

若用一级超前校正, 则 $\varphi_m = \gamma^* - \gamma + 5^\circ = 40^\circ + 46^\circ + 5^\circ = 91^\circ$ (不可能达到)。若用滞后, 则校正后系统在 $\omega_c' = 2.5$ 处的相角裕度为 $\gamma(2.5) = -9.06^\circ$ (不满足要求)。

故只能采用滞后-超前校正。

(2) $\omega_c^* = 3$, $\gamma^* = 43.65^\circ$, 满足要求

$$7.5 \leq K < 20.343$$

$$8. K = \frac{K^*}{2} < \frac{3\pi a}{2}$$

2002 年西北工业大学硕士研究生入学考试 自动控制原理试题简要解答

$$1. (1) \frac{C(s)}{E(s)} = \frac{2G_1G_2 + G_2 - G_1}{1 + G_1G_2}$$

$$(2) \frac{C(s)}{R(s)} = \frac{2G_1G_2 + G_2 - G_1}{1 + G_1G_2 + (2G_1G_2 + G_2 - G_1)H}$$

$$(3) 0.5 < K_1 < 2$$

$$2. (1) d = -10, \theta_{p_1} = -150^\circ, \theta_{p_2} = 150^\circ$$

$$(2) 0 < K_D < 0.1$$

$$(3) K_D = 0.0414$$

$$\Phi(s) = \frac{100(1 + 0.0414s)}{s^2 + 14.14s + 100}$$

$$3. (1) \Phi(s) = \frac{316.2}{s^2 + 10s + 316.2}$$

$$(2) \sigma = 40\%, t_s = 0.7 \text{ s}$$

$$(3) G(s) = \frac{316.2}{s\left(\frac{s}{10} + 1\right)}$$

渐近线 $\lim_{\omega \rightarrow 0^+} \text{Re}[G(j\omega)] = -3.162$, 开环幅相曲线(略)。

$$4. G(s) = \frac{K}{(T_1s + 1)(T_2s + 1)} = \frac{19}{(4.17s + 1)(0.4116s + 1)}$$

$$5. (1) K_c = 0.316, T = 0.316$$

$$(2) e_{ss} = 6.33$$

$$6. (1) G(z) = \frac{K(1 + cz^{-1})z}{1 + (a - K)z^{-1} + (b - Kc)z^{-2}}$$

(2) 略

$$7. K = \sqrt{10}\pi, \quad \tau = 0.322$$

$$8. \begin{cases} \frac{\dot{c}^2}{45} + \frac{(c+1)^2}{9} = 1 \\ \frac{\dot{c}^2}{45} + \frac{(c-1)^2}{9} = 1 \end{cases}$$

2003 年西北工业大学硕士研究生入学考试 自动控制原理试题简要解答

$$1. (1) -4 < a < 36$$

$$(2) a = 0$$

$$(3) \omega_c = 1, \gamma = 76^\circ$$

$$2. (1) \begin{cases} \sigma_s = -\frac{5}{3} \\ \varphi_n = \pm 60^\circ, 180^\circ \end{cases}, \quad \begin{cases} d_1 = -2.87 \\ d_2 = -0.46 \end{cases}, \quad \begin{cases} \omega = 0, K^* = 10 \\ \omega = 2, K^* = 30 \end{cases}$$

$$(2) \Phi_1(s) = \frac{3.936}{(s+2.87)^2(s-0.74)}, \quad \Phi_2(s) = \frac{10.88}{(s+0.46)^2(s+4.07)}$$

$$(3) 1 < K = \frac{K^*}{10} < 1.09$$

$$3. (1) G(s) = \frac{4K}{s^2 + 5s + 4}$$

$$(2) K = 8$$

$$(3) \omega_c = 5.657, \quad \gamma = 45.3^\circ$$

$$4. (1) G(s) = \frac{10.89}{s(s+1.98)}$$

(2) 解法一 用串联校正

$$G_c(s) = \frac{4.5(s+1.98)}{s+7}, \quad K = 7$$

解法二 用测速反馈

$$G_c(s) = \frac{49}{s(s+7)}, \quad K = 7$$

$$5. (1) 0 < K < 8.35 \quad (2) e_{ss} = 1$$

$$6. (1) \text{系统会自振} \quad (2) |c| = 17.95, \omega = 1$$