



Solution Sample

The Islamic university of Gaza-IUG
Electrical Engineering Department



Linear Control Systems Quiz (1-C)

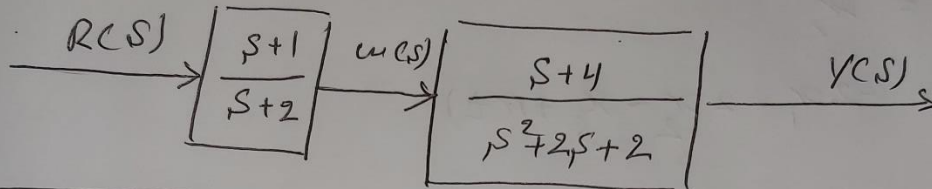
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Problem:

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

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

Solution:



$$\frac{w(s)}{R(s)} = \frac{1 + \bar{s}^1}{1 + 2\bar{s}^{-2}} \cdot \frac{v_1}{v_1}$$

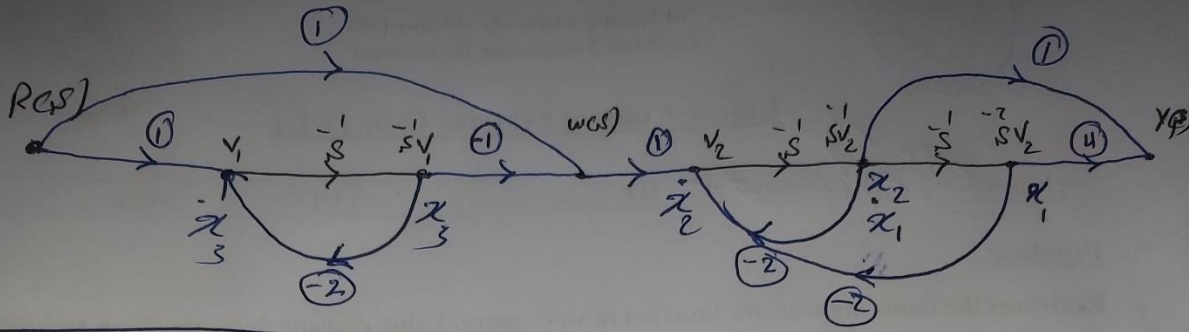
$$\begin{aligned} w(s) &= v_1 + \bar{s}^1 v_1 \Rightarrow w(s) = R(s) - \bar{s}^1 v_1 \quad \text{--- (1)} \\ 12(s) &= v_1 + 2\bar{s}^1 v_2 \Rightarrow v_1 = R(s) - 2\bar{s}^1 v_1 \quad \text{--- (2)} \end{aligned}$$

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

$$Y(s) = \bar{s}^{-1} v_2 + 4\bar{s}^{-1} v_2 \quad \text{--- (3)}$$

$$w(s) = v_2 + 2\bar{s}^1 v_2 + 2\bar{s}^2 v_2$$

$$v_2 = w(s) - 2\bar{s}^1 v_2 - 2\bar{s}^2 v_2 \quad \text{--- (4)}$$



~~or~~

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

$$\dot{x}_2 = -2x_1 - 2x_2 - x_3 + r(t)$$

$$\dot{x}_3 = r(t) - 2x_3$$

$$y(t) = 4x_1 + x_2$$