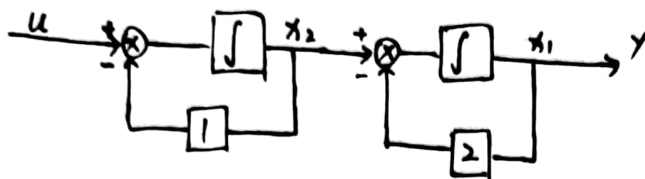




班级: 自11 姓名: 孙捷 编号: 2021013444 科目: 自动控制 第 1 页

1. 解: (1)



(2)

$$Q_k = \begin{pmatrix} 0 & 1 \\ 1 & -1 \end{pmatrix} \quad \text{rank}(Q_k) = 2 \quad \therefore \text{该系统完全可控}$$

\therefore 可以任意配置极点

(3)

$$|sI - A| = s^2 + 3s + 2 = f(s)$$

$$f^*(s) = (s+3)(s+3) = s^2 + 6s + 9$$

$$\therefore \tilde{k}^T = \begin{pmatrix} 7 & 3 \end{pmatrix} \quad \because Q_k = \begin{pmatrix} 0 & 1 \\ 1 & -1 \end{pmatrix} \quad \therefore Q_k^{-1} = \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix}$$

$$P_1^T = (0 \ 1) \begin{pmatrix} 1 & 1 \\ 1 & 0 \end{pmatrix} = (1 \ 0) \quad T^{-1} = \begin{pmatrix} P_1^T \\ P_1^T A \end{pmatrix} = \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix}$$

$$K^T = \tilde{k}^T T^{-1} = \begin{pmatrix} 7 & 3 \end{pmatrix} \begin{pmatrix} 1 & 0 \\ -2 & 1 \end{pmatrix} = \begin{pmatrix} 1 & 3 \end{pmatrix}$$

2. 解:

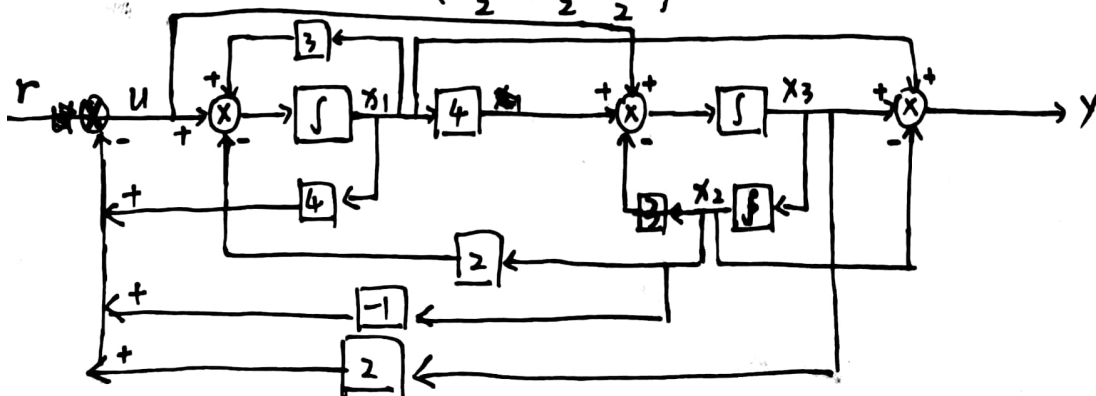
$$|sI - A| = s^3 - 3s^2 + 3s - 1 = f(s)$$

$$f^*(s) = (s+1)(s^2+2s+2) = s^3 + 3s^2 + 4s + 2$$

$$\therefore \tilde{k}^T = (3 \ 1 \ 6) \quad Q_k = (B \ AB \ A^2B) = \begin{pmatrix} 1 & 3 & 7 \\ 0 & 1 & 4 \\ 1 & 4 & 9 \end{pmatrix} \quad \therefore Q_k^{-1} = \begin{pmatrix} \frac{7}{2} & -\frac{1}{2} & -\frac{5}{2} \\ -2 & -1 & 2 \\ \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} \end{pmatrix}$$

$$\therefore P_1^T = (0 \ 0 \ 1) \quad Q_k^{-1} = \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} \\ \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \end{pmatrix}$$

$$T^{-1} = \begin{pmatrix} P_1^T \\ P_1^T A \\ P_1^T A^2 \end{pmatrix} = \begin{pmatrix} \frac{1}{2} & \frac{1}{2} & -\frac{1}{2} \\ -\frac{1}{2} & \frac{1}{2} & \frac{1}{2} \\ \frac{1}{2} & -\frac{1}{2} & \frac{1}{2} \end{pmatrix} \quad \therefore K^T = \tilde{k}^T T^{-1} = (4 \ -1 \ 2)$$



△

