6.1: CT H(jw) Output

6.1. Consider a continuous-time LTI system with frequency response $H(j\omega) = |H(j\omega)|\, e^{j\sphericalangle H(j\omega)}$ and real impulse response $h(t)$. Suppose that we apply an input $x(t) = \cos(\omega_0 t + \phi_0)$ to this system. The resulting output can be shown to be of the form

$$y(t) = Ax(t - t_0),$$

where A is a nonnegative real number representing an *amplitude-scaling* factor and t_0 is a time delay.

(a) Express A in terms of $|H(j\omega_0)|$.

(b) Express t_0 in terms of $\sphericalangle H(j\omega_0)$.

6.2: DT H(e^jw) Output

6.2. Consider a discrete-time LTI system with frequency response $H(e^{j\omega}) = |H(e^{j\omega})|e^{j\sphericalangle H(e^{j\omega})}$ and real impulse response $h[n]$. Suppose that we apply the input $x[n] = \sin(\omega_0 n + \phi_0)$ to this system. The resulting output can be shown to be of the form

$$y[n] = |H(e^{j\omega_0})|x[n - n_0],$$

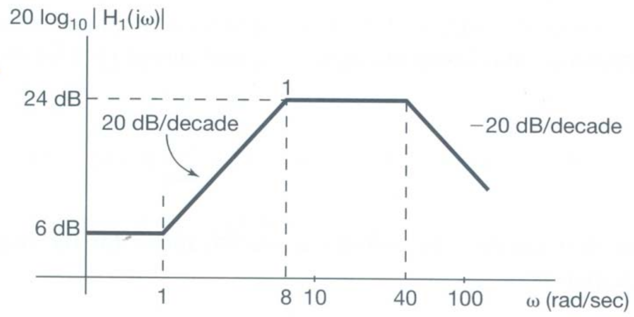
provided that $\sphericalangle H(e^{j\omega_0})$ and ω_0 are related in a particular way. Determine this relationship.

6.11: CT 2nd Bode Plot

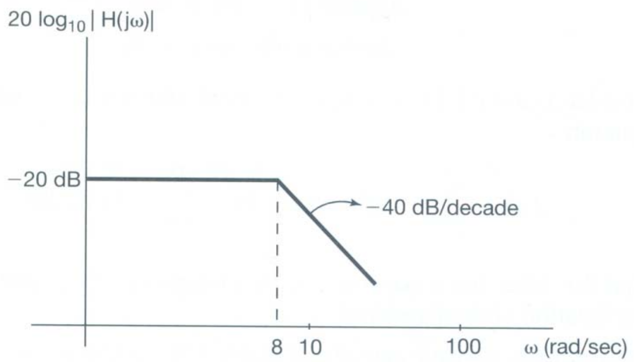
6.11. For each second-order system whose frequency response is as follows, specify the straight-line approximation of the Bode magnitude plot:

(a) $\frac{250}{(j\omega)^2+50.5j\omega+25}$ **(b)** $0.02\frac{j\omega+50}{(j\omega)^2+0.2j\omega+1}$

6.12. A continuous-time LTI system S with frequency response $H(j\omega)$ is constructed by cascading two continuous-time LTI systems with frequency responses $H_1(j\omega)$ and $H_2(j\omega)$, respectively. Figures P6.12(a) and P6.12(b) show the straight-line approximations of the Bode magnitude plots of $H_1(j\omega)$ and $H(j\omega)$, respectively. Specify $H_2(j\omega)$.



(a)



(b)