

Bode Magnitude Diagram Drawing Guidelines

Consider the following transfer function $G(s)$ as a product of basic factors from

$$G(s) = \frac{K_B \left(1 + \frac{s}{z_1}\right) \left(1 + \frac{s}{z_2}\right)}{s^\beta \left(1 + \frac{s}{p_1}\right) \left(1 + \frac{s}{p_2}\right) \left(1 + \frac{2\zeta}{\omega_n}s + \frac{s^2}{\omega_n^2}\right)}$$

Find the frequency response function $G(j\omega)$,

$$G(j\omega) = \frac{K_B \left(1 + \frac{j\omega}{z_1}\right) \left(1 + \frac{j\omega}{z_2}\right)}{(j\omega)^\beta \left(1 + \frac{j\omega}{p_1}\right) \left(1 + \frac{j\omega}{p_2}\right) \left(1 + \frac{2\zeta j\omega}{\omega_n} + \frac{(j\omega)^2}{\omega_n^2}\right)}$$

Step 1: Determine all of the basic factors of the $G(j\omega)$

Step 2: Determine all corner frequencies of the first-order and the second-order factors.

Step 3: Find the starting point and the starting slope at low frequencies:

- Starting Slope: **-20β dB/dec**
- Starting Point: **$20 \log \left| \frac{K_B}{(j\omega)^\beta} \right|$ dB**

Step 4: Draw the asymptote lines

- At each single pole's corner frequency add **-20dB/dec** to the slope.
- At each single zero's corner frequency add **+20dB/dec** to the slope.
- At each second-order pole's corner frequency add **-40dB/dec** to the slope.
- At each second-order zero's corner frequency add **+40dB/dec** to the slope.

Step 5: The exact curve can be obtained by adding proper corrections on the graph.