

문제 : 가제어성 , 가관측성 판별

linearly independent

$$A \begin{bmatrix} 1 \\ 0 \end{bmatrix} + B \begin{bmatrix} 0 \\ 1 \end{bmatrix} = 0 \quad \text{이 되는}$$

A, B 가 0 만 있을 경우, linearly independent

$$\begin{bmatrix} 1 & 0 \\ 0 & 1 \end{bmatrix} \quad \text{rank} = 2$$

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

$$A = 1 \quad B = 1$$

$$A = 2 \quad B = 2$$

Controllable Matrix

$$C_m = \begin{bmatrix} B & A^k B \end{bmatrix}$$

$$B = \begin{bmatrix} 1 \\ -1 \end{bmatrix} \quad A = \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$$

$$\begin{bmatrix} \begin{bmatrix} 1 \\ -1 \end{bmatrix} & \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix} \begin{bmatrix} 1 \\ -1 \end{bmatrix} \end{bmatrix}$$

$$2 \times 2 \times 2 \times 1$$

$$= 2 \times 1$$

$$\begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix}$$

matrix가 diagonal \Rightarrow 2x2

\Rightarrow column rank & row rank는 같지

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

$A=1 \quad B=1 \rightarrow$ not dependant

$$\text{Det} \begin{bmatrix} 1 & -1 \\ -1 & 1 \end{bmatrix} = 1 - (1) = 0 \quad \text{Singular.}$$

Uncontrollable.

Observability Matrix

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

rank=2.

$$\begin{bmatrix} 1 & 0 \end{bmatrix} \begin{bmatrix} 0 & 1 \\ -1 & -2 \end{bmatrix}$$

$$1 \times 2 \times 2 \times 2 = 1 \times 2$$

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

$A=0, \quad B=0$ 만 $\frac{1}{2} \times \frac{1}{2}$

Observable.