



班级: 自11

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科目: 自动控制原理

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1. 解:

$$\phi(\lambda) = \begin{vmatrix} 1-\lambda & 0 & 0 & 0 \\ 0 & -1-\lambda & 0 & 1 \\ 2 & 0 & -\lambda & 0 \\ 0 & 1 & 1 & -\lambda \end{vmatrix}$$

$$= (1-\lambda)(-\lambda)(\lambda(\lambda+1)-1) + 2 \cdot (-1) \cdot (\lambda(\lambda+1)-1)$$

$$= (\lambda^2 - \lambda - 2)(\lambda^2 + \lambda - 1) = \lambda^4 - 4\lambda^2 - \lambda + 2$$

列表:

	$\lambda^4$	$\lambda^3$	$\lambda^2$	$\lambda^1$	$\lambda^0$
1	1	0	-4	-1	2
2	0	1	-4	0	2
3	0	0	-2	-12	1
4	0	0	1	-12	-2
5	0	0	0	6	-30
6	0	0	0	0	-30

$\phi(1) = -2 < 0$ .  $\phi(-1) \cdot (-1)^4 = 0$   $a_n < |a_0|$ .  $b_0 > b_{n-1}$ .  $c_0 > c_{n-1}$   
 $\therefore$  该系统不是渐近稳定的.

2. 解: (a).  $G_{\pi}(s) = \frac{1}{Ts+1}$ , 0型系统.  $e(\infty) = e_{st} = \frac{C}{1 + \lim_{s \rightarrow 0} G_{\pi}(s)} = \frac{C}{2}$

$$y(\infty) = r(\infty) - e(\infty) = C - \frac{C}{2} = \frac{C}{2}$$

(b).  $\dot{r}(\infty) = C$ .  $\dot{e}(\infty) = \lim_{s \rightarrow 0} \frac{s^2}{1 + G_{\pi}(s)} r(s) \neq \lim_{s \rightarrow 0} s e(s)$

$$= \lim_{s \rightarrow 0} \frac{s^2}{1 + G_{\pi}(s)} r(s) \neq \lim_{s \rightarrow \infty} \frac{s^2}{1 + G_{\pi}(s)} r(s)$$

$$= 0 - 0 = 0$$

$$\therefore \dot{y}(\infty) = \dot{r}(\infty) - \dot{e}(\infty) = C$$





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3. 解:

① 输入信号  $r_1(t) = 4$   $r_1(s) = \frac{4}{s}$

$G(s) = \frac{4}{s(s+4)}$ , 为 I 型系统.  
 $= \frac{1}{s(\frac{1}{4}s+1)}$

$e_{st1} = 0.$

② 输入信号  $r_2(t) = 6t$   $r_2(s) = \frac{6}{s^2}$

~~6~~  $e_{st2} = 6$

③ 扰动信号  $p(t) = -1(t).$

左侧含积分, 右侧含积分.  $\therefore e_{st3} = \frac{1}{4}$

$\therefore e_{st} = e_{st1} + e_{st2} + e_{st3} = \frac{25}{4}$

