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Problem Set 2

DSP

10/7/2019

1) (a) $\frac{1}{3} < |z| < \frac{5}{2}$

(b)
$$h[n] = \begin{cases} a(\frac{1}{3})^n & n \geq 1 \\ (bn+c)(-\frac{5}{2})^n & n \leq -1 \end{cases}$$

(c) $\frac{5}{2} < |z| \leq \infty$

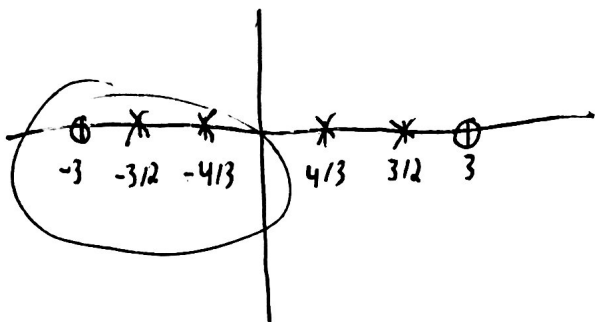
(d)
$$h[n] = \begin{cases} (an+b)(-\frac{5}{2})^n & n \geq 1 \end{cases}$$

(d)
$$H_{\min}(z) = \frac{z(2z-1)(4z+1)}{3(5z+2)^2(3z-1)}$$

$$A(z) = \frac{z(2z-1)(4z+1)}{(5z+2)^2(3z-1)(3)} \cdot \frac{(3)(3z-1)(2z+5)^2}{(2z-1)(z+4)}$$

$$= \frac{(4z+1)(2z+5)^2 z}{(z+4)(5z+2)^2}$$

$$2) H(s) = \frac{9-s^2}{(9-4s^2)(16-9s^2)} = \frac{(3+s)(3-s)}{(3+2s)(3-2s)(4+3s)(4-3s)}$$



$$H_{min} = \frac{s+3}{(s+\frac{3}{2})(s+\frac{4}{3})}$$

$$= \frac{s+3}{(2s+3)(3s+4)}$$

$$= K \frac{s+3}{(2s+3)(3s+4)}$$

$$H_{mm} = \frac{s+3}{(2s+3)(3s+4)}$$

$$|H_{min}(0)|^2 = H(0)$$

$$\frac{K^2(3)^2}{(3)^2(4)^2} = \frac{3(3)}{3(3)(4)(4)}$$

$$K^2 \frac{9}{9(16)} = \frac{9}{9(16)}$$

$$K=1$$

$$3) (a) S(\omega) = \frac{13+12\cos\omega}{(5+4\cos\omega)^2}$$

$$S(z) = \frac{13+12(\frac{z+z^{-1}}{2})}{(5+4(\frac{z+z^{-1}}{2}))^2}$$

$$= \frac{13+6z+6z^{-1}}{(5+2z+2z^{-1})^2}$$

$$(b) \frac{13z^2+6z^3+6z}{(5z+2z^2+2)^2}$$

$$= \frac{z(6z^2+13z+6)}{(2z^2+5z+2)^2}$$

$$= \frac{z(3z+2)(2z+3)}{(2z+1)^2(z+2)^2}$$

zeros: $\infty, 0, -2/3, -3/2$
poles: $-1/2, -2$
(2) (2)

$$(c) H(z) = K \frac{z(3z+2)}{(2z+1)^2}$$

$$|H(z=1)|^2 = |H(\omega=0)|^2$$

$$(K \frac{1(5)}{9})^2 = \frac{13+12\cos 0}{(5+4\cos 0)^2}$$

$$(\frac{5K}{9})^2 = \frac{25}{81}$$

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$$5K=9$$

whiten/ing

$$G(z) = \frac{1}{H(z)} = \frac{(2z+1)^2}{z(3z+2)}$$

$$K=1 \text{ Innovation}$$

$$H(z) = \frac{z(3z+2)}{(2z+1)^2}$$