hw9.1 $w_p=0.2\pi$, $w_s=0.5\pi$, $T_s=100\mu s$, $\alpha_p=3dB$, $\alpha_s=30dB$. 冲激响应不变法.

$\Omega_p=\frac{w_p}{T_s}=2\times10^4\pi$, $\Omega_s=\frac{w_s}{T_s}=5\times10^4\pi$.

$\lambda_p=1$, $\lambda_s=\frac{\Omega_s}{\Omega_p}=2.5$

$C=\sqrt{10^{2\alpha_p/10}-1}=1$.

$a=\sqrt{\frac{10^{\alpha_s/10}-1}{10^{\alpha_p/10}-1}}=31.68$

$n=\frac{\lg a}{\lg\lambda_s}=7.77$; N取4.

$\therefore p_k=\exp\left(j\frac{2k+N-1}{2N}\pi\right)=\exp\left(j\frac{2k+3}{8}\right)$, $k=1,\cdots N$.

$$a(p)=\frac{1}{\prod_{k=1}^{4}(p-p_k)}=\frac{1}{(p^2+0.7654p+1)(p^2+1.8478p+1)}.$$

$$a(s)=G(p=\frac{s}{\Omega_p})=\frac{\Omega_p^2}{[(s+0.3827\Omega_p)^2+0.8535\Omega_p^2]\cdot[(s+0.9239\Omega_p)^2+0.1464\Omega_p^2]}$$

$$=A\frac{B_1^2}{(s-a_1)^2+B_1^2}\cdot\frac{B_2^2}{(s-a_2)^2+B_2^2}$$

$$A=\frac{1}{(1-\cos^2\frac{5}{8}\pi)(1-\cos^2\frac{7}{8}\pi)},\quad a_1=\Omega_p\cdot\cos\frac{5}{8}\pi,\ a_2=\Omega_p\cdot\cos\frac{7}{8}\pi,$$

$$B_1=\Omega_p\cdot\sqrt{1-\cos^2\frac{5}{8}\pi},\quad B_2=\Omega_p\cdot\sqrt{1-\cos^2\frac{7}{8}\pi}.$$

同hw8.2理论 $H(z)=\frac{\Omega_p^2}{\sin\frac{5}{8}\pi\cdot\sin\frac{7}{8}\pi}\cdot\frac{z-e^{a_1T_s}\cdot\sin(B_1T_s)}{z^2-z[2e^{a_1T_s}\cdot\cos(B_1T_s)]+e^{2a_1T_s}}\cdot\frac{z-e^{a_2T_s}\cdot\sin(B_2T_s)}{z^2-z[2e^{a_2T_s}\cdot\cos(B_2T_s)]+e^{2a_2T_s}}$

hw9.2 $\omega_p=0.2\pi$, $\omega_s=0.5\pi$, $\alpha_p=3dB$, $\alpha_s=30dB$.

双线性变换法.

$\Omega_p=\tan\frac{\omega_p}{2}=0.3249$, $\Omega_s=\tan\frac{\omega_s}{2}=1$.

$\lambda=\Omega_s/\Omega_p$, $\lambda_p=1$, $\lambda_s=3.078$.

$a=\sqrt{\frac{10^{\frac{3}{10}}-1}{10^{\frac{30}{10}}-1}}=31.68$, $n=\frac{\lg a}{\lg\lambda_s}=3.07$, N取4.

$p_k=\exp\left(j\frac{2k+N-1}{2N}\pi\right)$, $k=1,2,\cdots N$

$$G(p)=\frac{1}{\prod_{k=1}^{N}(p-p_k)}=\frac{1}{(p^2+0.7654p+1)(p^2+1.8478p+1)}.$$

$G(s)=G(p)\big|_{p=\frac{s}{\Omega_p}}=\cdots$

$H(z)=G(s)\big|_{s=\frac{z-1}{z+1}}=\cdots$