Weizhe Guo

DSP.

PS 1.

1. a. poles: $-\frac{1}{4}$. mult: 2.

$\frac{1}{3}$ mult: 1.

$\frac{2}{3}$ mult: 1.

-3 mult: 1

∞ is not a pole because casual implies ROC includes ∞ and thus ∞ cannot be a pole.

b. 5. # of poles = # of zeros.

c. $\frac{1}{3} < |z| < \frac{2}{3}$.

d. $\frac{2}{3} < |z| < 3$. (include unit circle)

e. No (stable & causal)

f. No. (all poles & zeros in stability region)

2. $H(z) = \dfrac{(3z+4)(z+5)}{(2z-1)(z+3)^2}$

$A(z) =$

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

$$H_{min}(z) = H(z)\cdot A(z) = \frac{(3z+4)\cancel{(z+5)}}{(2z-1)\cancel{(z+3)^2}} \cdot \frac{\cancel{(z+3)^2}(-5z-1)(-\frac{4}{3}z-1)}{(z+\frac{1}{3})^2\cancel{(z+5)}(z+\frac{4}{3})} \cdot z^M$$

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

$\frac{1}{3}(3z+4)$

$\therefore m = 1.$

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

3. $|H(w)|^2 = \frac{9 + 4w^2}{(4+w^2)(16+w^2)}$.

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

4. $S(w) = \frac{(5 - 4\cos w)^2}{13 + 12\cos w}$.

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

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

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

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

$-2 \quad 1$

$1 \quad -2$

$\frac{3}{2} \quad \frac{2}{3}$

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

$$(H_{min}(z)|_{z=1})^2 = (K \frac{1}{5})^2 = \frac{1}{25}K = \frac{1}{25}.$$

$\therefore K = 1$.

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

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