Transformada de Fourier

$$\mathcal{F}\{x(t)\} = \int_{-\infty}^{\infty} x(t)e^{-j\omega t}dt = X(j\omega)$$

$$s = \sigma + j\omega \rightarrow \sigma = 0$$

$$si\ H(j\omega) es\ un\ LTI$$

$$\boldsymbol{Y(j\omega) = H(j\omega)X(j\omega)}$$

$$\boldsymbol{|Y(j\omega)| = |H(j\omega)||X(j\omega)|}$$

$$\boldsymbol{|Y(j\omega)|_{dB} = 20\ log(|Y(j\omega)|) = 20log(|H(j\omega)||X(j\omega)|)}$$

$$\boldsymbol{|Y(j\omega)|_{dB} = 20log(|H(j\omega)|) + 20log(|X(j\omega)|)}$$

$$\boldsymbol{arg\{Y(j\omega)\} = arg\{H(j\omega)\} + arg\{X(j\omega)\}}$$

Análisis en frecuencia de sistemas dinámicos

$$H(s) = K s^{\pm N} \prod_{i=1}^{n} \frac{p_i}{s + p_i} \prod_{k=1}^{m} \frac{s + c_k}{c_k} \prod_{o=1}^{r} \frac{\omega_{no}^2}{s^2 + 2\zeta_o \omega_{n_o} s + \omega_{no}^2} \prod_{u=1}^{t} \frac{s^2 + 2\zeta_u \omega_{nu} s + \omega_{nu}^2}{\omega_{nu}^2}$$

$$|H(j\omega)|_{dB} = 20Log(|H(j\omega)|)\ Magnitud\ del\ sistema\ en\ dB$$

$$\arg\{H(j\omega)\}\ fase\ del\ sistema$$

Ganancia:

$$H(s) = K$$

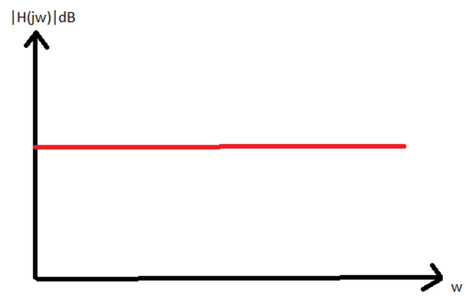
$$H(j\omega) = K$$

$$|H(j\omega)| = |K|$$

$$\boxed{|H(j\omega)|_{dB} = 20Log(|K|) > 0\ \ if |K| > 1}$$

$$\boxed{|H(j\omega)|_{dB} = 20Log(|K|) = 0\ \ if\ |K| = 1}$$

$$\boxed{|H(j\omega)|_{dB} = 20Log(|K|) < 0\ \ if |K| < 1}$$



$$\boxed{\arg\{H(j\omega)\} = 0 \; if \; K > 0}$$

$$\boxed{\arg\{H(j\omega)\} = 180° \; if \; K < 0}$$

Derivador puro:

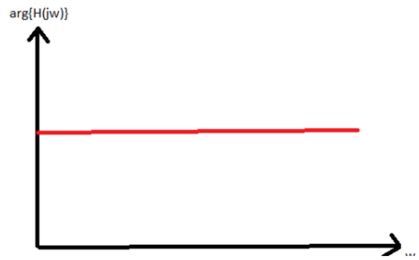
$$H(s) = s^N$$

$$H(j\omega) = (j\omega)^N$$

$$|H(j\omega)| = \omega^N$$

$$\boxed{|H(j\omega)|_{dB} = 20Log(\omega^N) = 20NLog(\omega)}$$

$$\boxed{\arg\{H(j\omega)\} = \arg\{(j\omega)^N\} = 90°N}$$



Integrador puro:

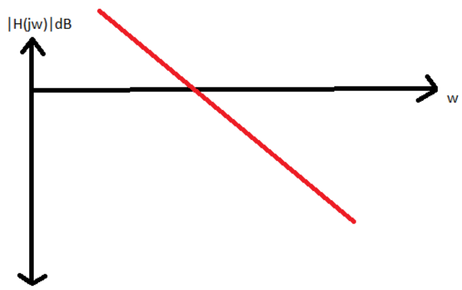
$$H(s) = s^{-N} = \frac{1}{s^N}$$

$$H(j\omega) = \frac{1}{(j\omega)^N}$$

$$|H(j\omega)| = \frac{1}{\omega^N}$$

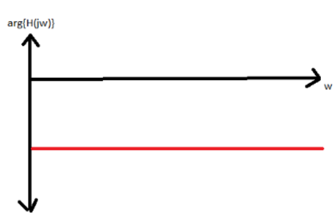
$$|H(j\omega)|_{dB} = 20Log\left(\frac{1}{\omega^N}\right) = 20Log(1) - 20Log(\omega^N)$$

$$\boxed{|H(j\omega)|_{dB} = -20NLog(\omega)}$$



$$\arg\{H(j\omega)\} = \arg\left\{\frac{1}{(j\omega)^N}\right\} = \arg\{1\} - \arg\{(j\omega)^N\}$$

$$\boxed{\arg\{H(j\omega)\} = -90°N}$$



Derivador simple (ceros reales distintos de cero):

$$H(s) = \frac{s + c}{c}$$

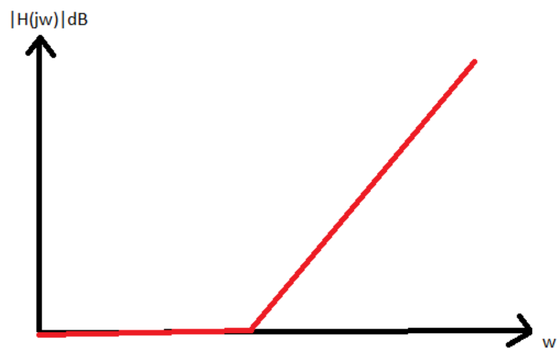
$$H(j\omega) = \frac{j\omega + c}{c}$$

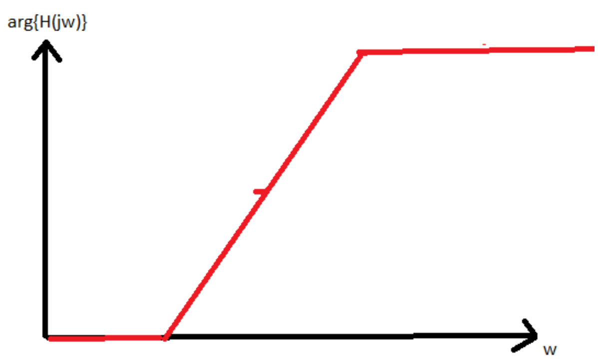
$$|H(j\omega)| = \frac{|j\omega + c|}{|c|} = \frac{\sqrt{\omega^2 + c^2}}{|c|}$$

$$\boxed{\boldsymbol{|H(j\omega)|_{dB} = 20Log\left(\frac{\sqrt{\omega^2 + c^2}}{|c|}\right) = 20Log\left(\sqrt{\omega^2 + c^2}\right) - 20Log(|c|)}}$$

$$\boxed{\boldsymbol{\arg\left\{\frac{j\omega + c}{c}\right\} = \arg\{j\omega + c\} - \arg\{c\} = \mathrm{atan}\left(\frac{\omega}{c}\right)}}$$

$\boldsymbol{\omega}$	$\boldsymbol{|H(j\omega)|_{dB}}$	$\boldsymbol{\arg\left\{\frac{j\omega + c}{c}\right\}^{\circ}}$
$(pequeña)\omega \approx 0$	0	0
$\omega = c$	3.01	45
$(grande)\omega \approx \infty$	$20Log(\omega)$	90





Integrador simple (polos reales distintos de cero):

$$H(s) = \frac{p}{s + p}$$

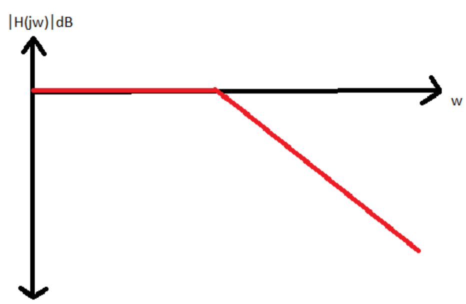
$$H(j\omega) = \frac{p}{j\omega + p}$$

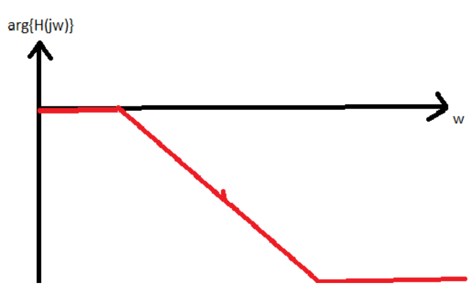
$$|H(j\omega)| = \frac{|p|}{|j\omega + p|} = \frac{|p|}{\sqrt{\omega^2 + p^2}}$$

$$\boxed{|H(j\omega)|_{dB} = 20Log\left(\frac{|p|}{\sqrt{\omega^2 + p^2}}\right) = 20Log(|p|) - 20Log\left(\sqrt{\omega^2 + p^2}\right)}$$

$$\boxed{\arg\left\{\frac{p}{j\omega + p}\right\} = \arg\{p\} - \arg\{j\omega + p\} = -\text{atan}\left(\frac{\omega}{p}\right)}$$

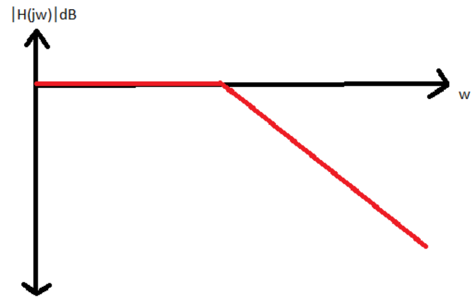
ω	$\lvert H(j\omega)\rvert_{dB}$	$\arg\left\{\frac{j\omega + c}{c}\right\}^{\circ}$
$(pequeña)\omega \approx 0$	0	0
$\omega = p$	-3.01	-45
$(grande)\omega \approx \infty$	$-20Log(\omega)$	-90

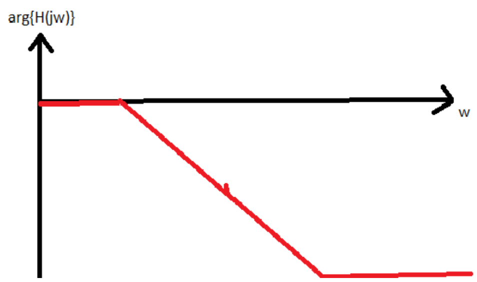




Polos complejos conjugados:

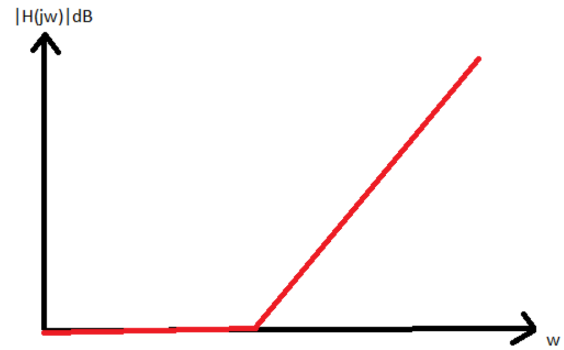
$$H(s) = \frac{\omega_n^2}{s^2 + 2\zeta_o\omega_n s + \omega_n^2}$$

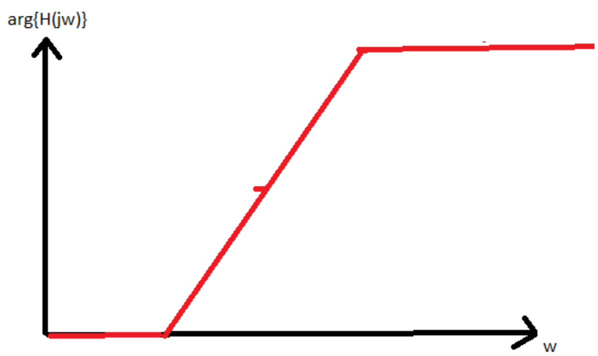




Ceros complejos conjugados:

$$H(s) = \frac{s^2 + 2\zeta_u \omega_n s + \omega_n^2}{\omega_n^2}$$


|H(jw)|dB
w


arg{H(jw)}
w