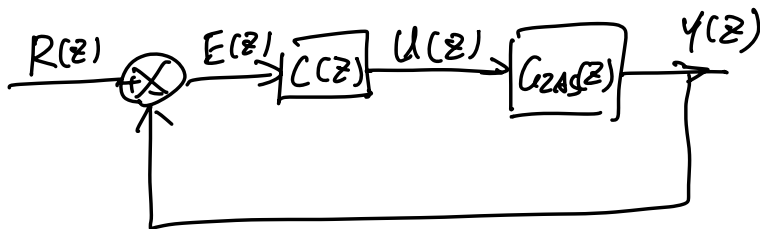


22-51-05

Q:  $T=1$

$$G_{zas}(z) = K \frac{0.8z + 0.2}{(z-1)(z-0.4)}$$



(a)  $C(s) = k_p$  range  $k_p k \rightarrow$  stable?

Solution

$$\begin{aligned} G_{cl}(z) &= \frac{C(z)G_{zas}(z)}{1 + C(z)G_{zas}(z)} \\ &= \frac{k_p k \frac{0.8z + 0.2}{(z-1)(z-0.4)}}{1 + k_p k \frac{0.8z + 0.2}{(z-1)(z-0.4)}} \\ &= \frac{k_p k (0.8z + 0.2)}{(z-1)(z-0.4) + k_p k (0.8z + 0.2)} \\ &= \frac{k_p k (0.8z + 0.2)}{z^2 + (-1.4 + 0.8k_p k)z + 0.4 + 0.2k_p k} \end{aligned}$$

July Test  $z^0$   $z^1$   $z^2$

$$0.4 + 0.2k_p k \quad -1.4 + 0.8k_p k \quad 1$$

$\therefore$  stable

$$\therefore \begin{cases} |0.4 + 0.2k_p k| < 1 \\ P(1) = 1 - 1.4 + 0.8k_p k + 0.4 + 0.2k_p k > 0 \\ P(-1) = 1 + 1.4 - 0.8k_p k + 0.4 + 0.2k_p k > 0 \quad n=2 \text{ even} \end{cases}$$

$$\therefore -1 < 0.4 + 0.2k_p k < 1$$

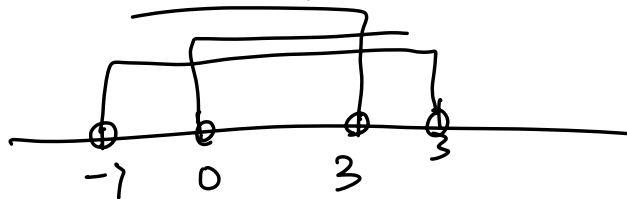
$$\frac{-1.4}{0.2} < k_p k < \frac{0.6}{0.2}$$

$$-7 < k_p k < 3 \quad (1)$$

$$k_p k > 0 \quad (2)$$

$$-0.6k_p k + 1.8 > 0$$

$$k_p k < \frac{1.8}{0.6} = 3 \quad (3)$$



$$\text{So } 0 < k_p k < 3$$

$$c) R(z) = \frac{1}{1-z^{-1}} \quad G_{cl}(1) = 1$$

$$U(z) = \frac{Y(z)}{G_{zas}(z)} = \frac{Y(z)}{R(z)} \frac{R(z)}{G_{zas}(z)} = G_{cl}(z) \frac{R(z)}{G_{zas}(z)}$$

$$= G_{cl}(z) \frac{\frac{1}{1-z^{-1}}}{k \frac{0.8z+0.2}{(z-1)(z-0.4)}} \xrightarrow{\text{代为 } z^{-1} \text{ 形式}} \frac{k(0.8+0.2z^{-1})z^{-1}}{(1-z^{-1})(1-0.4z^{-1})}$$

$$= G_{cl}(z) \frac{(z-1)(z-0.4)}{k(0.8z+0.2)(1-z^{-1})} \frac{1-0.4z^{-1}}{k(0.8+0.2z^{-1})z^{-1}}$$

$$\text{design } G_{cl}(z) = k_0 k (0.8+0.2z^{-1}) z^{-1}$$

$$\therefore G_{cl}(1) = k_0 k = 1 \Rightarrow k_0 k = 1$$

$$G_{cl}(z) = (0.8+0.2z^{-1}) z^{-1}$$

$$C(z) = \frac{1}{G_{zas}(z)} \frac{G_{cl}(z)}{1-G_{cl}(z)}$$

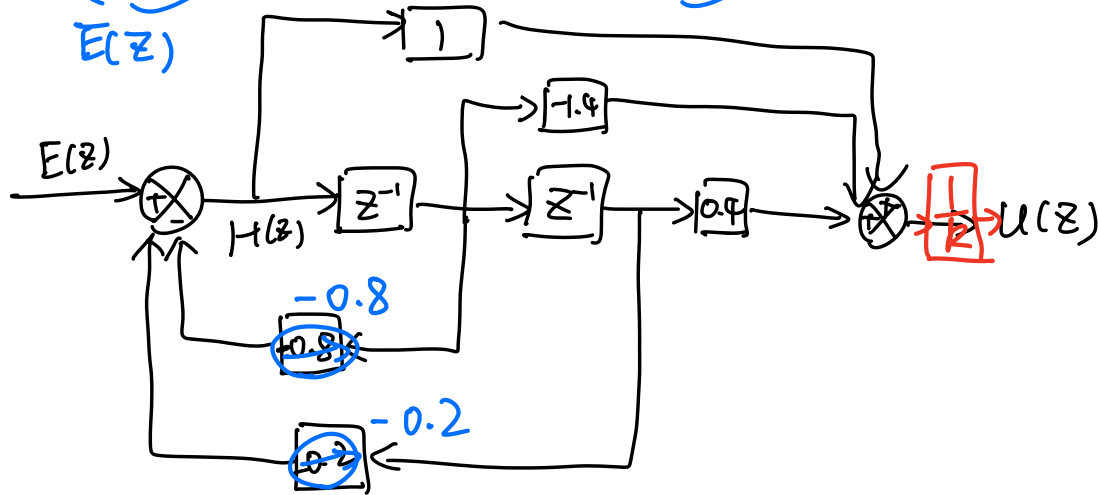
$$= \frac{(1-z^{-1})(1-0.4z^{-1})}{k(0.8+0.2z^{-1})z^{-1}} \frac{(0.8+0.2z^{-1})z^{-1}}{1-(0.8+0.2z^{-1})z^{-1}}$$

$$= \frac{(1-z^{-1})(1-0.4z^{-1})}{k[1-(0.8+0.2z^{-1})z^{-1}]}$$

$$c) C(z) = \frac{U(z)}{E(z)} = \frac{\frac{1}{K} (1 - 1.4z^{-1} + 0.4z^{-2})}{\frac{1}{K} H(z)} = \frac{U(z)}{H(z)} \frac{H(z)}{E(z)}$$

$$U(z) = (1 - 1.4z^{-1} + 0.4z^{-2}) H(z) \frac{1}{K}$$

$$\cancel{H(z)} = (1 - 0.8z^{-1} - 0.2z^{-2}) \cancel{E(z)} H(z) = H(z) - 0.8z^{-1} H(z) - 0.2z^{-2} H(z)$$



$$\text{So } H(z) = E(z) + 0.8z^{-1} H(z) + 0.2z^{-2} H(z)$$