

1. 稳定性 快速性

2. $5 + 0.7e^{-2.5t}$

3. 气压调节

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5. 结构 输入

6. 幅值裕度 相位裕度

7. P-n

1开环极点: $P_1=0$, $P_2=\frac{-1+i}{3}$, $P_3=-1-i$

无开环零点

实轴由: $(-\infty, 0]$

渐近线: $\left\{ \begin{array}{l} G_a = \frac{0-1-1}{3} = -\frac{2}{3} \\ \theta_a = \frac{\pm(2k+1)\pi}{3} = \pm 60^\circ, 180^\circ \end{array} \right.$

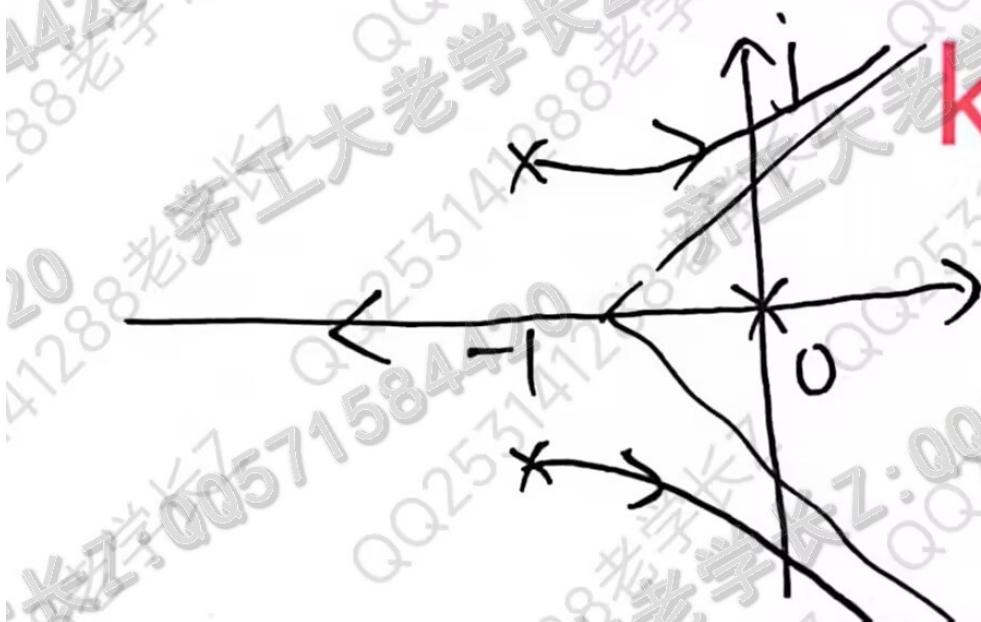
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$$\left\{ \begin{array}{l} G_a = \frac{0-1-1}{3} = -\frac{2}{3} \\ \theta_a = \frac{\pm(2k+1)\pi}{3} = \pm 60^\circ, 180^\circ \end{array} \right.$$

分界点: 无

与虚轴交点: $\left\{ \begin{array}{l} -w^3 + 2w = 0 \\ -2w^2 + k^* = 0 \end{array} \right. \Rightarrow \left\{ \begin{array}{l} w^2 = 2 \\ k^* = 4 \end{array} \right.$

$k^* = 2k$



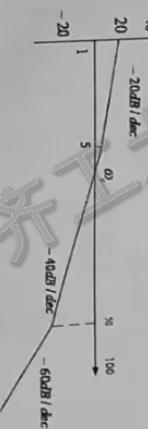
4、(共10分) 设反馈控制系統如下所示



绘制该系統根轨迹图，并判断閉环系统的稳定性。

5、(共12分) 已知系統开环对数频率特性折线如下图所示。求：

- (1) 系统的开环传递函数；
- (2) 写出系统的开环频率特性，开环幅频特性和开环相频特性；
- (3) 求系统的相位裕量和幅值裕量，并判定闭环系统的稳定性。



2.

$$G(s) = 1 + \frac{s^2 - 2s + 1}{s^3 + 7s^2 + 14s + 8}$$

$$= 1 + \frac{(s-1)^2}{(s+1)(s+2)(s+4)}$$

$$= 1 + \frac{\frac{4}{3}}{s+1} - \frac{\frac{9}{2}}{s+2} + \frac{\frac{25}{6}}{s+4}$$

$$g(t) = h(t) + \frac{4}{3}e^{-t} - \frac{9}{2}e^{-2t} + \frac{25}{6}e^{-4t}$$

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已知控制系统的响应是函数如下,试求系统输出

16

1

1

1

二

1

D

2

A

3

B

4

B

5

A

6 B

7 D

8 C

5.

$$(1) \quad G(s) = \frac{k}{s(\frac{1}{5}s+1)(\frac{1}{50}s+1)}$$

过 $(1, 20)$ 这点,

$$20(gk = 20 \Rightarrow k = 10)$$

$$(2) \quad G(jw) = \frac{10}{jw(\frac{1}{5}jw+1)(\frac{1}{50}jw+1)}$$

$$H(w) = \frac{10}{w\sqrt{\frac{1}{25}w^2+1}\sqrt{\frac{1}{2500}w^2+1}}$$

$$\varphi(w) = -9^\circ - \arctan \frac{1}{5}w - \arctan \frac{1}{50}w$$

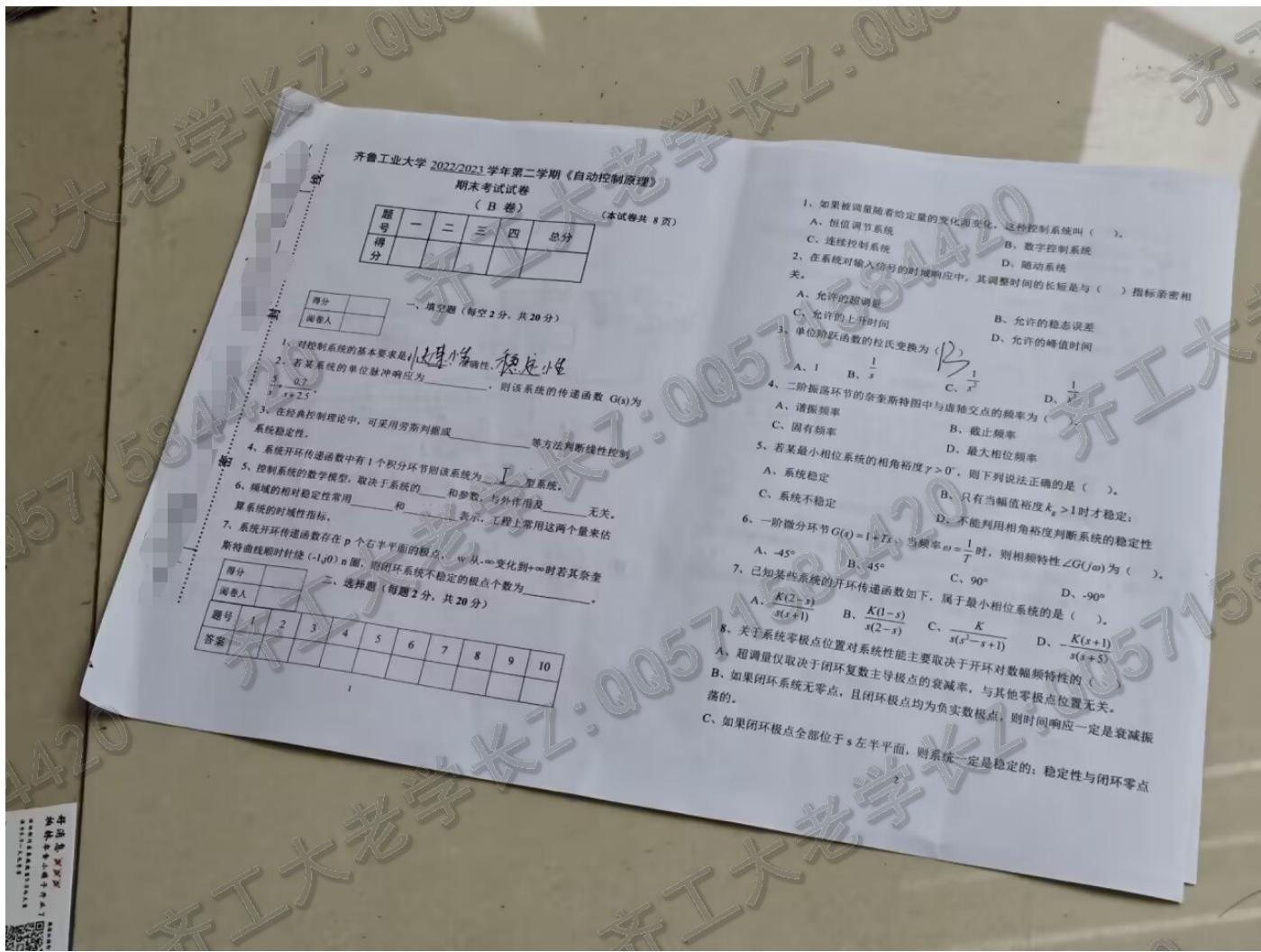
$$(3) \quad |G(jw_c)| = 1 \Rightarrow \frac{10}{jw_c^2} = 1 \Rightarrow w_c = 7.07$$

$$\gamma = 18^\circ + \varphi(w_c) = 27.2^\circ > 0$$

$$\varphi(w_g) = \pm(2k+1)\pi \Rightarrow 1 - \frac{1}{250}w_g^2 = 0$$

稳定

$$kg = \frac{1}{|G(jw_g)|} = 5.5$$



$$3. (a) R(s) = \frac{1}{s} + \frac{2.2}{s+20} - \frac{1.2}{s+30}$$

$$= \frac{600}{s(s+20)(s+30)}$$

$$\underline{\Phi}(s) = \frac{C(s)}{R(s)} = \frac{600}{s^2 + 50s + 600}$$

$$(b) \left. \begin{array}{l} 2\zeta\omega_n = 60 \\ \omega_n^2 = 600 \end{array} \right\} \Rightarrow \left. \begin{array}{l} \zeta = 1.02 \\ \omega_n = 24.5 \end{array} \right.$$