

Solution of ECE 316 Test 7 S06

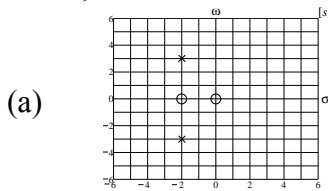
1. Find the numerical values of the unit step responses $h_{-1}(t)$ of the systems with these transfer functions at $t = 0^+$ and as $t \rightarrow \infty$.

(a) $H(s) = \frac{3s}{s+2}$, $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 3$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 0$

(b) $H(s) = \frac{10}{s+4}$, $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 0$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 2.5$

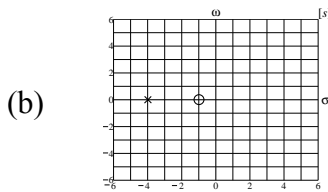
(c) $H(s) = \frac{15s}{s^2 + 2s + 8}$, $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 0$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 0$

2. Find the numerical values of the magnitude frequency responses $|H(f)|$ of the systems with these pole-zero plots at $f = 0$ and at $f \rightarrow \infty$. (Assume that the transfer functions are all in the form $H(s) = A \frac{(s - z_1) \dots (s - z_N)}{(s - p_1) \dots (s - p_D)}$ where $A = 1$, the z 's are the zeros and the p 's are the poles.)



$$|H(0)| = \frac{(0-0)(0-(-2))}{(0-(-2+j3))(0-(-2-j3))} = 0 ,$$

$$|H(\infty)| = 1$$



$$|H(0)| = \frac{0 - (-1)}{0 - (-4)} = \frac{1}{4} , \quad |H(\infty)| = 1$$

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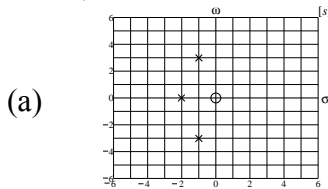
(a) $H(s) = \frac{7s}{s+5}$ $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 7$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 0$

(b) $H(s) = \frac{9}{s+3}$ $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 0$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 3$

(c) $H(s) = \frac{8s}{s^2 + 5s + 2}$ $h_{-1}(0^+) = \lim_{s \rightarrow \infty} H(s) = 0$, $\lim_{t \rightarrow \infty} h_{-1}(t) = \lim_{s \rightarrow 0} H(s) = 0$

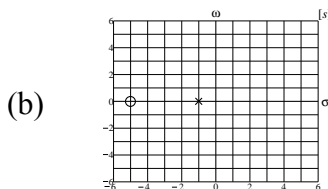
2. Find the numerical values of the magnitude frequency responses $|H(f)|$ of the systems with these pole-zero plots at $f = 0$ and at $f \rightarrow \infty$. (Assume that

the transfer functions are all in the form $H(s) = A \frac{(s - z_1)(s - z_N)}{(s - p_1)(s - p_D)}$ where $A = 1$, the z 's are the zeros and the p 's are the poles.)



$$|H(0)| = \frac{(0-0)}{(0-(-2))(0-(-1+j3))(0-(-1-j3))} = 0$$

$$|H(\infty)| = 0$$



$$|H(0)| = \frac{0-(-5)}{0-(-1)} = 5$$
 , $|H(\infty)| = 1$