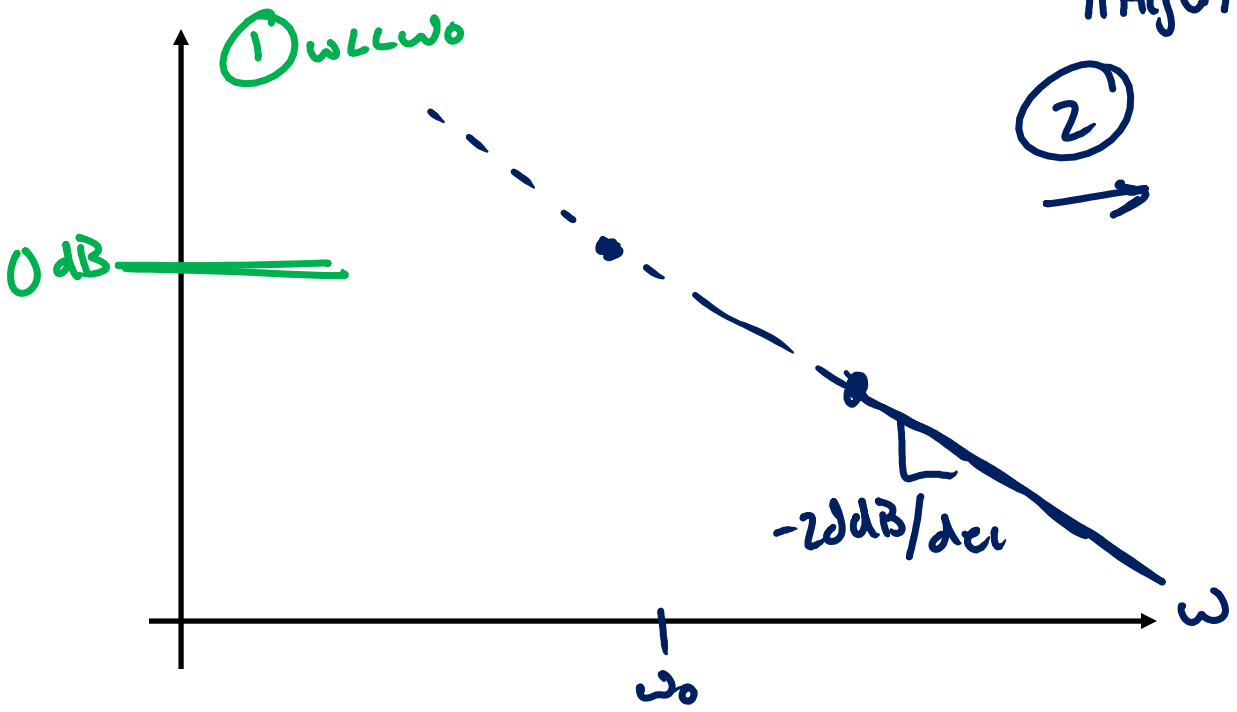
Asymptotic Behavior



$$\|H(j\omega)\|_{dB} = -10\log\left(1+\left(\frac{\omega}{\omega_0}\right)^2\right)$$

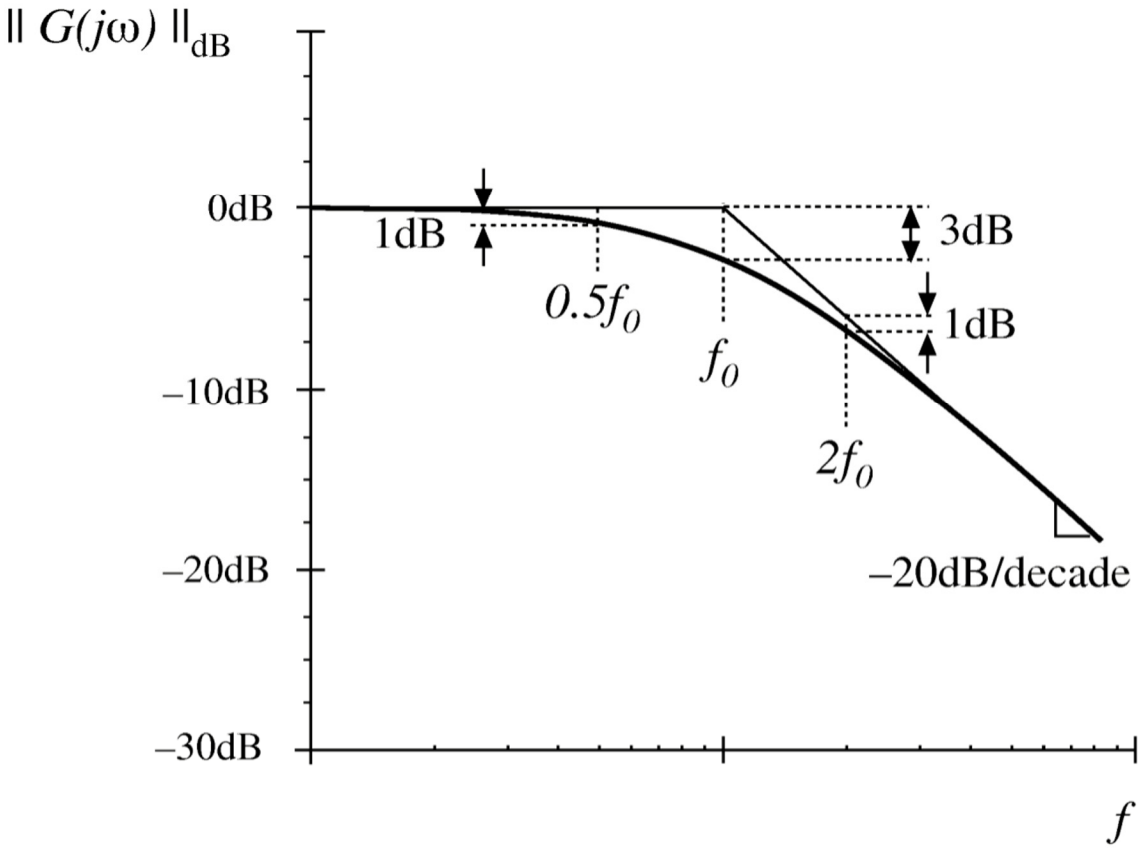
② $\Rightarrow$ $\begin{cases} \omega \ll \omega_0 \\ \omega = \omega_0 \\ \omega \gg \omega_0 \end{cases}$

① $\omega << \omega_0$, $\quad \|H(j\omega)\|_{dB} \approx -10\log(1) = 0\ dB$

② $\omega >> \omega_0$, $\quad \|H(j\omega)\|_{dB} \approx -10\log\left(\frac{\omega^2}{\omega_0^2}\right) = -20\log(\omega) + 20\log(\omega_0)$

③ $\omega = \omega_0$

Summary: Single Pole Magnitude

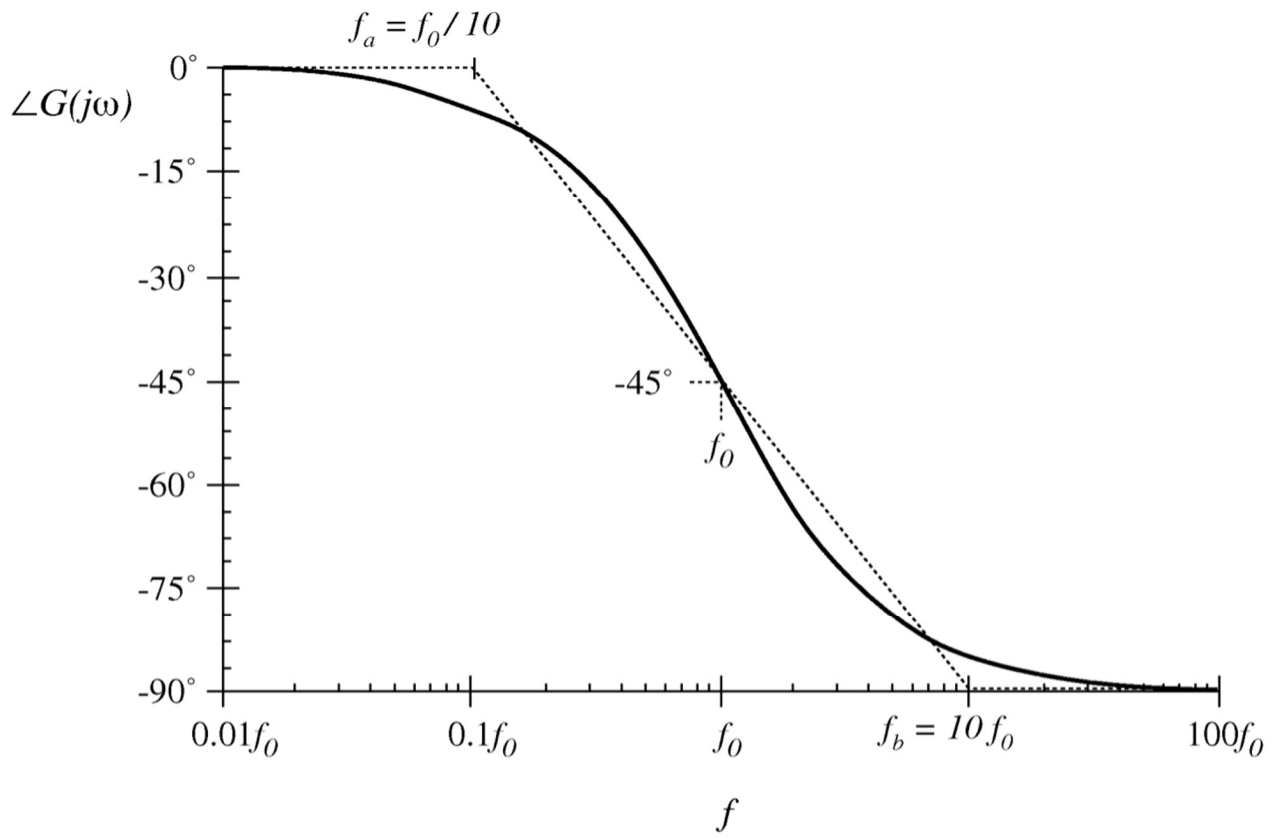


Phase of Single Pole

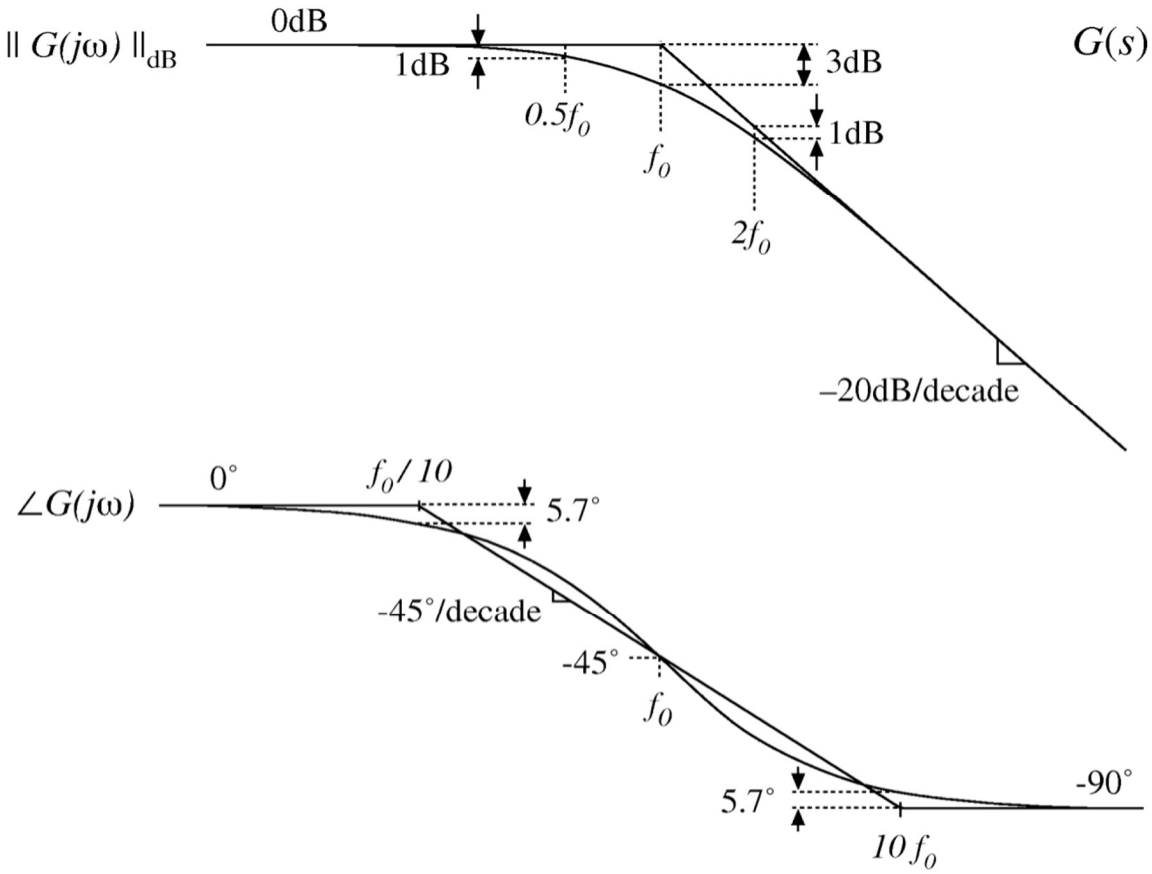
Phase Asymptotes

$f_a = f_0 / 10$

$f_b = 10\ f_0$

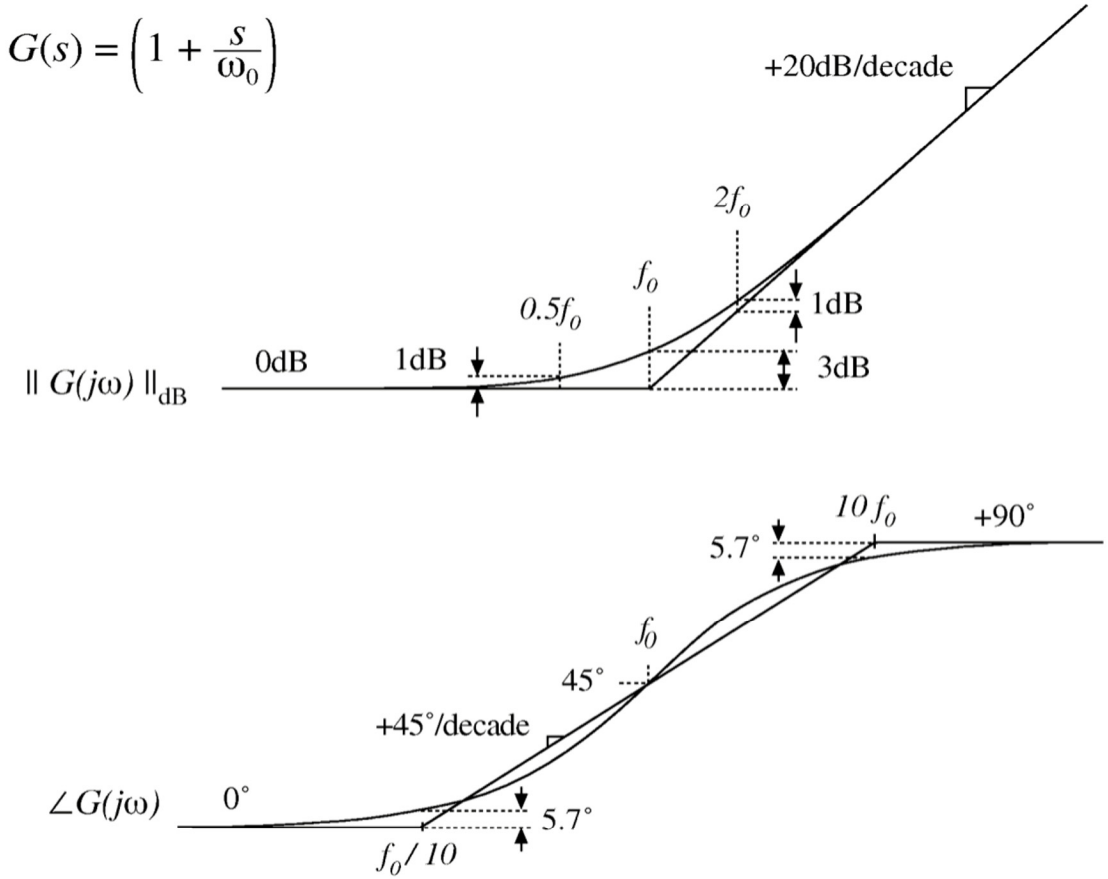


Summary: Single Real Pole

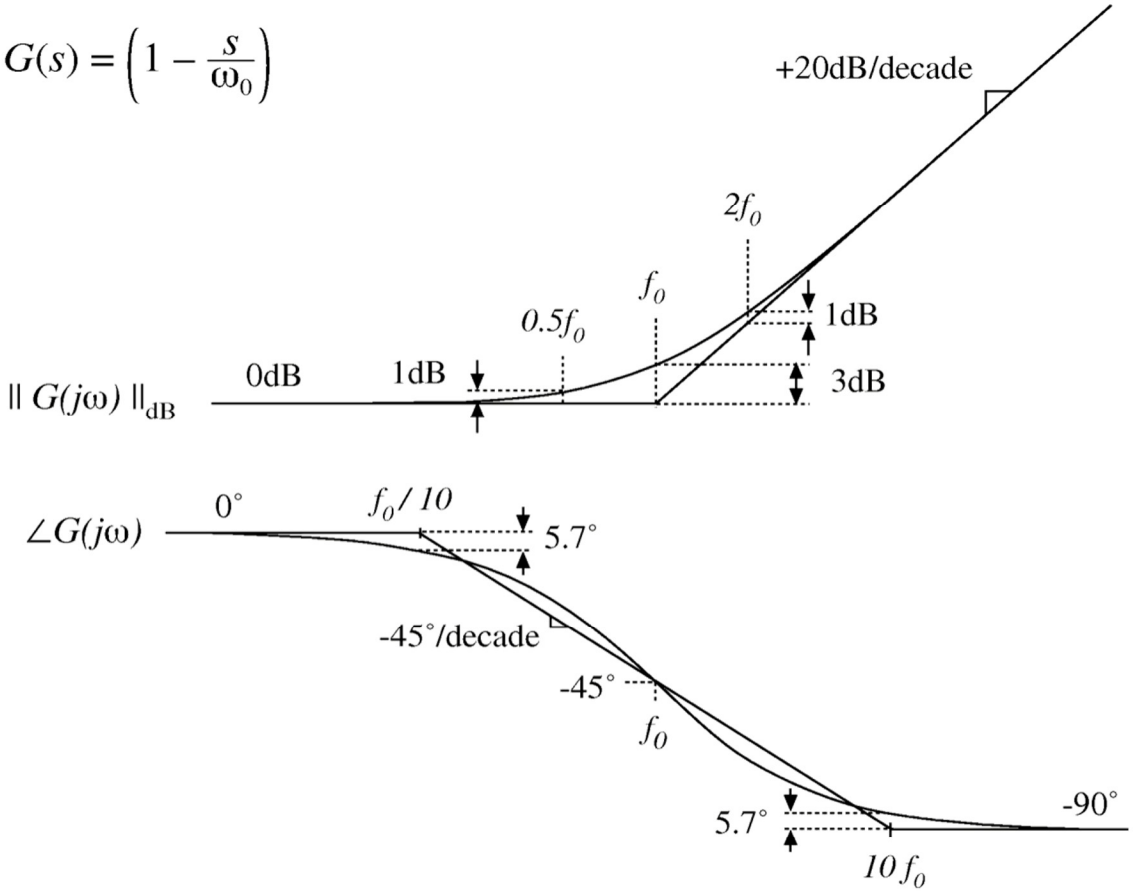


$$G(s) = \frac{1}{\left(1 + \frac{s}{\omega_0}\right)}$$

Bode Plot: Real Zero



RHP Zero

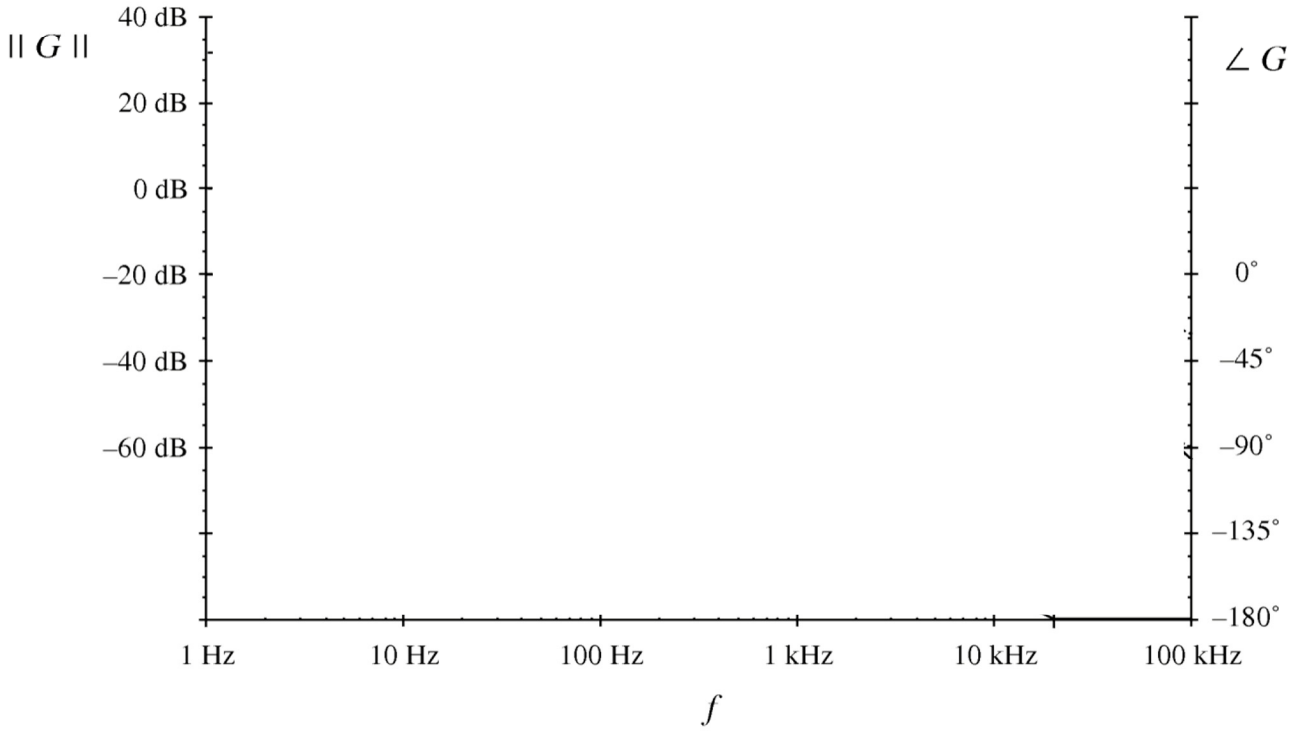


Multiplying Transfer Functions

Example 1

$$G(s) = \frac{G_0}{\left(1 + \frac{s}{\omega_1}\right)\left(1 + \frac{s}{\omega_2}\right)}$$

with $G_0 = 40 \Rightarrow 32$ dB, $f_1 = \omega_1/2\pi = 100$ Hz, $f_2 = \omega_2/2\pi = 2$ kHz



Example 2

Determine the transfer function $A(s)$ corresponding to the following asymptotes: