Lect 3 Example 3.13.

Q : K ? $\longrightarrow$ deadbeat control $\forall x(0)$

$$x(k+1) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -0.5 & -0.2 & 1.1 \end{bmatrix} x(k) + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u(k)$$

$$y(k) = \begin{bmatrix} 0 & 1 & 0 \end{bmatrix} x(k)$$

Solution $[A - BK]^n = 0$ , some $n > 0$

$\lambda_i [A - BK] = 0$ , $i = 0, 1, 2 \cdots$

$\alpha_c(\lambda) = z^n$

方法1: $|zI - A + BK| \equiv z^3$ $BK = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \begin{bmatrix} k_1 & k_2 & k_3 \end{bmatrix}$

$$\begin{vmatrix} z & -1 & 0 \\ 0 & z & -1 \\ 0.5+k_1 & 0.2+k_2 & z-1.1+k_3 \end{vmatrix} \qquad = \begin{bmatrix} 0 & 0 & 0 \\ 0 & 0 & 0 \\ k_1 & k_2 & k_3 \end{bmatrix}$$

$= z^2(z - 1.1 + k_3) + 0.5 + k_1 + 0$

$- 0 - (-1)(0.2 + k_2) z - 0$

$= z^3 + (k_3 - 1.1) z^2 + (0.2 + k_2) z + k_1 + 0.5 \equiv z^3$

$$\Rightarrow \begin{cases} k_1 = -0.5 \\ k_2 = -0.2 \\ k_3 = 1.1 \end{cases} \qquad k = [-0.5 \quad -0.2 \quad 1.1]$$

$$x(k+1) = [A - BK]\, x(k) = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} x(k)$$

let $X(0) = [a, b, c]^T$

$\forall a, b, c$

$$\begin{bmatrix} x_1(1) \\ x_2(1) \\ x_3(1) \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} a \\ b \\ c \end{bmatrix} = \begin{bmatrix} b \\ c \\ 0 \end{bmatrix}$$

$$\begin{bmatrix} x_1(2) \\ x_2(2) \\ x_3(2) \end{bmatrix} = \begin{bmatrix} c \\ 0 \\ 0 \end{bmatrix} \qquad \begin{bmatrix} x_1(3) \\ x_2(3) \\ x_3(3) \end{bmatrix} = \begin{bmatrix} 0 \\ 0 \\ 0 \end{bmatrix}$$

$X(k) = 0, \; k = 3, 4, 5 \cdots$

deadbeat. $n = 3$.