Diagrama de Flujo de señal

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① $G(s) = \frac{4}{s^3+2s^2+s+3}$

$\frac{x(s)}{u(s)} = \dddot{x} + 2\ddot{x} + \dot{x} + 3x$

$u(t) = (s^3+2s^2+s+3)x(t)$

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

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

$\dot{x}_3 = -2x_3 - x_2 - 3x_1 - 4u$

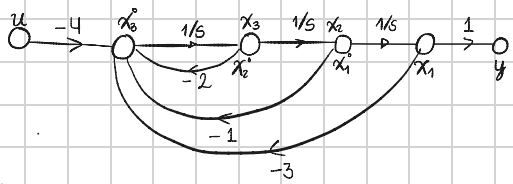
$x_1 = x$

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

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

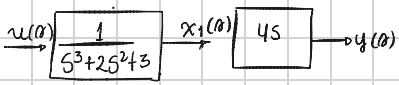
$x_4 = \dot{x}_3 = \dddot{x}_2 = \ddot{x}_1 = \dddot{x}$

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



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

② $G(s) = \frac{4s}{s^3+2s^2+3}$



$\frac{x_1(s)}{u(s)} = \frac{1}{s^3+2s^2+3}$

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

$\mathcal{L}^{-1}(s^3x_1 + 2s^2x_1 + 3x_1) = u(s)$

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

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

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

$y = 4s(x_1)$

$4\dot{x}$

$y = 4x_2$

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

$x_1 = x$

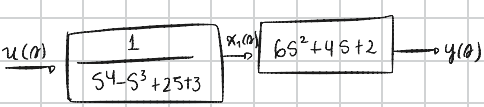
$x_2 = \dot{x}_1 = \dot{x}$

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

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

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

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



$\frac{x_1(s)}{u(s)} = s^4 - s^3 + 2s + 3$

$(s^4 - s^3 + 2s + 3)x_1(s) = u(s)$

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

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

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

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

$x_1 = x$

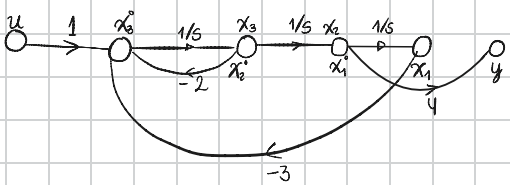
$x_2 = \dot{x}_1 = \dot{x}$

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

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

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

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



$\frac{y}{x_1(s)} = 6s^2 + 4s + 2$

$y(s) = (6s^2x_1 + 4sx_1 + 2x_1)\mathcal{L}^{-2}$

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

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

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