5.1 解：1. $r(t)=\sin 2t$　　$R(s)=\frac{2}{s^2+4}$

系统的闭环传递函数　$G(s)=\frac{\frac{1}{s+1}}{1+\frac{1}{s+1}}=\frac{1}{s+2}$

频率响应　$G(j\omega)=G(s)\big|_{s=j\omega}=\frac{1}{j\omega+2}$　　当 $r(t)=\sin 2t$ 即 $\omega=2$ 时

$A(\omega)=\frac{\sqrt{2}}{4}$　　$\varphi(\omega)=-\arctan 1=-\frac{\pi}{4}$

由正弦信号输入的频响规则　$c_{ss}(t)=\frac{\sqrt{2}}{4}\sin\left(2t-\frac{\pi}{4}\right)$

稳态误差　$e_{ss}(t)=\sin 2t-\frac{\sqrt{2}}{4}\sin\left(2t-\frac{\pi}{4}\right)$

5.2 解：$h(t)=1-1.8e^{-4t}+0.8e^{-9t}\quad t\geq 0$

作拉氏变换　$H(s)=\frac{1}{s}-\frac{1.8}{s+4}+\frac{0.8}{s+9}=\frac{36}{s(s+4)(s+9)}$

单位阶跃响应下　$R(s)=\frac{1}{s}$　　$G(s)=\frac{H(s)}{R(s)}=\frac{36}{(s+4)(s+9)}$

即 $G(j\omega)=\frac{36}{(j\omega+4)(j\omega+9)}$　　$A(\omega)=|G(j\omega)|=\frac{36}{\sqrt{(16+\omega^2)(81+\omega^2)}}$

$\varphi(\omega)=-\arctan\frac{13\omega}{36-\omega^2}$

5.3 解：系统的闭环传递函数 $G(s)=\frac{\omega_n^2}{s^2+2\zeta\omega_n s+1}$　　$G(j\omega)=\frac{\omega_n^2}{2j\zeta\omega_n\omega+\omega_n^2-\omega^2}$

当 $r(t)=2\sin t$ 时　$c(t)=4\sin(t-45^\circ)$　故　$A(\omega)\big|_{\omega=1}=|G(j\omega)|\big|_{\omega=1}=2$

$\varphi(\omega)\big|_{\omega=1}=\angle G(j\omega)\big|_{\omega=1}=-45^\circ$

即：$\begin{cases}\frac{\omega_n^2}{\sqrt{(\omega_n^2-1)^2+4\zeta^2\omega_n^2}}=2\\ -\arctan\frac{2\zeta\omega_n}{\omega_n^2-1}=-45^\circ\end{cases}\Rightarrow\begin{cases}\omega_n=1.24\\ \zeta=0.22\end{cases}$