SISTEMAS DINAMICOS

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BONOS PARCIAL 2.

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

$$\frac{y(s)}{u(s)} = \frac{4}{s^3+2s^2+s+3}$$

$$y(s)(s^3+2s^2+s+3) = 4\,u(s)$$

$$s^3 y(s) + 2s^2 y(s) + s\,y(s) + 3y(s) = 4\,u(s)$$

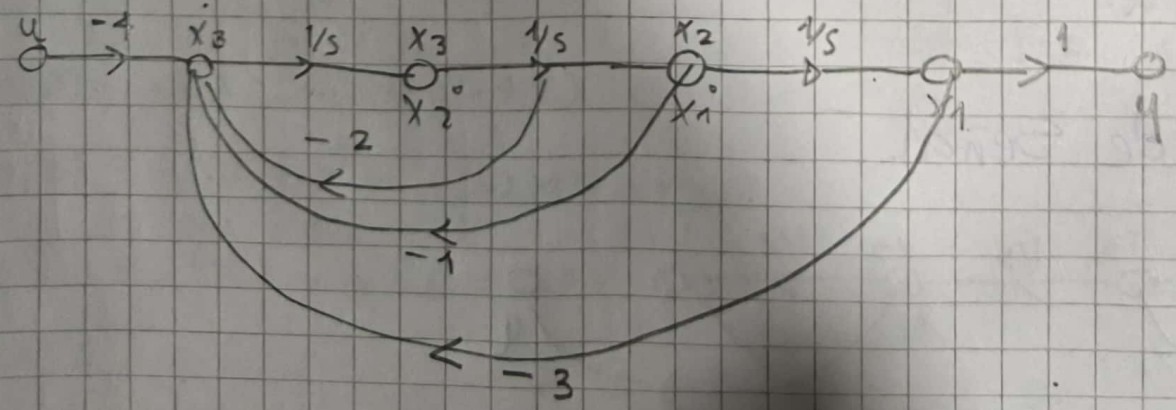
$$y''' + 2y'' + y' + 3y = 4u$$

$$q_1 = y$$
$$q_2 = \dot{y} - q_1$$
$$q_3 = \ddot{y} + q_2 \rightarrow \dot{q}_3 - 2q_3 - q_2 - 3q_1 + 4$$

$$y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$

$$\begin{bmatrix} q_1 = x_1 \\ q_2 = \dot{x}_1 \\ q_3 = \dot{x}_3 \end{bmatrix} \qquad \begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ -4 \end{bmatrix} u$$

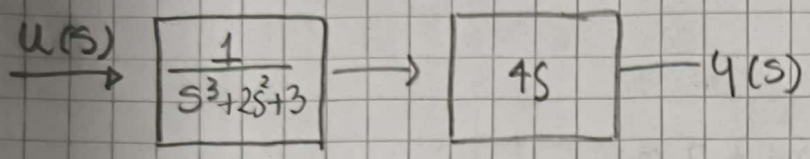
Diagrama flyo de señal



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

$4S\,u(S) = 4(S)(S^3+2S^2+S+3$

$= 4(S)S^3 + 4(S)2S^2 + 4(S)S + 3\,4(S)$



$y = 4S(x1) = 4\dot{x}$

$y = 4x_2$

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

$\frac{x(S)}{u(S)} = \frac{1}{S^3+2S^2+3}$

$x(S)(S^3+2S^2+S+31 = uS$

Aplicando L^{-1}

$S^3x_1 + 2S^2x_1 + 3x_1 = u(S)$

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

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

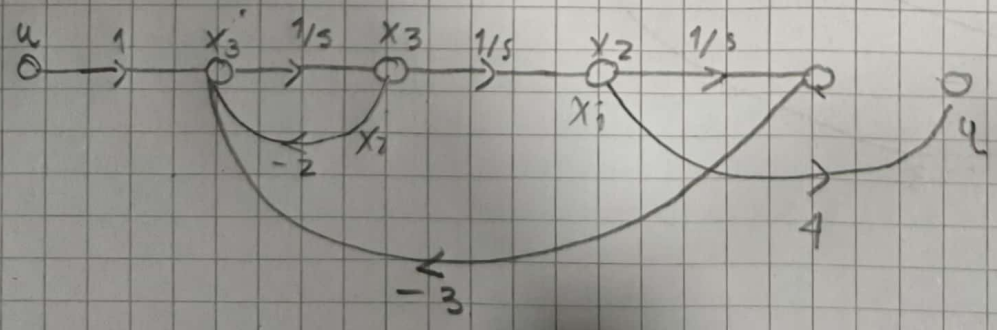
$\dot{x}_3 = -2x_3 - 3x_1 + u$

$x_1 = x \quad x_2 = \dot{x}_1 = \dot{x} \quad x_3 = \dot{x}_2 = \ddot{x}_1 = \ddot{x}$

$x_4 = \dot{x}_3 = \ddot{x}_2 = \dot{x}_1 = \dddot{x}$

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

Diagrama Flyo de Señal.



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

$u(s) \rightarrow \boxed{\frac{1}{s^4 - s^3 + 2s + 3}} \xrightarrow{x(s)} \boxed{6s^2 + 4s + 2} \rightarrow y(s)$

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

$$X(s)(s^4 - s^3 + 2s + 3) = u$$

$\mathcal{L}^{-1}$

$$\dddot{x}_1 - \ddot{x}_1 + 2\dot{x}_1 + 3x_1 = u$$

$$\dddot{x}_1 = \ddot{x}_1 - 2\dot{x}_1 - 3x_1 - u$$

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

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

$x_1 = x$

$x_2 = \dot{x}_1 = \dot{x}$

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

$x_4 = \dot{x}_3 = \ddot{x}_2 = \dddot{x}_1 = \dddot{x}$

$x_5 = \dot{x}_4 = \ddot{x}$

$$y(s) = X(s)(6s^2 + 4s + 2)$$

$$y(s) = X(s)\,6s^2 + X(s)\,4s + X(s)\,2$$

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

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

$$y = \begin{bmatrix} 2 & 4 & 6 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix}$$