

문제 5 pole placement

$$\dot{X} = AX + BU$$

pole placement를 풀려면

$$Y = CX + DU$$

최종 전달함수의 CE

⇒

$$\ddot{X} = AX + BU = AX - BKX = (A - BK)X$$

$$|sI - A + BK| = CE$$

$$A = \begin{bmatrix} -1 & -1 & -1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix}$$

$$B = \begin{bmatrix} 1 \\ 0 \\ 0 \end{bmatrix}$$

$$C = \begin{bmatrix} 0 & 0 & 1 \end{bmatrix}$$

$$D = 0$$

$$CE = s^3 + 6s^2 + 11s + 6$$

$$\begin{bmatrix} s & 0 & 0 \\ 0 & s & 0 \\ 0 & 0 & s \end{bmatrix} - \begin{bmatrix} -1 & -1 & -1 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \end{bmatrix} + \begin{bmatrix} k_1 & k_2 & k_3 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$$

$$= \begin{bmatrix} s+1+k_1 & 1+k_2 & 1+k_3 \\ -1 & s & 0 \\ 0 & -1 & s \end{bmatrix}$$

$$\det \rightarrow = (s+1+k_1) - (1+k_2) + (1+k_3)(1)$$

$$(s+1+k_1) s^2 - (1+k_2) (-s) + (1+k_3)$$

$$= s^3 + s^2 + k_1 s^2 + s + s k_2 + 1 + k_3$$

$$1 \quad 1+k_1 \quad +1+k_2 \quad 1+k_3$$

$$1 \quad 6 \quad 11 \quad 6$$

$$k_1 = 5 \quad k_2 = 10 \quad k_3 = 5$$

$$\begin{aligned} k_2 &= 5 \\ k_1 &= 5 \\ k_3 &= -12 \end{aligned}$$