State space control.

Q1

2.1. **Find the matrix state equations in the first canonical form for the linear time-invariant differential equation**

$$\ddot{y} + 5\dot{y} + 6y = \dot{u} + u \qquad (2.41)$$

with initial conditions $y(0) = y_0$, $\dot{y}(0) = \dot{y}_0$. **Also find the initial conditions on the state variables.**

Q2

2.2. **Find the matrix state equations in the second canonical form for the equation (2.41) of Problem 2.1, and the initial conditions on the state variables.**

Q3

2.4. **Given the state equations**

$$\frac{d}{dt}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} = \begin{pmatrix} 0 & 1 \\ -6 & -5 \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \end{pmatrix} + \begin{pmatrix} 0 \\ 1 \end{pmatrix} u$$

$$y = (1 \;\; 1)\begin{pmatrix} x_1 \\ x_2 \end{pmatrix}$$

Find the differential equation relating the input to the output.

Q4

2.5. **Given the feedback system of Fig. 2-17 find a state space representation of this closed loop system.**

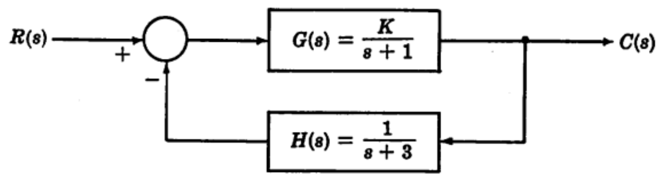

Fig. 2-17