

自控作业 1

6、

$$F(s) = \frac{5}{s+2} - \frac{2}{s^2+4}$$

7、

$$f(t) = 2e^{-t}\cos(2t)$$

8、

$$\frac{Y(s)}{R(s)} = \frac{ms^2 + bs + k}{Mms^4 + (M+m)bs^3 + (M+m)ks^2}$$

9、

$$\frac{V_0(s)}{V(s)} = -\frac{2s+2}{s+2}$$

自控作业 2

1、

$G(s)$

$$= \frac{G_1 G_2 G_3 G_4 G_5 + G_4 G_5 G_6 + G_2 G_4 G_5 G_6 + G_7 + G_2 G_7 + G_4 G_7 + G_2 G_4 G_7}{-G_1 G_2 G_3 G_4 G_5 - G_4 G_5 G_6 - G_2 G_4 G_5 G_6 - G_7 - G_2 G_7 - G_4 G_7 - G_2 G_4 G_7 + G_1 + G_2 + G_4 + G_2 G_4}$$

2、

$$G(s) = \frac{G_1 G_2 G_3 G_4}{1 + G_1 G_2 H_1 + G_3 G_4 H_2 - G_2 G_3 H_3 + G_1 G_2 G_3 G_4 H_1 H_2}$$

3、

$$H(s) = \frac{1 + G_3 G_4 - G_1 G_5}{1 + G_2 G_4 + G_2 G_3 G_5}$$

4、

$$1 + G_1 G_2 H_1 = 0$$

and

$$1 + G_1 G_2 H_1 + G_2 G_3 H_2 + G_1 G_2 G_3 + G_1 G_4 + G_1 G_2 G_4 H_1 H_2 \neq 0$$

自控作业 3

1、(a)

$$\begin{aligned}\dot{y} &= \frac{k}{M}x - \frac{k}{M}y + \frac{b}{M}\dot{x} - \frac{b}{M}\dot{y} + \frac{1}{M}r \\ \ddot{x} &= -\frac{k}{m}x + \frac{k}{m}y - \frac{b}{m}\dot{x} + \frac{b}{m}\dot{y}\end{aligned}$$

(b)

$$\begin{bmatrix} \dot{x} \\ \ddot{x} \\ \dot{y} \\ \ddot{y} \end{bmatrix} = \begin{bmatrix} 0 & 1 & 0 & 0 \\ -\frac{k}{m} & -\frac{b}{m} & \frac{k}{m} & \frac{b}{m} \\ 0 & 0 & 0 & 1 \\ \frac{k}{M} & \frac{b}{M} & -\frac{k}{M} & -\frac{b}{M} \end{bmatrix} \begin{bmatrix} x \\ \dot{x} \\ y \\ \dot{y} \end{bmatrix} + \begin{bmatrix} 0 \\ 0 \\ 0 \\ \frac{1}{M} \end{bmatrix} r$$
$$y = [0 \quad 0 \quad 1 \quad 0] \begin{bmatrix} x \\ \dot{x} \\ y \\ \dot{y} \end{bmatrix}$$

(c)同作业 1 第 8 题

2、

(a)

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -8 & -14 & -7 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C = [8 \quad 0 \quad 0]$$

(b)

$$A = \begin{bmatrix} 0 & 1 & 0 \\ 0 & 0 & 1 \\ -10 & -3 & -2 \end{bmatrix} \quad B = \begin{bmatrix} 0 \\ 0 \\ 1 \end{bmatrix} \quad C = [5 \quad 2 \quad 1]$$

5、

(1)

$$Z[x(n)] = \frac{2z}{2z - 1}$$

收敛域 $|z| > \frac{1}{2}$

(2)

$$Z[X(s)] = \frac{z^T}{(z - 1)^2}$$

自控作业 4

1、

$$x(kT) = 1 - e^{-akT}$$

$$x^*(t) = \sum_{k=0}^{\infty} (1 - e^{-akT} \delta(t - kT))$$

2、

(1)

$$\frac{Y(z)}{R(z)} = \frac{G_1(z)G_2(z)}{1 + G_1(z)G_2H(z)}$$

(2)

$$\frac{C(z)}{R(z)} = \frac{G_1(z)}{1 + G_1H_1(z) + G_1(z)H_2(z)}$$

3、

	ξ	主反馈	内反馈
(b)	0	-	0
(c)	<0	-	+
(d)		0	0
(e)	(0,1)	-	-

4、

(1) 开环: $z_1 = -2.5, p_1 = 0, p_2 = -0.5$

闭环: $z_1 = -2.5, p_1 = -0.45 + 0.893i, p_2 = -0.45 - 0.893i$

(2) $\omega_n = 1, \xi = 0.45$

(3) $\sigma = 23\%, T_r = 1.82, T_p = 3, T_s = 8.89(2\%) 6.67(5\%)$

(4) $\sigma = 44.4\%, T_r = 1.89, T_p = 3.25, T_s = 16(2\%)12(5\%)$

5、

(1) $k_1 = 0.55, k_2 = 3.31$

(2) $k_1 = 0.5, k_2 = 5$

自控作业 5

1、

$$(1) T(s) = \frac{10}{(s^2+2s+2)(s+5)}$$

$$(2) G(s) = \frac{2}{(s+1+j)(s+1-j)}$$

3、

特征方程: $\lambda^3 + \lambda^2 + \lambda = 0$

特征根: $\lambda_1 = 0, \lambda_{2,3} = -\frac{1}{2} \pm \frac{\sqrt{3}}{2}j$

约旦标准型: $J = \begin{bmatrix} 0 & & \\ & -\frac{1}{2} + \frac{\sqrt{3}}{2} & \\ & & -\frac{1}{2} - \frac{\sqrt{3}}{2} \end{bmatrix}$

4、

$$(1) e^{At} = \begin{bmatrix} e^{-2t} & te^{-2t} \\ 0 & e^{-2t} \end{bmatrix}$$

$$(2) e^{At} = \begin{bmatrix} \cos 2t & -\frac{1}{2} \sin 2t \\ 2 \sin 2t & \cos 2t \end{bmatrix}$$

5、

(a) $e_{ss} = 0 (e_{ss} = R(s) - H(s)Y(s)); e_{ss} = 0.967 (e_{ss} = R(s) - Y(s))$

(b) $G_p(s) = 30$

自控作业 6

1、

$$e^{At} = \begin{bmatrix} e^{\lambda t} & 0 & 0 & 0 \\ 0 & e^{\lambda t} & te^{\lambda t} & \frac{t^2}{2}e^{\lambda t} \\ 0 & 0 & e^{\lambda t} & te^{\lambda t} \\ 0 & 0 & 0 & e^{\lambda t} \end{bmatrix}$$

2、

$$A = \begin{bmatrix} -2 & 0 \\ 0 & -2 \end{bmatrix}$$
$$\Phi(t) = \begin{bmatrix} e^{-2t} & 0 \\ 0 & e^{-2t} \end{bmatrix}$$

3、

$$y(t) = 1 - e^{-t}$$

4、

$$x(k+1) = \begin{bmatrix} 1 & T \\ 0 & 1 \end{bmatrix} x(k) + \begin{bmatrix} T^2 \\ T \end{bmatrix} u(k)$$

5、

$$y(k) = \frac{1}{2}(-1)^k - \frac{2}{3}(-2)^k + \frac{1}{6}$$