Inversa del término de 1er orden

$$\left.\begin{array}{l}\boxed{G(s) = Ts + 1} \\ s = j\omega\end{array}\right\} \quad G(j\omega) = T.\omega j + 1$$

→ Ganancia:

$$|G(j\omega)| = \sqrt{(T\omega)^2 + 1^2} \rightarrow 20 \log |G(j\omega)| = 20 \log \left((T\omega)^2 + 1^2\right)^{1/2} =$$

$$= \underbrace{10 \log\left((T\omega)^2 + 1^2\right)}$$

→ Fase:

$$\arg[G(j\omega)] = \underbrace{\operatorname{arctg} \frac{T\omega}{1}}$$

* ~~Bajas~~ frecuencias ($\omega \to 0$)

$$20 \log |G(j\omega)| = 10 \log 1 = \underline{0 \, dB}$$

$$\arg[G(j\omega)] = \operatorname{arctg} \frac{0}{1} = \underline{0^\circ}$$

* Frecuencias intermedias ($\omega = 1/T$)

$$20 \log |G(j\omega)| = 10 \log\left((T/T)^2 + 1^2\right) = 10 \log 2 \simeq \underline{3 \, dB}$$

$$\arg[G(j\omega)] = \operatorname{arctg} \frac{T \cdot 1/T}{1} = \underline{45^\circ}$$

* Altas frecuencias ($\omega \to \infty$)

$$20 \log |G(j\omega)| \cong 10 \log (T\omega)^2 = \underline{20 \log T\omega}$$

$$\arg[G(j\omega)] = \operatorname{arctg} \frac{T\omega}{1} \simeq \underline{90^\circ}$$

Inversa del término de 2° orden

$$\boxed{G(s) = \frac{s^2 + 2\xi \omega_n s + \omega_n^2}{\omega_n^2}}$$

$s = j\omega$

$$G(j\omega) = \frac{-\omega^2 + 2\xi\omega_n . \omega j + \omega_n^2}{\omega_n^2}$$

→ Ganancia:

$$|G(j\omega)| = \frac{\sqrt{(2\xi\omega_n.\omega)^2 + (\omega_n^2 - \omega^2)^2}}{\sqrt{0^2 + (\omega_n^2)^2}} \rightarrow 20 \log|G(j\omega)| = \underbrace{20 \log\left[\frac{((2\xi\omega_n\omega)^2 + (\omega_n^2 - \omega^2)^2)}{\omega_n^2}\right]^{1/2}}$$

→ Fase:

$$\arg[G(j\omega)] = \text{arctg} \frac{2\xi\omega_n.\omega}{\omega_n^2 - \omega^2} - \cancel{\text{arctg} \frac{0}{\omega_n^2}}^{0^\circ} = \underbrace{\text{arctg} \frac{2\xi\omega_n\omega}{\omega_n^2 - \omega^2}}$$

* Bajas frecuencias ($\omega \sim 0$)

$$20 \log|G(j\omega)| = 20 \log \frac{\omega_n^2}{\omega_n^2} = \underline{0 \text{ dB}}$$

$$\arg[G(j\omega)] = \text{arctg} \frac{0}{\omega_n^2} = \underline{0^\circ}$$

* Frecuencias intermedias ($\omega \sim \omega_n$)

$$20 \log|G(j\omega)| = 20 \log \frac{2\xi\omega_n^2}{\omega_n^2} = \underline{20 \log 2\xi}$$

$$\arg[G(j\omega)] = \text{arctg} \frac{2\xi\omega_n^2}{0} = \underline{90^\circ}$$

Frecuencias altas ($\omega \sim \infty$)

$$20 \log|G(j\omega)| = \underline{20 \log \frac{\omega^2}{\omega_n^2}}$$

$$\arg[G(j\omega)] = \text{arctg} \frac{2\xi\omega_n.\omega}{\omega_n^2 - \omega^2} \simeq \underline{180^\circ}$$