

# Ejercicios Bonificación

hallar la representación en forma canónica y en diagrama de flujo de señal de

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

$$\rightarrow Y(s)(s^3 + 2s^2 + 2s + 3) = 4X(s) \xrightarrow{y'''} \ddot{y} + 2\ddot{y} + 2\dot{y} + 3y = 4x$$

$$\rightarrow y_1 = y \quad \rightarrow \dot{y}_3 = 4x - 2y_3 - 2\dot{y}_2 - 3y_1$$

$$y_2 = \dot{y}_1 = \dot{y}$$

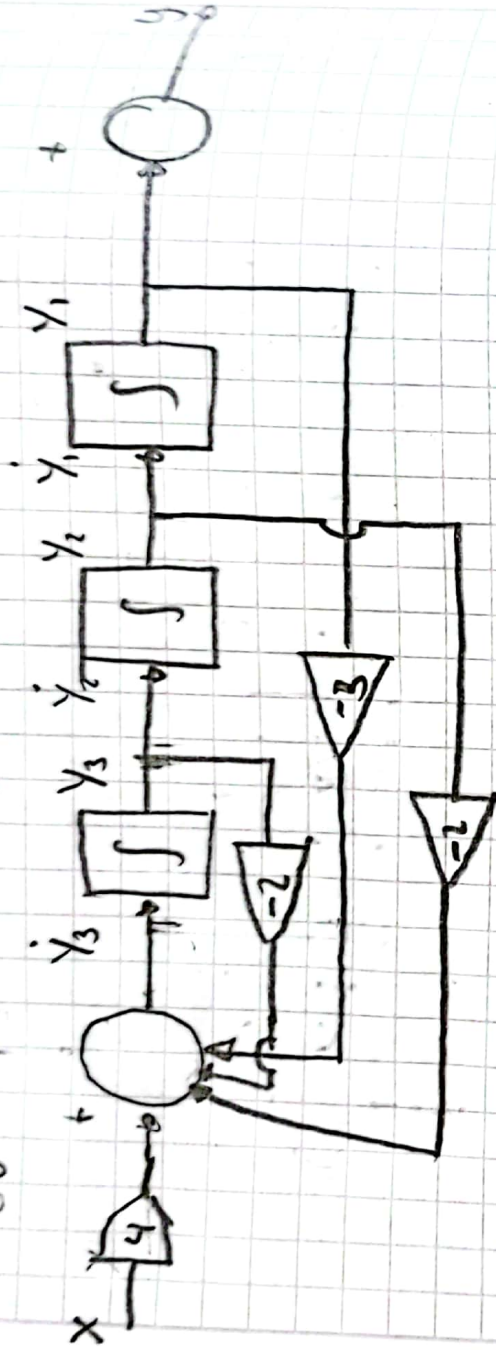
$$y_3 = \dot{y}_2 = \ddot{y}$$

Matriz

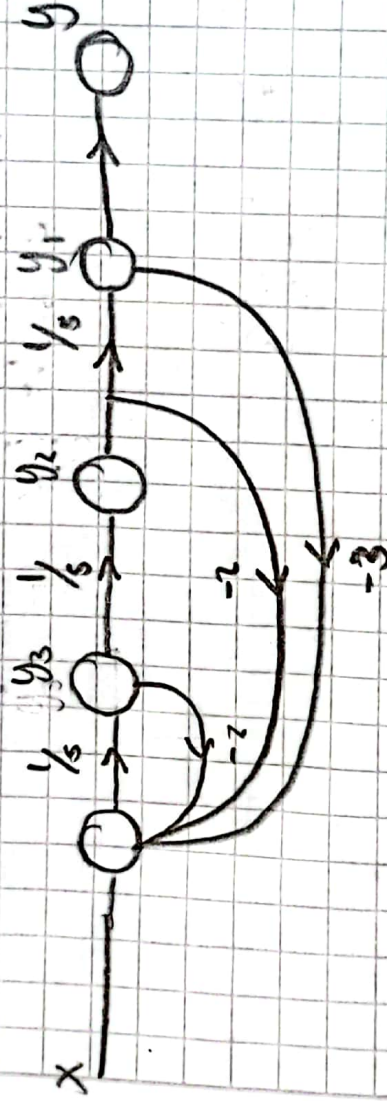
$$\begin{bmatrix} \dot{y}_1 \\ \dot{y}_2 \\ \dot{y}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -3 & -2 & -2 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 4 \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ -3 \end{bmatrix}$$

$$Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

# Diagrama de bloques



## Diagrama de flujo de señal



$$2) G(s) = \frac{4s}{s^3 + 2s^2 + 2s + 3} \rightarrow \frac{Y(s)}{X(s)} = \frac{4s}{s^3 + 2s^2 + 2s + 3}$$

$$Y(s)[s^3 + 2s^2 + 2s + 3] = 4s X(s) \rightarrow Y + 2\ddot{Y} + 2\dot{Y} + 3Y = 4\dot{X}$$

$$Y_1 = \dot{Y}$$

$$Y_2 = \dot{Y}_1 = \ddot{Y}$$

$$Y_3 = \dot{Y}_2 = \ddot{\dot{Y}}$$



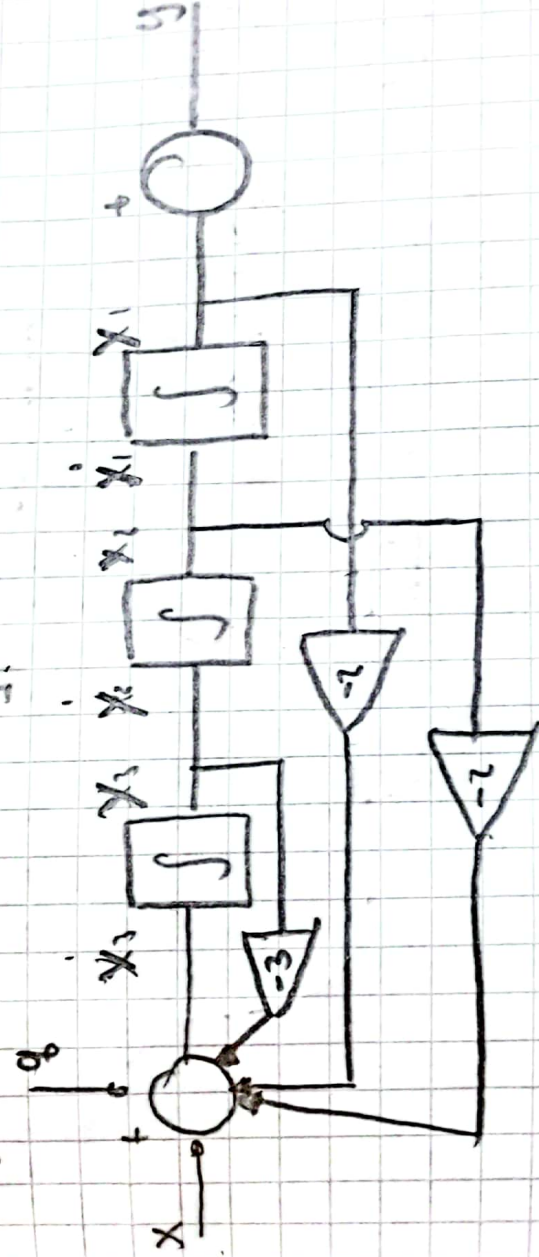
$$\rightarrow \dot{y}_3 = 4q - 2y_3 - 2y_2 - 3y_1$$

Matriz

$$\begin{bmatrix} \dot{y}_1 \\ \dot{y}_2 \\ \dot{y}_3 \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -2 & -2 & -3 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 4 \end{bmatrix} q$$

$$Y = \begin{bmatrix} 1 & 0 & 0 \end{bmatrix} \begin{bmatrix} y_1 \\ y_2 \\ y_3 \end{bmatrix}$$

Diagrama de bloques





$$Y(s) = 6x_3 + 4x_2 + 2x_1$$

$$X(s) = 5x_4 - x_1 + 2x_2 + 3x_1 \rightarrow 5x_4 = X(s) + x_1 - 2x_2 - 3x_1$$

→ Pasando al dominio de tiempo

$$\begin{aligned} x_1 &= 5x_4 - x_1 + 2x_2 + 3x_1 \\ x_2 &= 5x_4 - x_1 + 2x_2 + 3x_1 \end{aligned}$$

$$5x_3 = x_4 \xrightarrow{s} x_3 = x_4$$

$$5x_4 = X(s) - x_1 + 2x_2 + 3x_1 \xrightarrow{s} x_4 = X(s) + x_1 - 2x_2 - 3x_1$$

$$Y(s) = 6x_3 + 4x_2 + 2x_1 \xrightarrow{s} Y(s) = 6x_3 + 4x_2 + 2x_1$$

Planteo la matriz

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

$$Y(s) = \begin{bmatrix} 2 & 4 & 6 & 0 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{bmatrix}$$



Diagrama de bloques

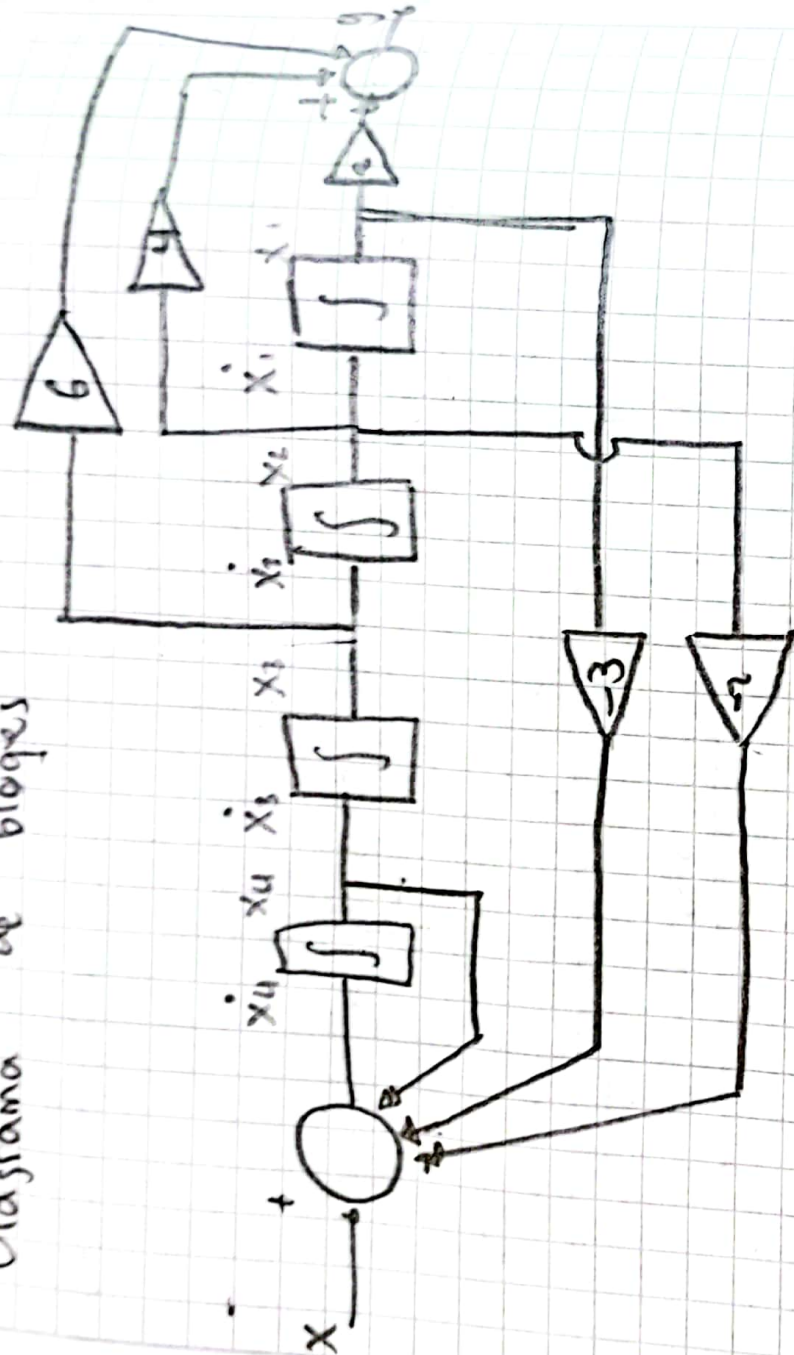


Diagrama de flujo de señal

