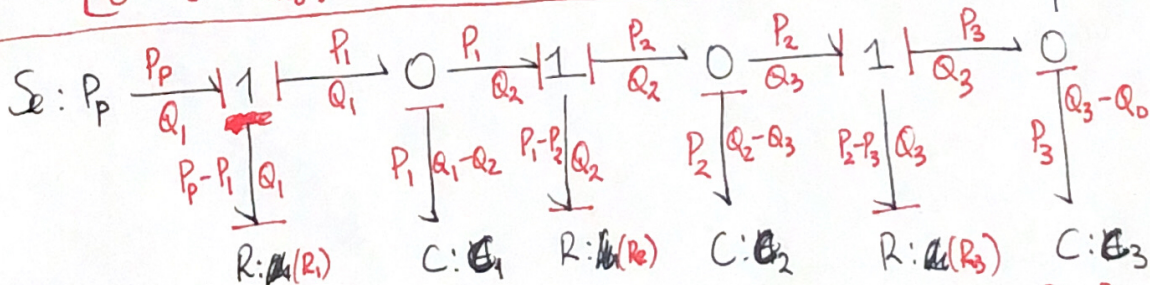


$$y = \begin{bmatrix} 1/r_g & 0 & 0 \\ 0 & 1/r_g & 0 \\ 0 & 0 & 1/r_g \\ 0 & 0 & 1/r_o \end{bmatrix} x + \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \end{bmatrix} u$$

$P: r_{ho}$

$R: d(R_o)$
 $P_3 Q_0$



$$x = \begin{bmatrix} P_1 \\ P_2 \\ P_3 \end{bmatrix} \Rightarrow \dot{x} = \begin{bmatrix} (Q_1 - Q_2)/C_1 \\ (Q_2 - Q_3)/C_2 \\ (Q_3 - Q_0)/C_3 \end{bmatrix}$$

$$Q_1 = \frac{P_P - P_1}{R_1}, \quad Q_2 = \frac{P_1 - P_2}{R_2}$$

$$Q_3 = \frac{P_2 - P_3}{R_3}, \quad Q_0 = \frac{P_3}{R_o}$$

$$\Rightarrow \dot{x} = \begin{bmatrix} -\frac{1}{C_1} \left(\frac{1}{R_1} + \frac{1}{R_2} \right) & \frac{1}{R_2 C_2} & 0 \\ \frac{1}{R_2 C_2} & -\frac{1}{C_2} \left(\frac{1}{R_2} + \frac{1}{R_3} \right) & \frac{1}{R_3 C_2} \\ 0 & \frac{1}{R_3 C_3} & -\frac{1}{C_3} \left(\frac{1}{R_3} + \frac{1}{R_o} \right) \end{bmatrix} x + \begin{bmatrix} \frac{1}{R_1 C_1} \\ 0 \\ 0 \end{bmatrix} u$$