

$$\textcircled{2} \quad \dot{x}_1 = x_2 \quad * \quad \dot{x}_3 = x_3 + u \quad *$$

$$\dot{x}_2 = x_3$$

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

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

$$C = [B \quad AB \quad A^2B]$$

$$AB = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} = \begin{matrix} (0)(0) + (1)(0) + (0)(1) \\ (0)(0) + (0)(0) + (1)(1) \\ (0)(0) + (0)(0) + (1)(1) \end{matrix}$$

$$= \begin{matrix} 0 \\ 1 \\ 1 \end{matrix}$$

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

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

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

$$\det(C) = (1) [(0)(1) - (1)(1)]$$

$$= \boxed{-1}$$