



Solution Sample

The Islamic university of Gaza-IUG
Electrical Engineering Department



Linear Control Systems Quiz (1-B)

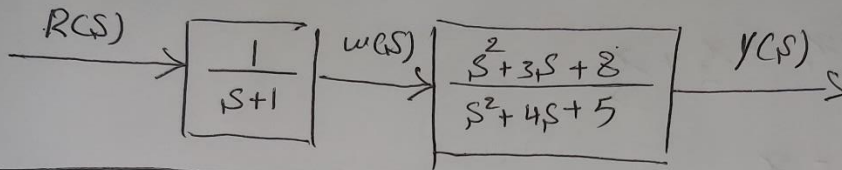
Name: ... ID: DIV: Mark:

Problem:

Represent the following transfer function in state space. Using cascade decomposition.

$$T(s) = \frac{(s^2 + 3s + 8)}{(s + 1)(s^2 + 4s + 5)}$$

Solution:



$$\frac{w(s)}{R(s)} = \frac{\bar{s}}{1 + s^{-1}} \cdot \frac{v_1}{v_1}$$

$$\begin{aligned} w(s) &= \bar{s} v_1 \quad \text{--- (1)} \\ v_1 &= R(s) - \bar{s} v_1 \quad \text{--- (2)} \end{aligned}$$

$$\frac{Y(s)}{w(s)} = \frac{1 + 3\bar{s} + 8\bar{s}^2}{1 + 4\bar{s} + 5\bar{s}^2} \cdot \frac{v_2}{v_2}$$

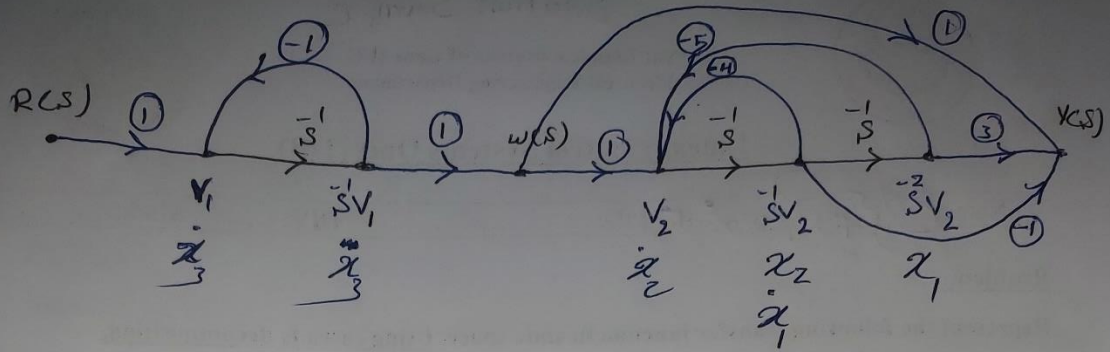
$$Y(s) = v_2 + 3\bar{s} v_2 + 8\bar{s}^2 v_2$$

$$w(s) = v_2 + 4\bar{s} v_2 + 5\bar{s}^2 v_2$$

$$\rightarrow v_2 = w(s) - 4\bar{s} v_2 - 5\bar{s}^2 v_2 \quad \text{--- (3)}$$

$$\rightarrow Y(s) = w(s) - 4\bar{s} v_2 - 5\bar{s}^2 v_2 + 3\bar{s} v_2 + 8\bar{s}^2 v_2$$

$$Y(s) = w(s) - \bar{s} v_2 + 3\bar{s} v_2 \quad \text{--- (4)}$$



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

$$\dot{x}_2 = -5x_1 - 4x_2 + x_3$$

$$\dot{x}_3 = r(t) - x_3$$

$$y(t) = 3x_1 - x_2 + x_3$$