课堂练习_第六章

1 设单位负反馈系统的开环传递函数为：

$$G_0(s)=\frac{K}{s(0.1s+1)(0.2s+1)}$$

试设计一校正装置，使系统满足下列性能指标：

静态速度误差系数： $K_v=30$

相角裕度： $\gamma \geq 40^\circ$

课堂练习_第六章

2 已知单位负反馈系统的开环传递函数

$$G(s)=\frac{K_0}{s(0.1s+1)(0.001s+1)}$$

试用频率法设计串联超前校正装置，

相角裕度：$\gamma \geq 45^\circ$

静态速度误差系数：$K_v=1000s^{-1}$

练习讲解

课堂练习讲解_第六章

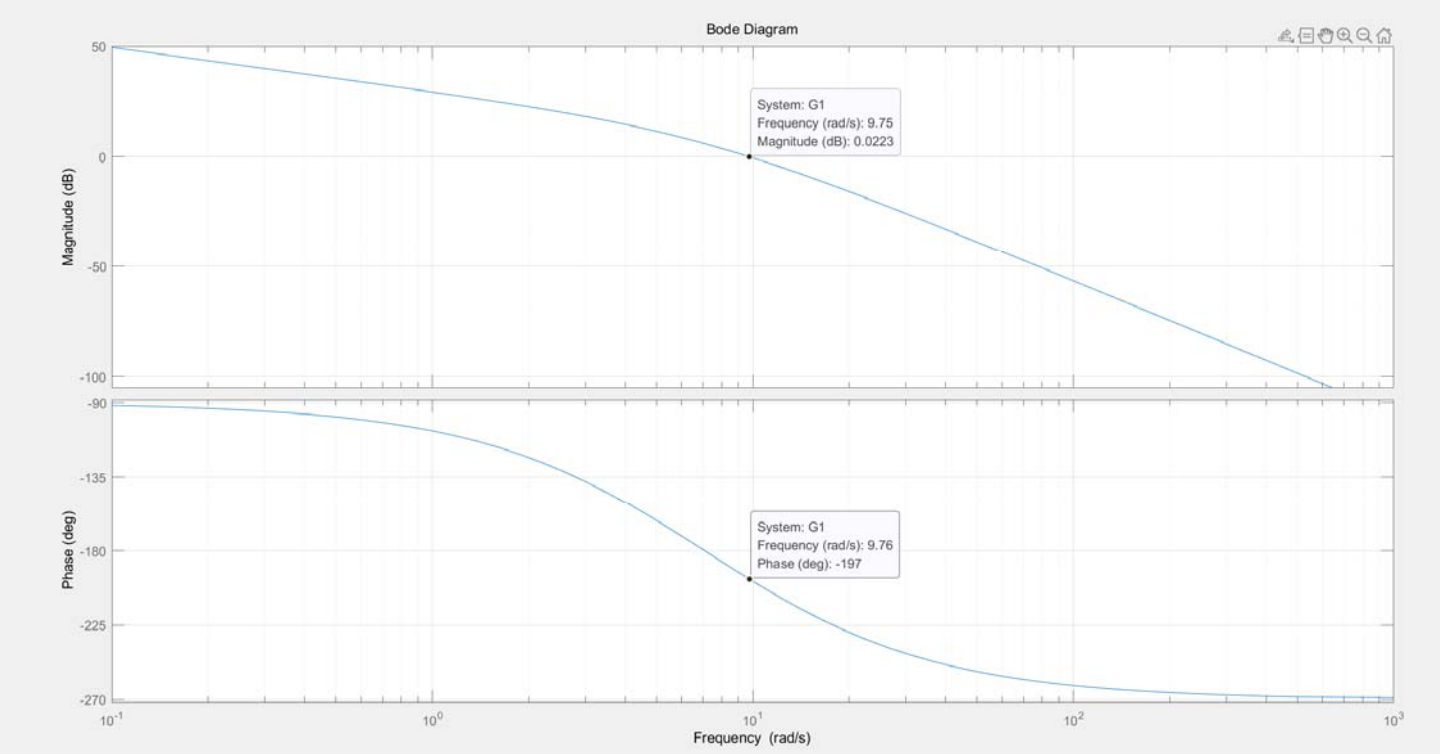
1

$$G_0(s)=\frac{K}{s(0.1s+1)(0.2s+1)}$$

静态速度误差系数： $K_v=30$

相角裕度： $\gamma \geq 40^\circ$

$$K=K_v=30 \qquad G_0(s)=\frac{30}{s(0.1s+1)(0.2s+1)}$$

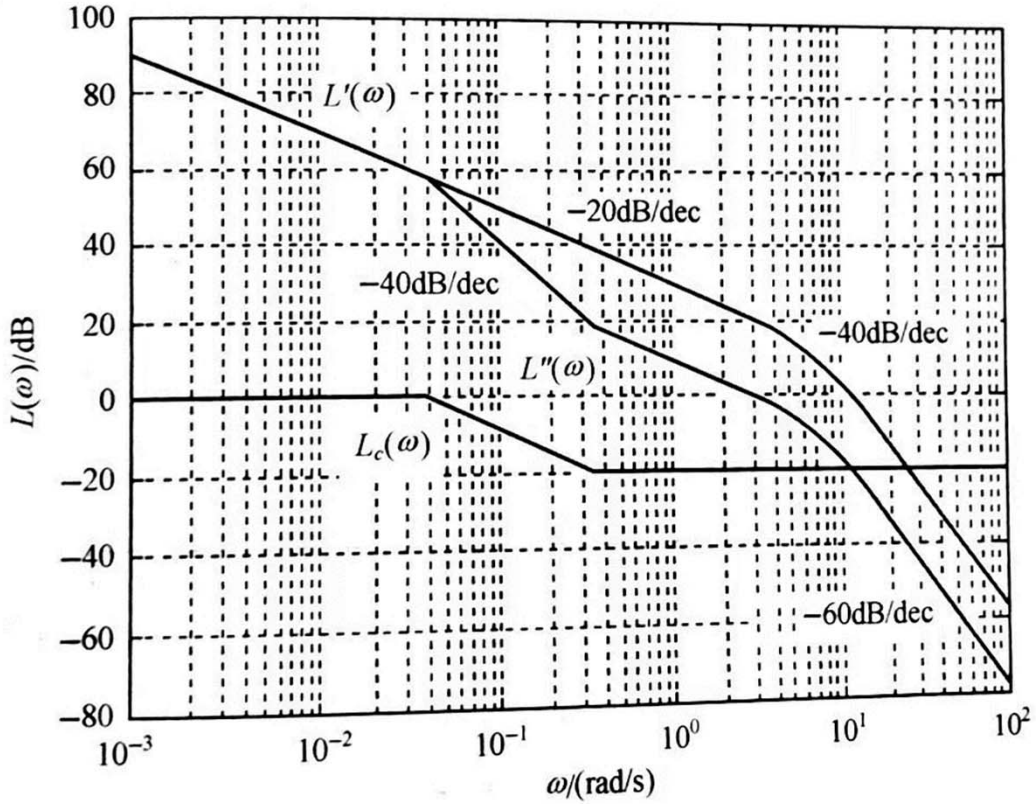


1

截止频率：$\omega_c^{'} = 11.45 rad/s$

$$\gamma' = \left(180^\circ - 90^\circ - \arctan 0.1\omega_c' - \arctan 0.2\omega_c'\right)\Big|_{\omega_c'=12.25} = -25.26^\circ$$

系统不稳定，采用滞后校正



1

$$\varepsilon = 6^\circ \qquad \gamma'(\omega_c'') = \gamma'' + \varepsilon = 46^\circ$$

$$\gamma'' = 90^\circ - \arctan 0.1\omega_c'' - \arctan 0.2\omega_c''$$

$$\omega_c'' = 2.74 rad/s$$

$$L'(\omega_c'') = 20.79dB \qquad 20\lg b = -L'(\omega_c'')$$

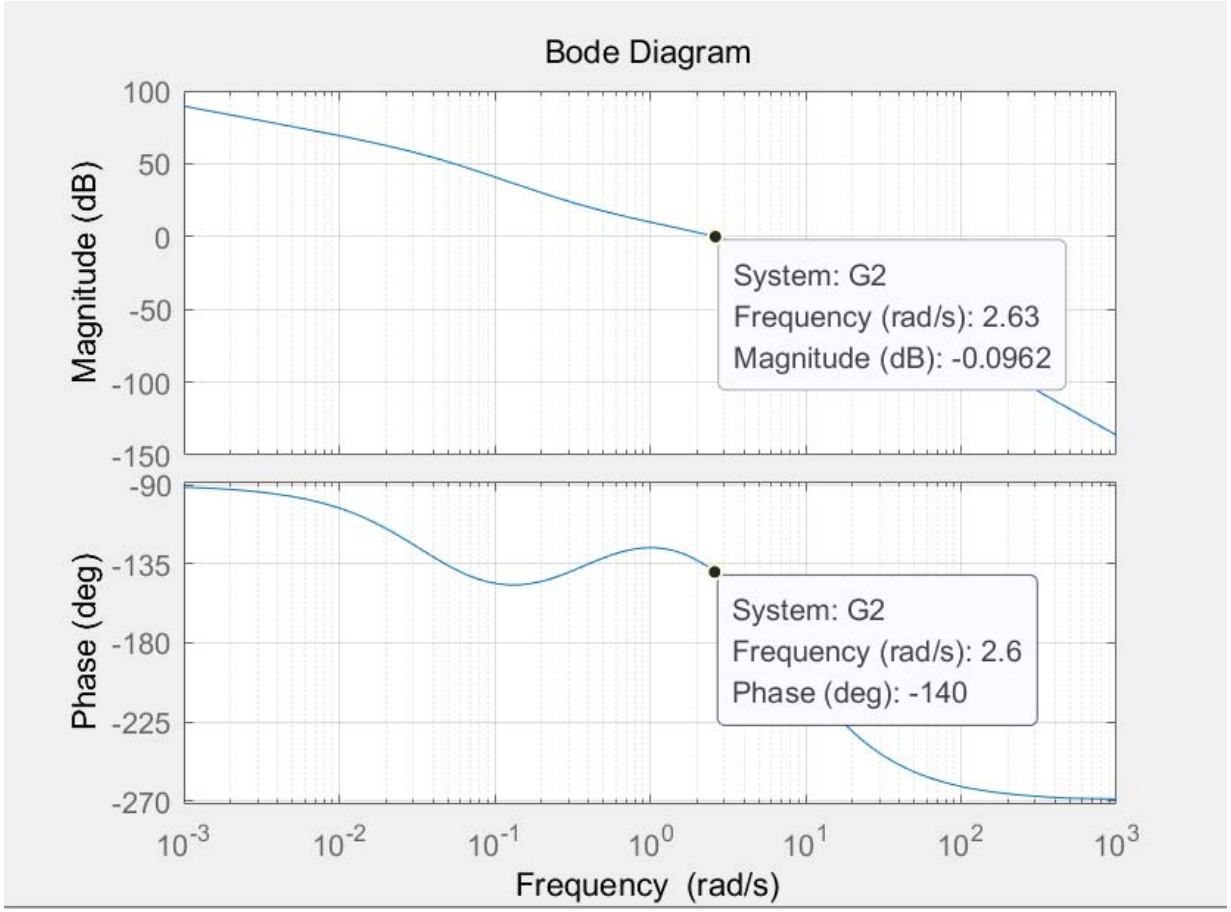
$$\frac{1}{bT} = 0.14\omega_c'' \qquad b = 0.1 \qquad G_c(s) = \frac{1+bTs}{1+Ts} = \frac{1+2.61s}{1+26.07s}$$

$$T = 26.07$$

课堂练习讲解_第六章

1 校验：

$$G_c(s)=\frac{1+2.61s}{1+26.07s} \qquad G_c(s)G_0(s)=\frac{30(2.61s+1)}{s(0.1s+1)(0.2s+1)(26.07s+1)}$$



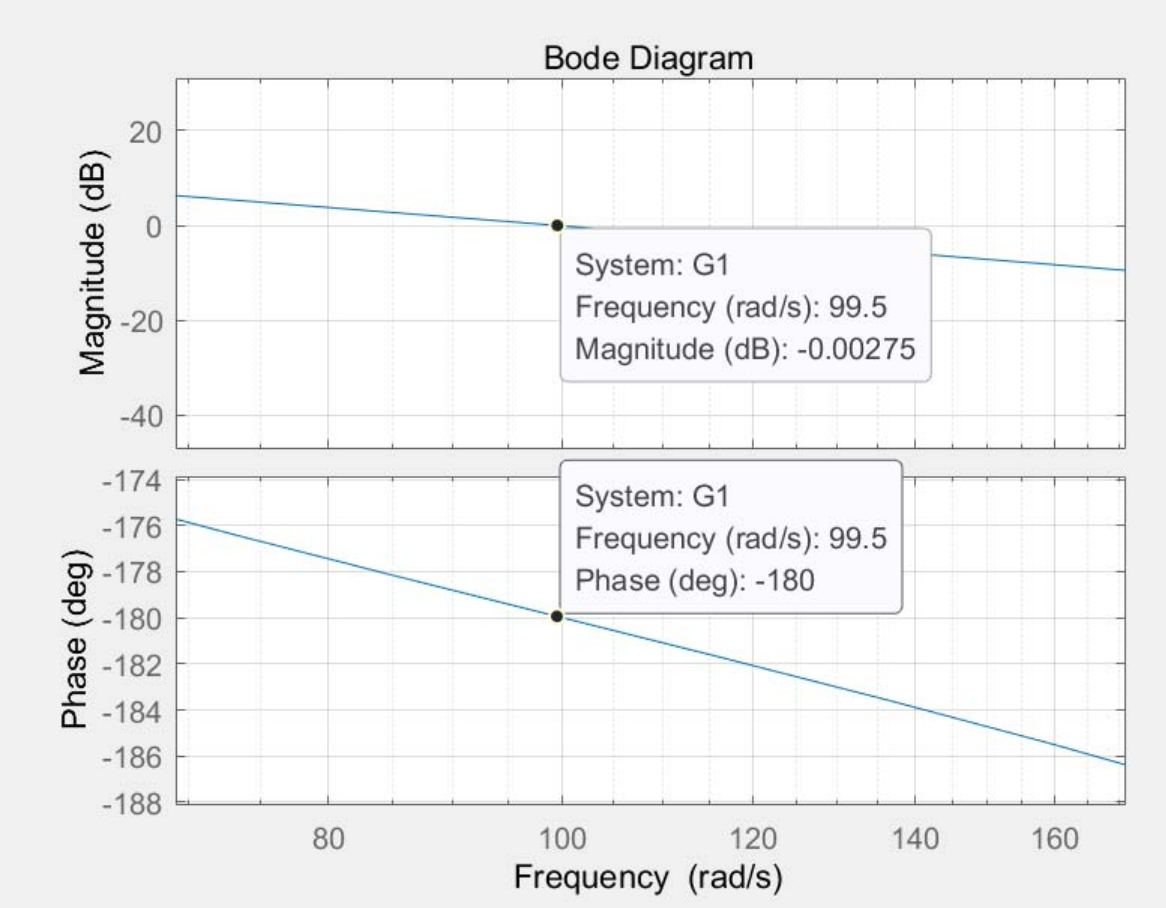
课堂练习_第六章

2

$$G(s)=\frac{K_0}{s(0.1s+1)(0.001s+1)}$$

相角裕度： $\gamma \geq 45^{\circ}$

静态速度误差系数： $K_v = 1000s^{-1}$



课堂练习_第六章

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$$G(s)=\frac{K_0}{s(0.1s+1)(0.001s+1)}$$

相角裕度： $\gamma \geq 45^\circ$

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超前校正传递函数： $G_c(s)=\frac{1+\alpha Ts}{1+Ts}(\alpha>0)$

$$\varphi_m = \gamma - \gamma_0 + (5\sim 10^\circ) \qquad \varphi_m = \gamma + \Delta\varphi = 50^\circ$$

$$a=\frac{1+\sin\varphi_m}{1-\sin\varphi_m} \qquad \omega_m=\frac{1}{\sqrt{a}T}$$

课堂练习_第六章

2

$$G(s)=\frac{K_0}{s(0.1s+1)(0.001s+1)}$$

相角裕度： $\gamma \geq 45^\circ$

静态速度误差系数： $K_v = 1000s^{-1}$

$$G_c(s)=\frac{0.01694s+1}{0.002124s+1}$$