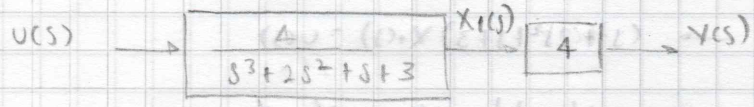
Diagrama de Bloques y
Diagrama de flujo de señal

Juan Sebastian Casas Barbosa
cod: 20211005031

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



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

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

Variables de estado

$$x_1 = x_1$$
$$x_2 = \dot{x}_1$$
$$x_3 = \dot{x}_2 = \ddot{x}_1$$
$$\dot{x}_3 = \dddot{x}_1$$

Remplazando

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

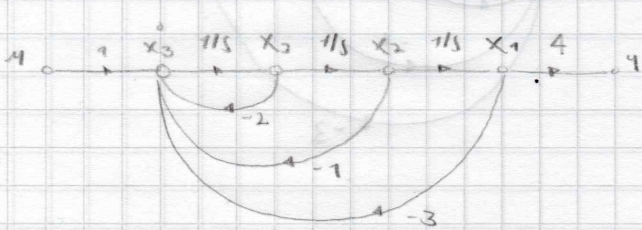
$$Y(s) = 4X_1(s) = 4x_1 \longrightarrow \boxed{y = 4x_1}$$

Representación en espacio de estados

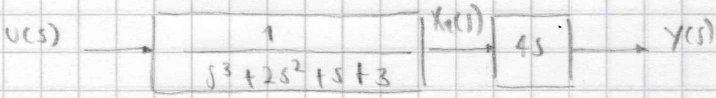
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

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

Diagrama de flujo de señal



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



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

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

Variables de estado

$x_1 = x_1$

$x_2 = \dot{x}_1$

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

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

Remplazando

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

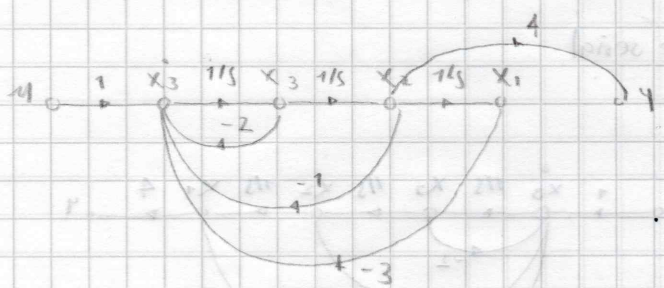
$$Y(s) = 4s\,X_1(s) = 4\dot{x}_1 \longrightarrow \boxed{y = 4x_2}$$

Representación en espacio de estados

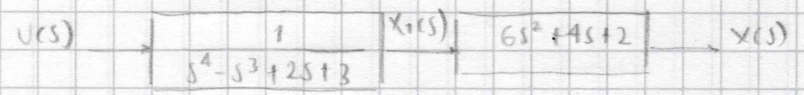
$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \\ \dot{x}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -1 & -2 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} u$$

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

Diagrama de flujo de señal



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



$\dfrac{X_1(s)}{U(s)} = \dfrac{1}{s^4 - s^3 + 2s + 3} \longrightarrow (s^4 - s^3 + 2s + 3)X_1(s) = U(s)$

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

Variables de estado

$x_1 = x_1$
$x_2 = \dot{x}_1$
$x_3 = \dot{x}_2 = \ddot{x}_1$
$x_4 = \dot{x}_3 = \ddot{x}_2 = \dddot{x}_1$
$\dot{x}_4 = \ddddot{x}_1$

Remplazando

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

$\longrightarrow \boxed{\dot{x}_4 = -3x_1 - 2x_2 + x_4 + u}$ 1.

$Y(s) = (6s^2 + 4s + 2)X_1(s) = 6\ddot{x}_1 + 4\dot{x}_1 + 2x_1 \longrightarrow \boxed{y = 6x_3 + 4x_2 + 2x_1}$

Representación en espacio de estados

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

$$y = \begin{bmatrix} 2 & 4 & 6 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$

Diagrama de flujo de señal