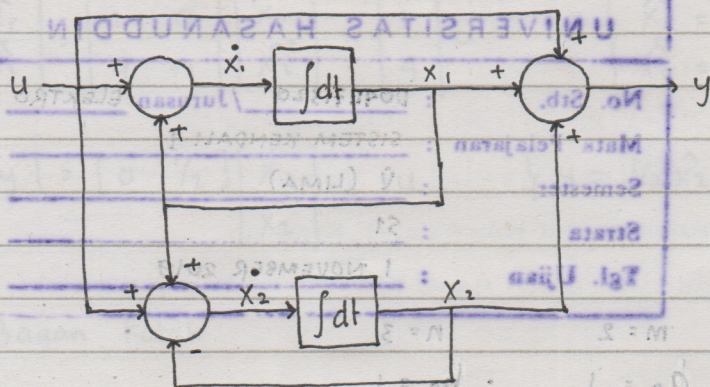


2.



(a) Model Ruang Keadaan

$$\dot{x}_1 = x_1 + u$$

$$y = x_1 + x_2 + u$$

$$\dot{x}_2 = x_1 - x_2 + u$$

$$\dot{x} = \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \underbrace{\begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix}}_A \underbrace{\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}}_x + \underbrace{\begin{bmatrix} 1 \\ 1 \end{bmatrix}}_B \underbrace{u}_u$$

$$y = \underbrace{\begin{bmatrix} 1 & 1 \end{bmatrix}}_C \underbrace{\begin{bmatrix} x_1 \\ x_2 \end{bmatrix}}_x + \underbrace{u}_D$$

$$A = [2 \times 2]$$

$$B = [2 \times 1]$$

$$C = [1 \times 2]$$

$$D = [1]$$

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(b) Model Nisbah Alih

$$G(s) = \frac{y(s)}{u(s)} = C[sI - A]^{-1}B + D$$

$$[sI - A] = \begin{bmatrix} s & 0 \\ 0 & s \end{bmatrix} - \begin{bmatrix} 1 & 0 \\ 1 & -1 \end{bmatrix} = \begin{bmatrix} s-1 & 0 \\ -1 & s+1 \end{bmatrix}$$

$$[sI - A]^{-1} = \begin{bmatrix} \frac{s+1}{(s+1)(s-1)} & 0 \\ \frac{1}{(s+1)(s-1)} & \frac{1}{s+1} \end{bmatrix}$$

$$G(s) = [1 \ 1] \begin{bmatrix} \frac{1}{s-1} & 0 \\ \frac{1}{(s+1)(s-1)} & \frac{1}{s+1} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} + [1]$$

$$= \begin{bmatrix} \frac{s+2}{s^2-1} & \frac{1}{s+1} \end{bmatrix} \begin{bmatrix} 1 \\ 1 \end{bmatrix} + [1]$$

$$= \frac{s+2}{s^2-1} + \frac{1}{s+1} + \frac{s+1}{s+1}$$

$$= \frac{s+2+s-1+s^2-1}{(s+1)(s-1)}$$

$$= \frac{s^2+2s}{s^2-1}$$

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