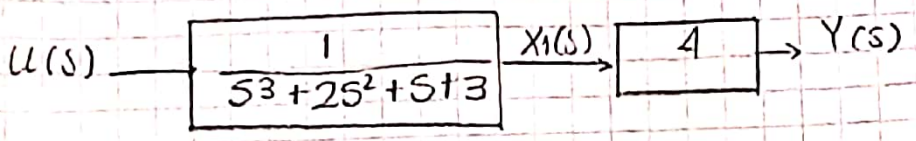
Camila Andrea Caceres Ricaro - 20172005133.

1)

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



$$\frac{X_1(s)}{U(s)} = \frac{1}{s^3+2s^2+s+3}$$

$$(s^3+2s^2+s+3)X_1(s) = U(s)$$

$$s^3X_1(s) + 2s^2X_1(s) + sX_1(s) + 3X_1(s) = U(s)$$

$$\dddot{x}_1 + 2\ddot{x}_1 + \dot{x}_1 + 3x_1 = u(t)$$

$x_1 = x_1$ $\quad \dot{x}_3 = \dddot{x}_1$

$x_2 = \dot{x}_1$ $\quad \dot{x}_3 = -2x_3 - x_2 + 3x_1 + u$ ①

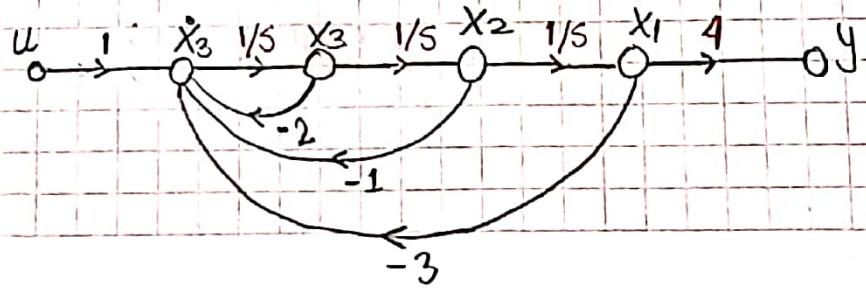
$x_3 = \ddot{x}_1 = \dot{x}_2$

$Y(s) = 4X_1(s)$

$y(t) = 4x_1$ ②

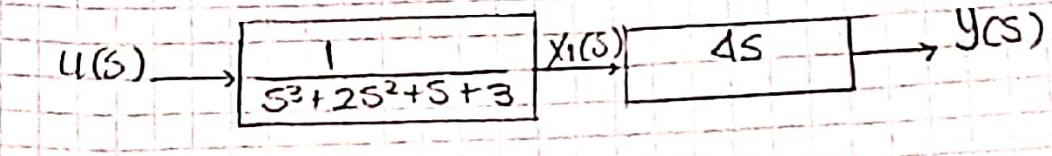
$$\begin{bmatrix}\dot{x}_1\\ \dot{x}_2\\ \dot{x}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -3 & -1 & -2\end{bmatrix}\begin{bmatrix}x_1\\ x_2\\ x_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}u(t)$$

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



2)

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



$$\frac{X_1(S)}{U(S)} = \frac{1}{S^3+2S^2+S+3}$$

$$(S^3+2S^2+S+3)X_1(S) = U(S)$$

$$S^3X_1(S) + 2S^2X_1(S) + SX_1(S) + 3X_1(S) = U(S)$$

$$\dddot{X}_1 + 2\ddot{X}_1 + \dot{X}_1 + 3X_1 = U(t)$$

$X_1 = X_1$ $\qquad$ $\dot{X}_3 = \dddot{X}_1$

$X_2 = \dot{X}_1$ $\qquad$ $\dot{X}_3 = -2X_3 - X_2 - 3X_1 + U$ (1)

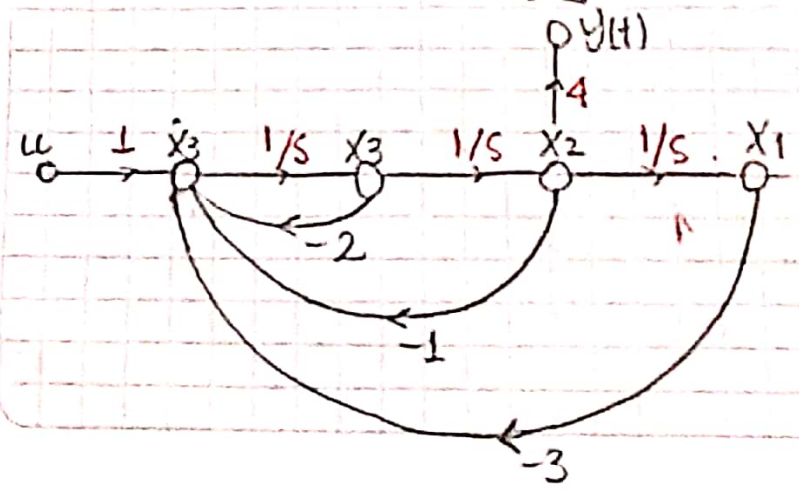
$X_3 = \dot{X}_2 = \ddot{X}_1$

$Y(S) = 4SX_1(S)$

$y(t) = 4\dot{X}_1 = 4X_2$ (2)

$$\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\\ \dot{X}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -3 & -1 & -2\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}U(t)$$

$$y(t) = \begin{bmatrix}0 & 4 & 0\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix} + [0]\,U(t)$$



3)

$$G(S) = \frac{6S^2+4S+2}{S^4-S^3+2S+3}$$

$U(S) \rightarrow \boxed{\frac{1}{S^4-S^3+2S+3}} \xrightarrow{X_1(S)} \boxed{6S^2+4S+2} \rightarrow Y(S)$

$$\frac{X_1(S)}{U(S)} = \frac{1}{S^4-S^3+2S+3}$$

$$(S^4-S^3+2S+3)X_1(S) = U(S)$$

$$S^4X_1(S) - S^3X_1(S) + 2SX_1(S) + 3X_1(S) = U(S)$$

$$\dddot{X}_1 - \ddot{X}_1 + 2\dot{X}_1 + 3X_1 = U(t)$$

$X_1 = X_1$

$X_2 = \dot{X}_1$

$X_3 = \dot{X}_2 = \ddot{X}_1$

$X_4 = \dot{X}_3 = \dddot{X}_1$

$\dot{X}_4 = \dddot{X}_1$

$$\boxed{\dot{X}_4 = X_4 - 2X_2 - 3X_1 + U(t)} \quad (1)$$

$$Y(S) = (6S^2+4S+2)X_1(S)$$

$$= 6S^2X_1(S) + 4SX_1(S) + 2X_1(S)$$

$$y(t) = 6\ddot{X}_1 + 4\dot{X}_1 + 2X_1$$

$$\boxed{y(t) = 6X_3 + 4X_2 + 2X_1} \quad (2)$$

$$\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\\ \dot{X}_3\\ \dot{X}_4\end{bmatrix} = \begin{bmatrix}0 & 1 & 0 & 0\\ 0 & 0 & 1 & 0\\ 0 & 0 & 0 & 1\\ -3 & -2 & 0 & 1\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\\ X_4\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 0\\ 1\end{bmatrix}U(t)$$

$$y(t) = \begin{bmatrix}2 & 4 & 6 & 0\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\\ X_4\end{bmatrix} + [0]\,U(t)$$