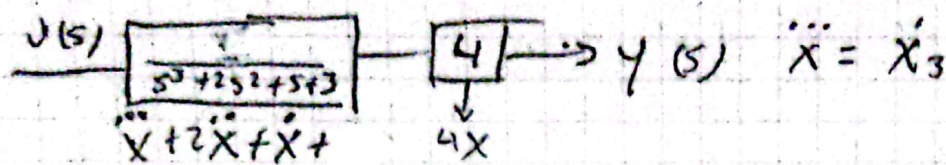


Bonificación

$$1) G(s) = \frac{4}{s^3 + 2s^2 + s + 3}$$



$$\begin{aligned} x &= x_1 \\ \dot{x} &= x_2 = \dot{x}_1 \\ \ddot{x} &= x_3 = \dot{x}_2 \\ \dddot{x} &= \dot{x}_3 \end{aligned}$$

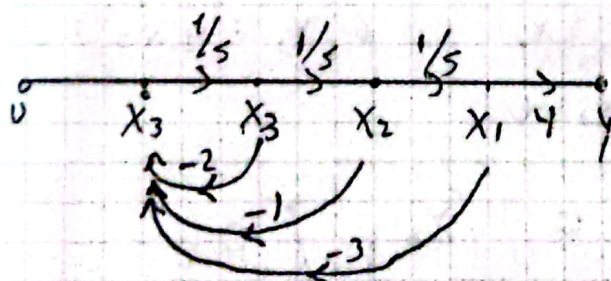
$$\ddot{x}_3 + 2x_3 + x_2 + 3x_1 = 0$$

$$4x = \dot{x}$$

$$\dot{x}_3 = -2x_3 - x_2 - 3x_1$$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = [4 \ 0 \ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + [0] u$$



$$2) U \rightarrow \left[\frac{1}{s^3 + 2s^2 + s + 3} \right] x_1 \rightarrow \left[\frac{4s}{4\dot{x}} \right] Y(s) \quad G(s) = \frac{4s}{s^3 + 2s^2 + s + 3}$$

$$\ddot{x} + 2\dot{x} + \dot{x} + 3x = 0$$

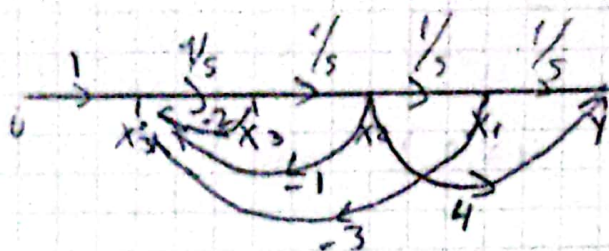
$$x = x_1 \quad \ddot{x}_3 + 2x_3 + x_2 + 3x_1 = 0$$

$$\dot{x} = x_2 \quad \dot{x}_3 = 0 - 2x_3 - x_2 + 3x_1$$

$$\ddot{x} = x_3 \quad y = 4\dot{x}_2$$

$$\ddot{x} = \dot{x}_3$$

$$\begin{bmatrix} \dot{x}_1 \\ \ddot{x}_2 \\ \ddot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u \quad y = [0 \ 4 \ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + [0] u$$



3) $u \rightarrow \frac{1}{s^4 - s^3 + 2s^2 + 3} \rightarrow x_1 \rightarrow \frac{6s^2 + 4s + 2}{s^4 - s^3 + 2s^2 + 3} \rightarrow y$ $b(s) = \frac{6s^2 + 4s + 2}{s^4 - s^3 + 2s^2 + 3}$

$$\ddot{\ddot{x}} - \ddot{x} + 2\dot{x} + 3x = u$$

$$6\ddot{x} + 4\dot{x} + 2x = y$$

$$\dot{x}_4 = u, \quad x_4 = 2x_2 - 3x_1$$

$$6x_3 + 4x_2 + 2x_1 = y$$

$$x = x_1$$

$$\dot{x} = x_2$$

$$\ddot{x} = x_3$$

$$\ddot{\ddot{x}} = x_4$$

$$\ddot{\ddot{\ddot{x}}} = x_4$$

$$\dot{x}_4 - x_4 + 2x_2 + 3x_1 = u$$

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \\ \dot{x}_4 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \\ -3 & -2 & 0 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 1 \end{bmatrix} u$$

$$y = [2 \ 4 \ 6 \ 0] \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix} + [0] u$$

