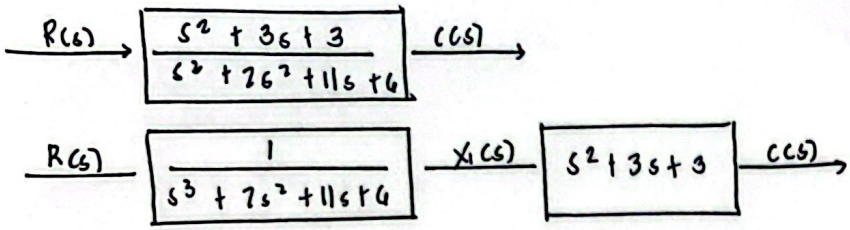
Problem 3



$$\frac{X_1(s)}{R(s)} = \frac{1}{s^3+2s^2+11s+6}$$

$$X_1(s)\left[s^3+2s^2+11s+6\right] = R(s)$$

$$s^3X_1(s) + 2s^2X_1(s) + 11sX_1(s) + 6X_1(s) = R(s)$$

$$\mathcal{L}^{-1}\left\{s^3X_1(s) + 2s^2X_1(s) + 11sX_1(s) + 6X_1(s) = R(s)\right\}$$

$$\dddot{X}_1 + 2\ddot{X}_1 + 11\dot{X}_1 + 6X_1 = r$$

$\dot{X}_3 \quad X_3 \quad X_2 \quad X_1 \quad U_1$

$x_1 = X_1 \qquad \dot{x}_1 = \dot{X}_1 = x_2 \qquad U_1 = r$

$x_2 = \dot{x}_1 \qquad \dot{x}_2 = \ddot{X}_1 = x_3$

$x_3 = \ddot{X}_1 \qquad \dot{x}_3 = \dddot{X}_1$

$$\dot{X}_1 = X_2$$

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

$$\dot{X}_3 = -6X_1 - 11X_2 - 2X_3 + U_1$$

STATE EQUATION:

$$\begin{bmatrix}\dot{X}_1\\ \dot{X}_2\\ \dot{X}_3\end{bmatrix} = \begin{bmatrix}0 & 1 & 0\\ 0 & 0 & 1\\ -6 & -11 & -2\end{bmatrix}\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix} + \begin{bmatrix}0\\ 0\\ 1\end{bmatrix}U_1$$

CONTINUATION:

$$\mathcal{L}^{-1}\left\{s^2X_1(s) + 3sX_1(s) + 3X_1(s)\right\}$$

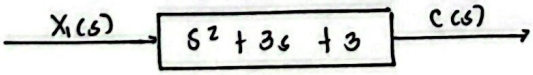
$$C = \ddot{X}_1 + 3\dot{X}_1 + 3X_1$$

$$y = \ddot{X}_1 + 3\dot{X}_1 + 3X_1$$

$$y = X_3 + 3X_2 + 3X_1$$

$$y = \overset{X_1}{3}\quad \overset{X_2}{3}\quad \overset{X_3}{1}\begin{bmatrix}X_1\\ X_2\\ X_3\end{bmatrix} + \begin{bmatrix}0\end{bmatrix}U_1$$

OUTPUT EQUATION:



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

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