8.1 (1) $\frac{1}{2}UZ^{-1}+X=U$

$U+UZ^{-1}\times\frac{1}{4}=Y$

$\Rightarrow H=\frac{Y}{X}=\frac{1+\frac{1}{4}Z^{-1}}{1-\frac{1}{2}Z^{-1}}$

(2) $\begin{cases} VZ^{-1}\times r\cos\theta+(X+U(-r\sin\theta \\ =V \\ U\cdot r\cos\theta+V\cdot Z^{-1}=Y \\ YZ^{-1}=U \end{cases}$

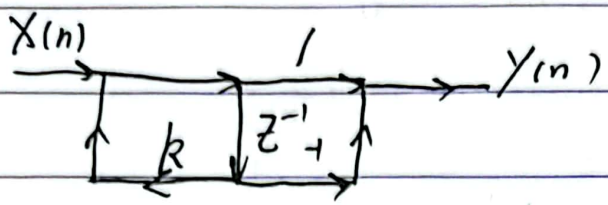
$H=\frac{Y}{X}=\frac{1}{Z^2-2r\cos\theta+r^2\cos^2\theta\cdot Z^{-1}+Z^{-1}+r\sin\theta}$

(3) $X+XZ^{-1}\cdot Z^{-1}\times(-1)+YZ^{-1}\cdot Z^{-1}\times(-0.9)$

$+YZ^{-1}\times 1.6=Y$

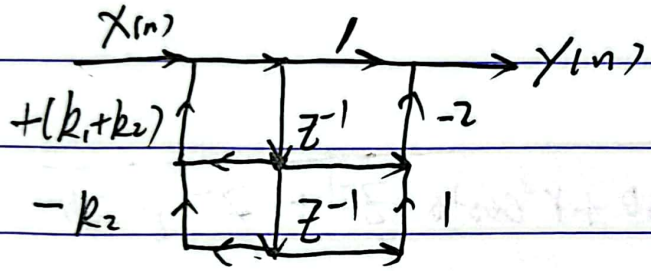
$\Rightarrow \frac{Y}{X}=\frac{1-Z^{-2}}{1+0.9Z^{-2}-1.6Z^{-1}}$

8.2 (1) $H_1(z) = \dfrac{1-z^{-1}}{1-kz^{-1}}$

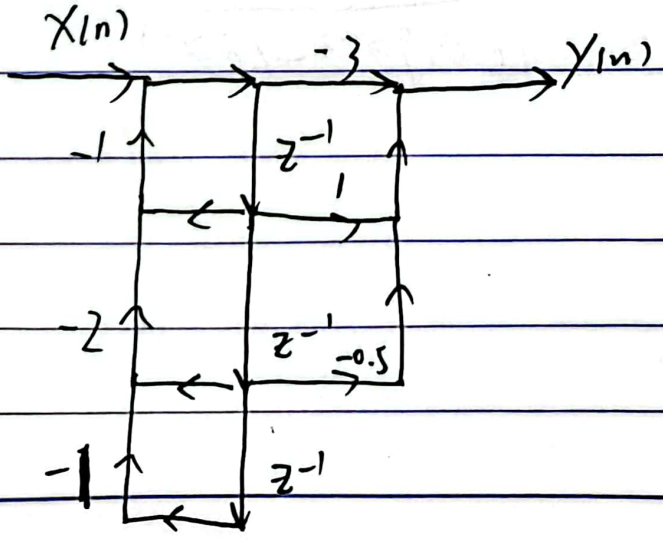


(2) $H_2(z) = \dfrac{(1-z^{-1})^2}{1-(k_1+k_2)z^{-1}+k_2z^{-2}}$

$= \dfrac{1-2z^{-1}+z^{-2}}{1-(k_1+k_2)z^{-1}+k_2z^{-2}}$



(3) $H_3(z) = \dfrac{-3+z^{-1}-0.5z^{-2}}{1+z^{-1}+2z^{-2}+z^{-3}}$



8.4.

$$H(s)=\frac{s+0.5}{(s+0.5)^2+4}=\frac{1}{2}\frac{1}{s+0.5+2j}+\frac{1}{2}\frac{1}{s+0.5-2j}$$

$$H(z)=\frac{z(z-e^{-0.5T}\cos(2T))}{(z-e^{-0.5T}e^{-2jT})(z-e^{-0.5T}e^{2jT})}$$

8.5 $\omega_p = 0.2613\pi$, $\alpha_p = 0.75\,dB$,

$\omega_s = 0.4018\pi$, $\alpha_s = 20\,dB$

$$\Omega_p = \frac{2}{T}\tan\frac{\omega_p}{2}$$

$$\Omega_s = \frac{2}{T}\tan\frac{\omega_s}{2}$$

$$\lambda_{sp} = \frac{\Omega_s}{\Omega_p} = 1.6795, \quad k_{sp} = \sqrt{\frac{10^{0.1\alpha_p}-1}{10^{0.1\alpha_s}-1}} = 0.04$$

$$N = -\frac{\lg k_{sp}}{\lg \lambda_{sp}} = 6.2 \quad 取\ 7.$$

$$\Omega_c = \Omega_s \times (10^{0.1\alpha_s}-1)^{-\frac{1}{2N}} = 0.5264$$

$$S_k = \Omega_c e^{j\left[\frac{1}{2}+\frac{2k-1}{2\times 7}\right]\pi}, \quad k = 1, 2, \cdots, 7$$

$$= 0.5264 \times e^{j\left[\frac{1}{2}+\frac{2k-1}{14}\right]\pi}, \quad k = 1, 2, \cdots, 7$$

$$H_a(s) = \frac{\Omega_c^7}{\prod_{k=1}^{7}(S-S_k)}$$

$$H(z) = H_a(s)\Big|_{S=\frac{2}{T}\frac{1-z^{-1}}{1+z^{-1}}}$$

8.12 $\omega_c = 2\pi \frac{f_c}{f_s} = 0.4\pi$

$$\Omega_c = \frac{2}{T}\tan\frac{\omega_c}{2}$$

$$C_1 = \tan\frac{\omega_c}{2} = 0.727$$

由 $H_{LP}(s) = \frac{1}{s^3+2s^2+2s+1}$

$$H_{HP}(z) = H_{LP}(s)\Big|_{s=C_1\frac{1+z^{-1}}{1-z^{-1}}}$$

$$= \frac{0.266(1-z^{-1}+3z^{-2}-z^{-3})}{1-0.5z^{-1}+0.43z^{-2}-0.056z^{-3}}$$

8.13. $f_2 = 400\,Hz$, $f_1 = 60\,Hz$

$$\omega_1 = 2\pi\frac{f_c}{f_s} = \frac{6\pi}{43}$$

$$\omega_2 = 2\pi\frac{f_c}{f_s} = \frac{40\pi}{43}$$

$$\cos\omega_0 = \frac{\sin(\omega_1+\omega_2)}{\sin\omega_1+\sin\omega_2} = 0.065$$

$$\Omega_c = \frac{\cos\omega_0-\cos\omega_2}{\sin\omega_2} = 18$$

由 $H_a(p) = \frac{1}{1+2p+2p^2+p^3}$

令 $P=\frac{S}{\Omega_c}$，令 $S=\frac{z^2-0.1z+1}{z^2-1}$

得 $H(z)$