \infty} |T| = 1$

$\bullet \lim\limits_{\omega \to \omega_{op}=1} |T| = \dfrac{8/9}{1/5} = \dfrac{40}{9}$; $\bullet \lim\limits_{\omega \to \omega_{oz}=\frac{1}{3}} |T| = 0$

C. $|T_3(j\omega)| = 1 \cdot \dfrac{\sqrt{(1-\omega^2)^2 + \omega^2 \frac{1}{(5)^2}}}{\sqrt{(1-\omega^2)^2 + \omega^2 \frac{1}{(1/\sqrt{2})^2}}}$; $\bullet \lim\limits_{\omega \to 0} |T| = 1$; $\bullet \lim\limits_{\omega \to \infty} |T| = 1$

$\bullet \lim\limits_{\omega \to \omega_{op}=1} |T| = \dfrac{1/5}{\sqrt{2}} = \dfrac{\sqrt{2}}{10}$; $\bullet \lim\limits_{\omega \to \omega_{oz}=1} |T| = \dfrac{\sqrt{2}}{10}$

Por otro lado, $$\measuredangle T(j\omega) = Tg^{-1}\left(\frac{Img(T(j\omega))}{Re(T(j\omega))}\right) = Tg^{-1}\left(\frac{\left[\frac{\omega \cdot \omega_{oz}}{\xi_z}\right]\cancel{k}}{[\omega_{oz}^2 - \omega^2]\cancel{k}}\right) - Tg^{-1}\left(\frac{\left[\frac{\omega \cdot \omega_{op}}{\xi_p}\right]}{[\omega_{op}^2 - \omega^2]}\right)$$

A. $\measuredangle T_1(j\omega) = \cancel{Tg^{-1}\left(\dfrac{\frac{\omega \cdot 3}{\infty}}{9-\omega^2}\right)} - Tg^{-1}\left(\dfrac{\frac{\omega \cdot 1}{(1/\sqrt{2})}}{1-\omega^2}\right)$; $\bullet \lim\limits_{\omega \to 0} \measuredangle T = 0$; $\bullet \lim\limits_{\omega \to \infty} \measuredangle T = 0$

$\bullet \lim\limits_{\omega \to \omega_{op}=1} \measuredangle T = \dfrac{-\pi}{2}$; $\bullet \lim\limits_{\omega \to \omega_{oz}=3} \measuredangle T \simeq 0,487$

B. $\measuredangle T_2(j\omega) = \cancel{Tg^{-1}\left(\dfrac{\frac{\omega \cdot (1/3)}{\infty}}{\frac{1}{9}-\omega^2}\right)} - Tg^{-1}\left(\dfrac{\frac{\omega \cdot 1}{5}}{1-\omega^2}\right)$; $\bullet \lim\limits_{\omega \to 0} \measuredangle T = 0$; $\bullet \lim\limits_{\omega \to \infty} \measuredangle T = 0$

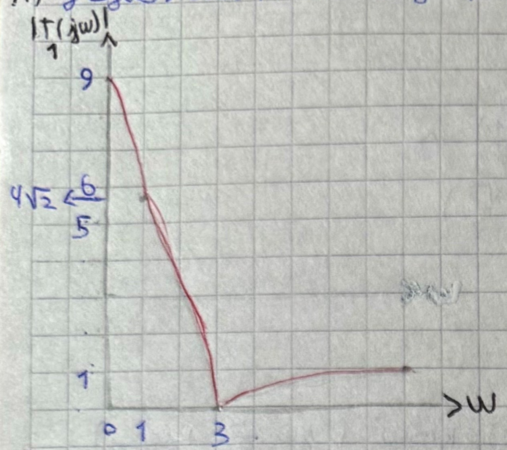
$\bullet \lim\limits_{\omega \to \omega_{op}=1} \measuredangle T = \dfrac{\pi}{2}$; $\bullet \lim\limits_{\omega \to \omega_{oz}=\frac{1}{3}} \measuredangle T \simeq -0,074$

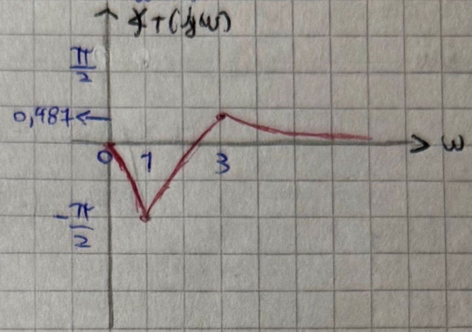
C. $\measuredangle T_3(j\omega) = Tg^{-1}\left(\dfrac{\frac{\omega \cdot 1}{5}}{1-\omega^2}\right) - Tg^{-1}\left(\dfrac{\frac{\omega \cdot 1}{(1/\sqrt{2})}}{1-\omega^2}\right)$; $\bullet \lim\limits_{\omega \to 0} \measuredangle T = 0$; $\bullet \lim\limits_{\omega \to \infty} \measuredangle T = 0$

$\bullet \lim\limits_{\omega \to \omega_{op}=1} \measuredangle T = 0$; $\bullet \lim\limits_{\omega \to \omega_{oz}=1} \measuredangle T = 0$

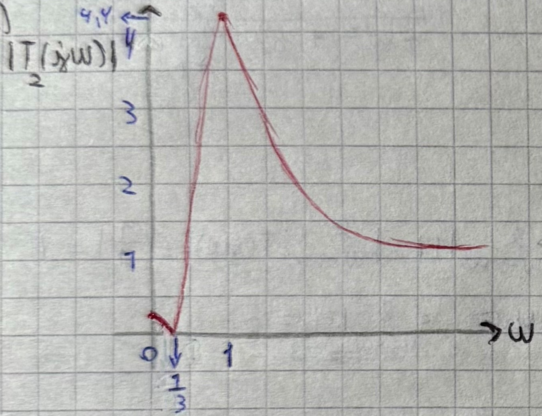
NOTA

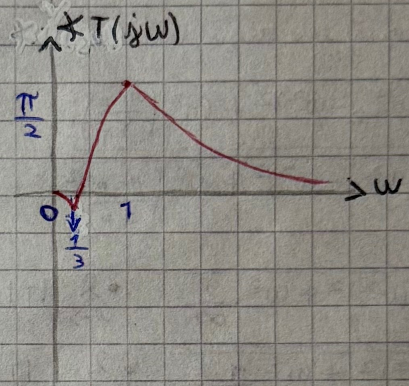
A) gráficos del $|T(j\omega)|$ y $\measuredangle T(j\omega)$ para c/ $T_i(s)$



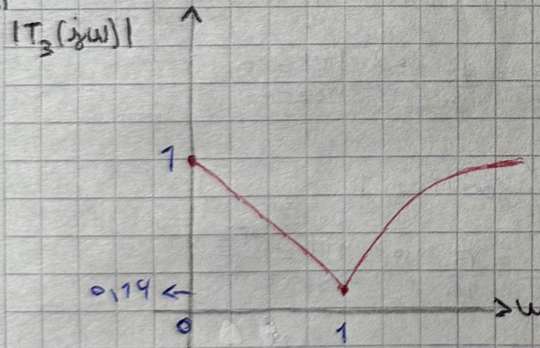


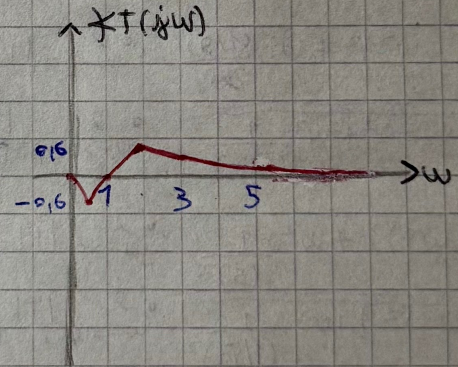
B)





C)





△ Se grafica en dB mediante código para evidenciar las asíntotas sobre la RTA en frecuencia.

• Se debe hacer hincapié en que cada función transferencia define un elimina banda (filtro notch).