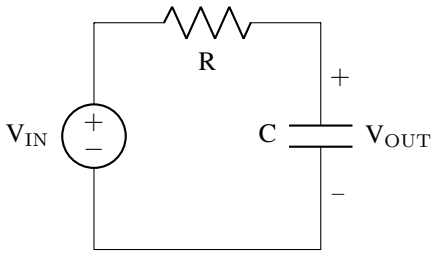
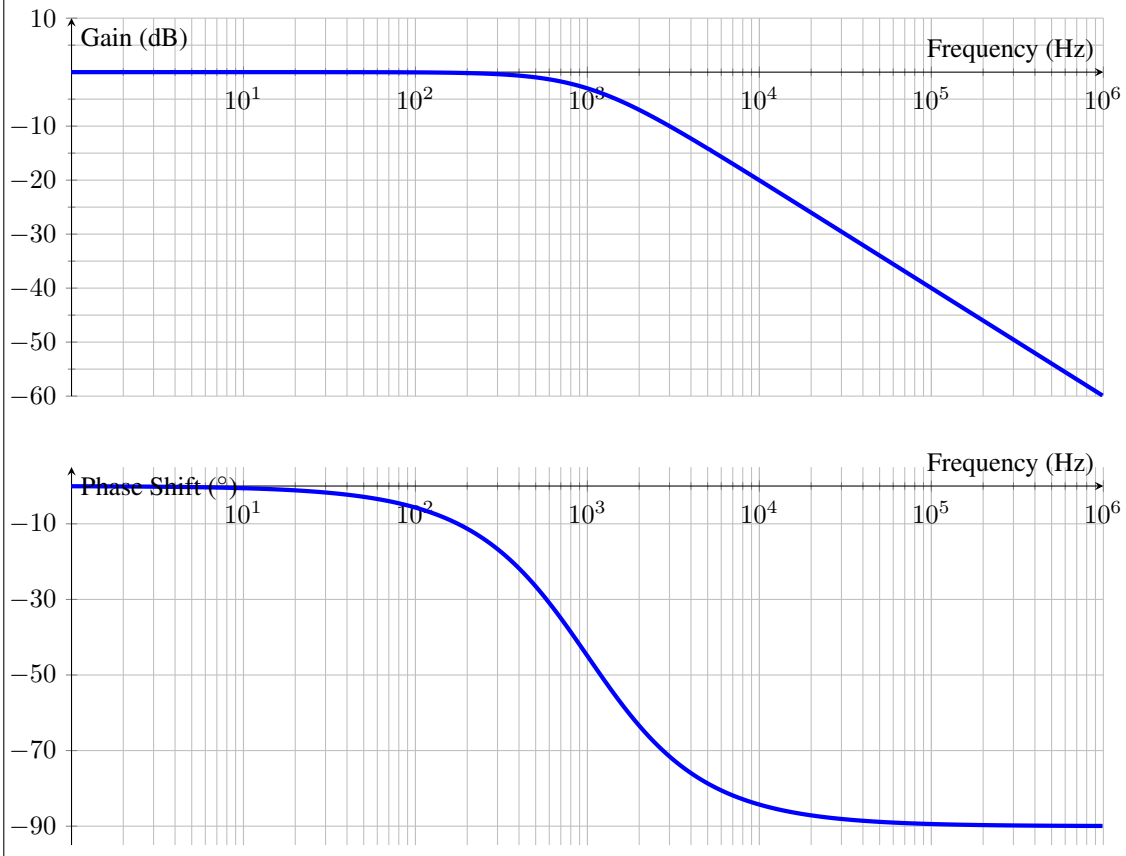
RC Low-pass



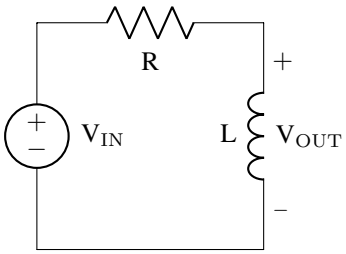
$H(s) = \frac{1}{RCs+1}$ $\omega_c = \frac{1}{RC}$ $f_c = \frac{1}{2\pi RC}$

Bode Plot Example

R=1 kΩ, C=159 nF



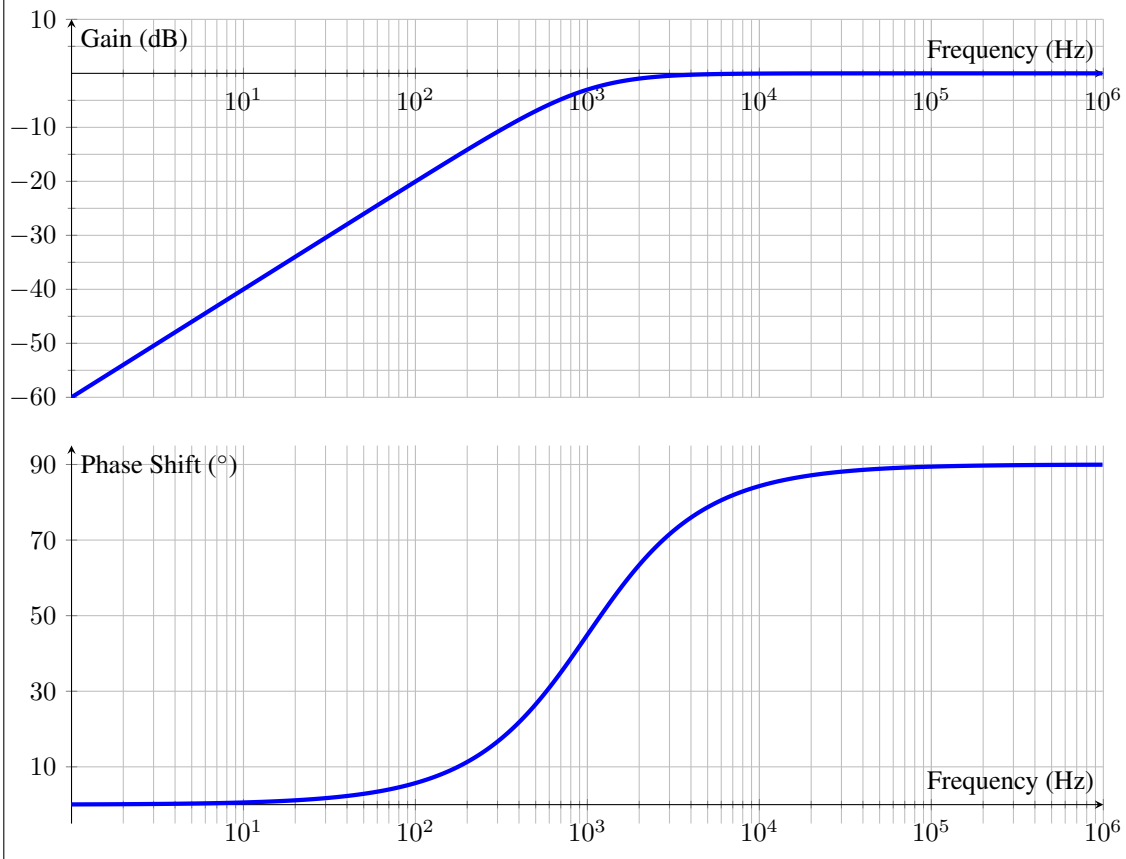
RL High-pass



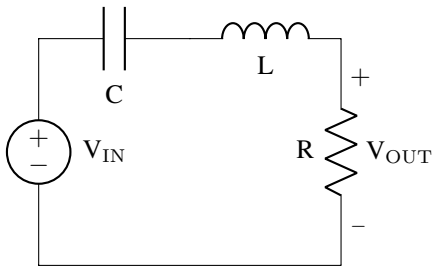
$$H(s) = \frac{\frac{L}{R}s}{\frac{L}{R}s+1} \qquad \omega_c = \frac{R}{L} \qquad f_c = \frac{R}{2\pi L}$$

Bode Plot Example

R=628 Ω, L=100 mH



Series RLC Band-pass



$$H(s) = \frac{RCs}{LCs^2+RCs+1}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \qquad f_r = \frac{1}{2\pi\sqrt{LC}}$$

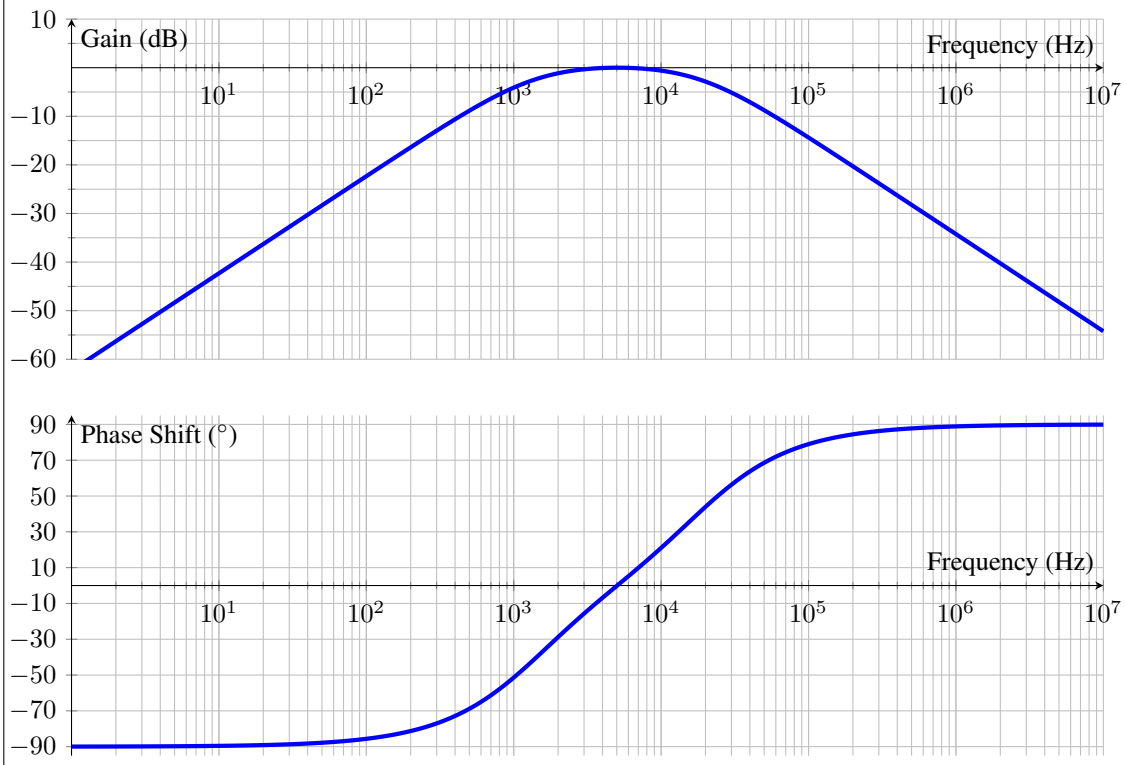
$$X_L = 2\pi f L \qquad Q = \frac{X_L}{R}$$

If Q>>10 these estimates are useful:

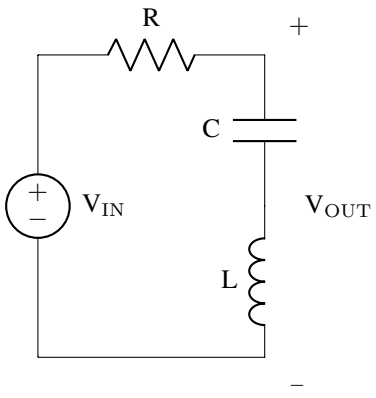
$$BW = \frac{f_r}{Q} \qquad f_1 = f_r - \frac{1}{2}BW \qquad f_2 = f_r + \frac{1}{2}BW$$

Bode Plot Example

R=12.2 kΩ, L=100 mH, C=.01 μF



Series RLC Band-stop/Notch



$$H(s) = \frac{RCs}{LCs^2+RCs+1}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \qquad f_r = \frac{1}{2\pi\sqrt{LC}}$$

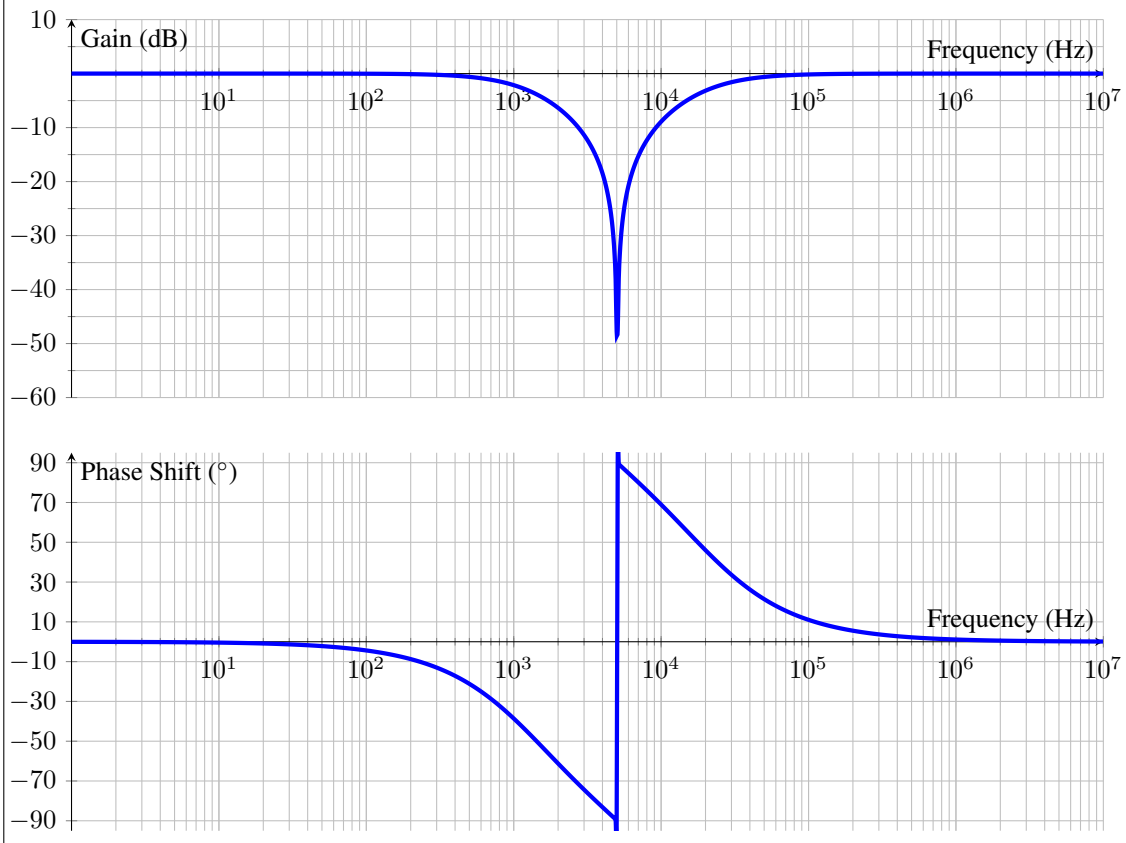
$$X_L = 2\pi f L \qquad Q = \frac{X_L}{R}$$

If Q>>10 these estimates are useful:

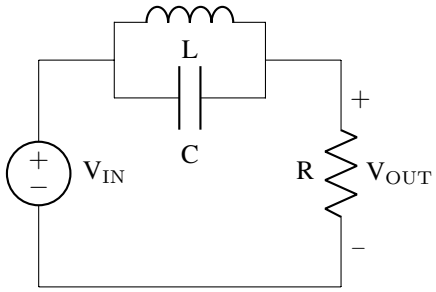
$$BW = \frac{f_r}{Q} \qquad f_1 = f_r - \frac{1}{2}BW \qquad f_2 = f_r + \frac{1}{2}BW$$

Bode Plot Example

R=12.2 kΩ, L=100 mH, C=.01 μF



Parallel RLC Band-stop/Notch



$$H(s) = \frac{RCs}{LCs^2+RCs+1}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \qquad f_r = \frac{1}{2\pi\sqrt{LC}}$$

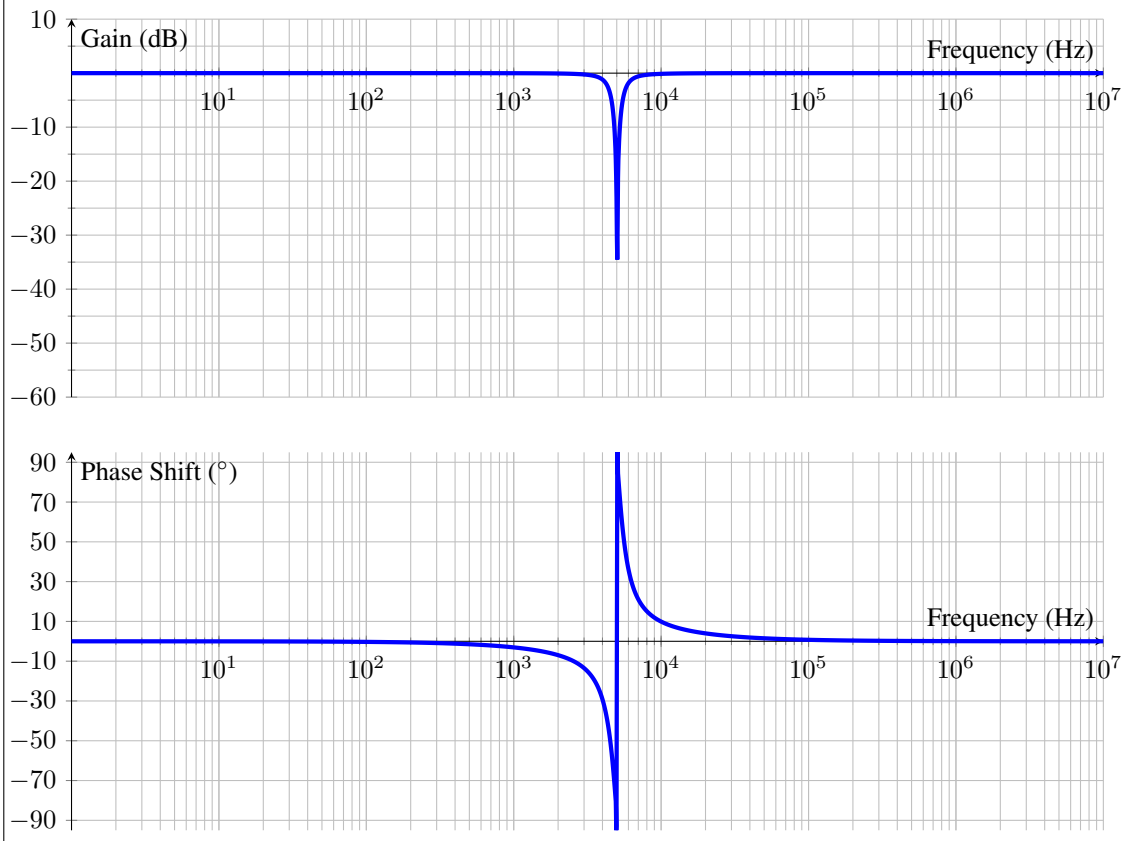
$$X_L = 2\pi f L \qquad Q = \frac{R}{X_L}$$

If Q>>10 these estimates are useful:

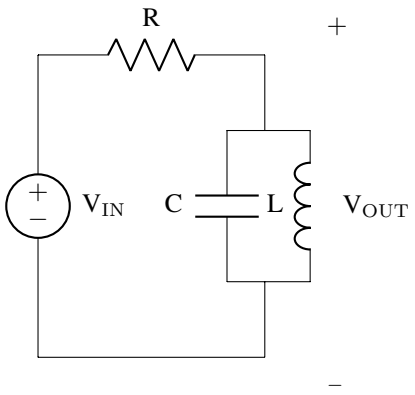
$$BW = \frac{f_r}{Q} \qquad f_1 = f_r - \frac{1}{2}BW \qquad f_2 = f_r + \frac{1}{2}BW$$

Bode Plot Example

R=12.2 kΩ, L=100 mH, C=.01 μF



Parallel RLC Band-pass



$$H(s) = \frac{RCs}{LCs^2+RCs+1}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \qquad f_r = \frac{1}{2\pi\sqrt{LC}}$$

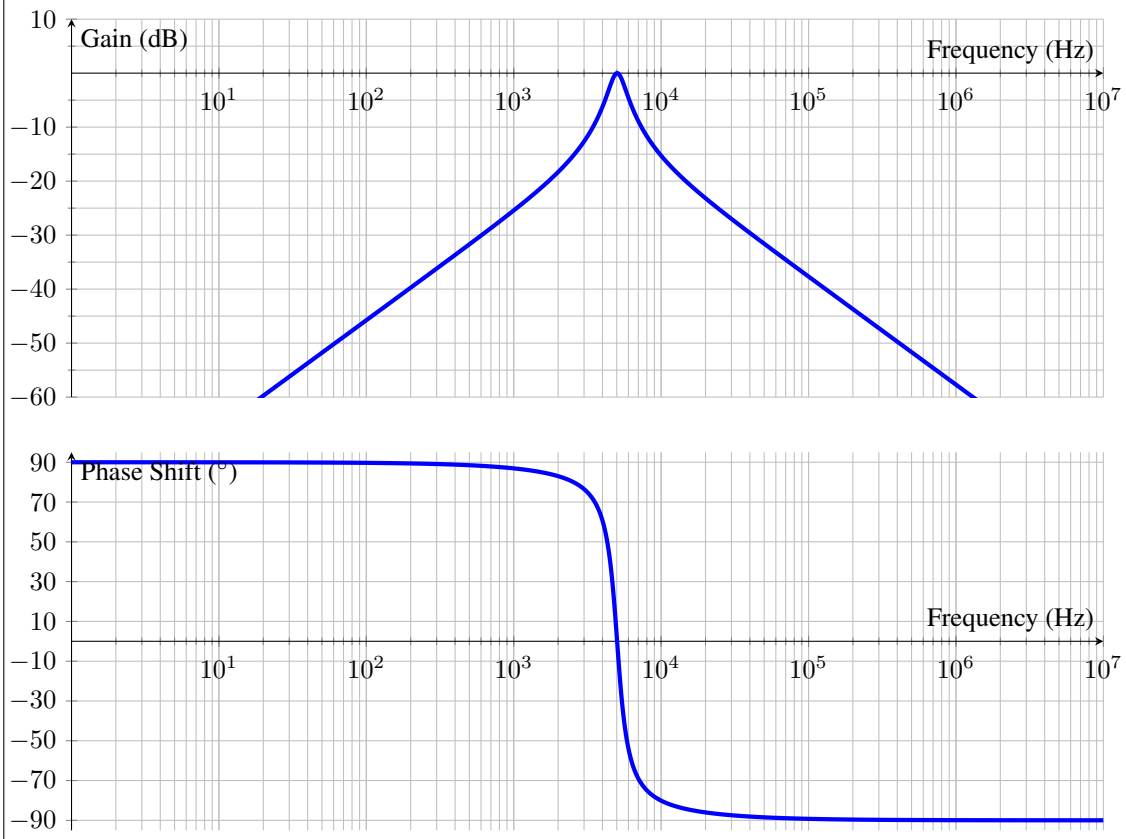
$$X_L = 2\pi f L \qquad Q = \frac{R}{X_L}$$

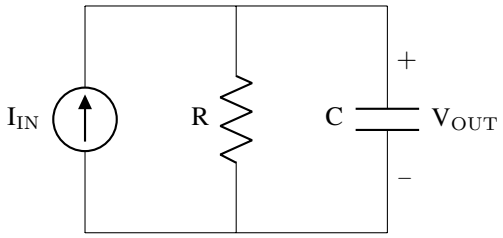
If Q>>10 these estimates are useful:

$$BW = \frac{f_r}{Q} \qquad f_1 = f_r - \frac{1}{2}BW \qquad f_2 = f_r + \frac{1}{2}BW$$

Bode Plot Example

R=12.2 kΩ, L=100 mH, C=.01 μF

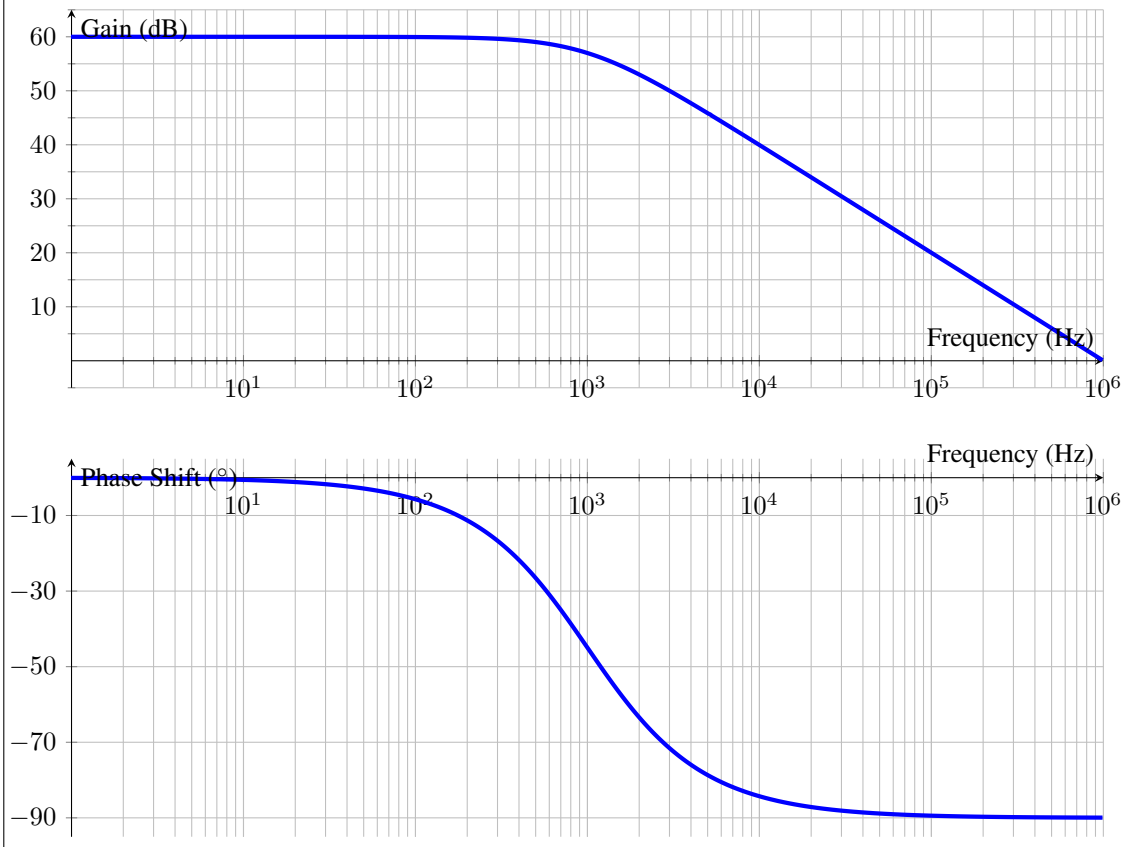




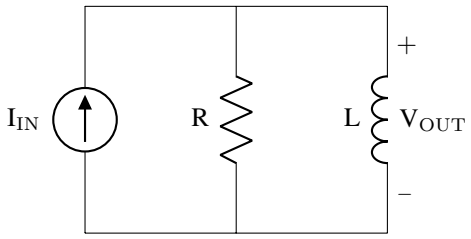
$H(s) = \frac{R}{RCs+1}$ $\omega_c = \frac{1}{RC}$ $f_c = \frac{1}{2\pi RC}$

Bode Plot Example

R=1 kΩ, C=159 nF



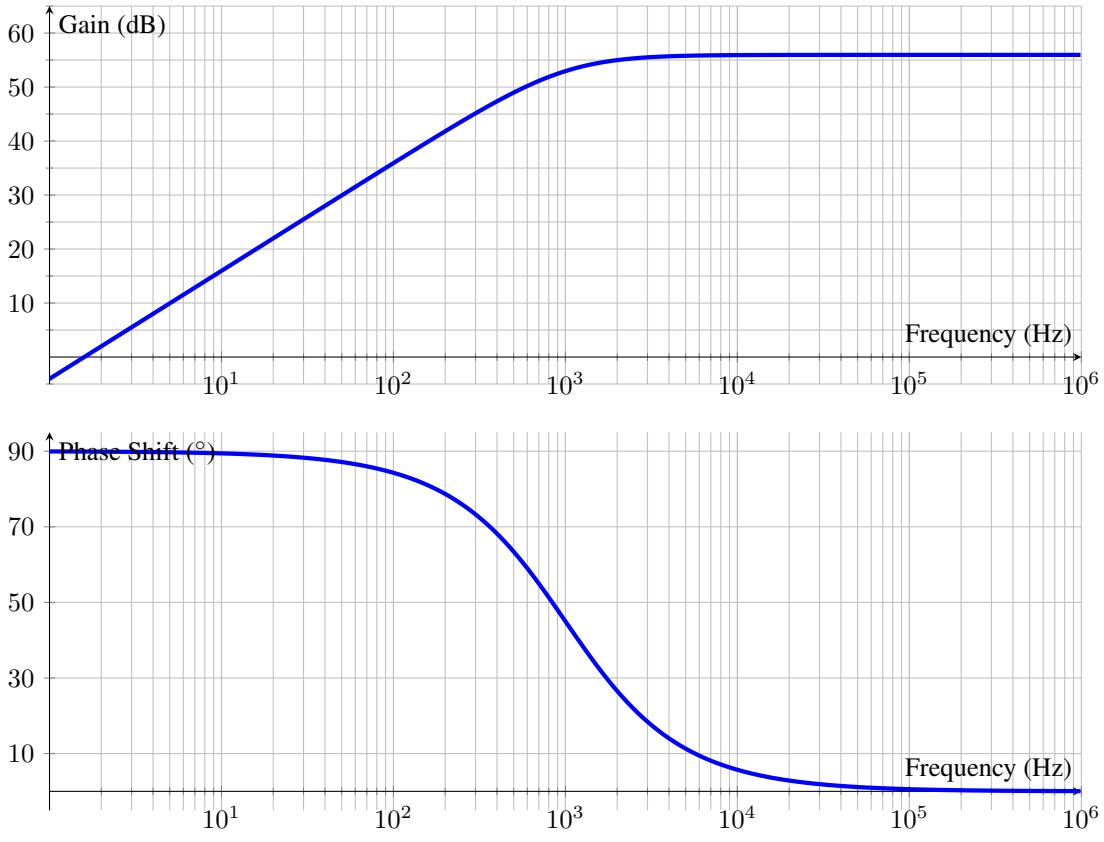
Parallel RL High-pass

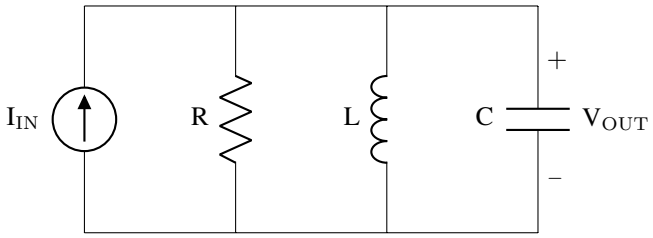


$$H(s) = \frac{\frac{L}{R}s}{\frac{L}{R}s+1} \qquad \omega_c = \frac{R}{L} \qquad f_c = \frac{R}{2\pi L}$$

Bode Plot Example

R=628 Ω, L=100 mH





$$H(s) = \frac{RCs}{LCs^2+RCs+1}$$

$$\omega_r = \frac{1}{\sqrt{LC}} \qquad f_r = \frac{1}{2\pi\sqrt{LC}}$$

$$X_L = 2\pi f L \qquad Q = \frac{R}{X_L}$$

If Q>>10 these estimates are useful:

$$BW = \frac{f_r}{Q} \qquad f_1 = f_r - \tfrac{1}{2}BW \qquad f_2 = f_r + \tfrac{1}{2}BW$$

Bode Plot Example

R=62.5 Ω, L=700 μH, C=126 nF