

REVIEWED LAST EXAMPLE...

$$\hat{Y}(s) = \frac{s+2}{s^2+s+1}$$

$$\frac{Q(s)}{U(s)} = \frac{1}{s^2+s+1}$$

$$\frac{\hat{Y}(s)}{Q(s)} = s+2$$

$$x_1 = q_0$$

$$x_2 = \dot{q}_0$$

$$\dot{x}_1 = \dot{q}_0 = x_2$$

$$\dot{x}_2 = \ddot{q}_0 = \ddot{x}_1$$

$$s^2 Q(s) + s Q(s) + Q(s) = U(s)$$

$$\ddot{q}_0 + \dot{q}_0 + q_0 = u$$

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

$$\dot{x}_2 = -\dot{q}_0 - q_0 + u = -x_1 - x_2 + u$$

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

$$\begin{aligned} Y(s) &= Z U(s) + \hat{Y}(s) = Z U(s) + (s+2) Q(s) \\ &= s Q(s) + 2 Q(s) + Z U(s) \end{aligned}$$

$$\begin{aligned} Y(t) &= \dot{q}_0 + 2 q_0 + Z u = 2 x_1 + x_2 + Z u \\ &= \begin{bmatrix} 2 & 1 \end{bmatrix} \begin{bmatrix} x_1 \\ x_2 \end{bmatrix} + \boxed{2} u \end{aligned}$$