EE 451 – HW5

9.4 The specs on the lowpass filter are:

Passband ripple $1\pm\delta p$

Passband frequency ωp and $-\omega p$

Stopband frequency ωs and $-\omega s$

The specs on the highpass filter are:

Passband ripple $1\pm\delta p$

Passband frequency $\pi-\omega p$ and $-(\pi-\omega p)$

Stopband frequency $\pi-\omega s$ and $-(\pi-\omega s)$

9.15 $s=1/T(1-z^{-1})$ or $z=1/(1-sT)$

For $s=\sigma+j\Omega$ and $|z|=1/(\sqrt{(1-\sigma T)^2+(\Omega T)^2})$

For $\sigma<0$ then $|z|<0$ O.K.

For $\sigma=0$, ONLY for $\Omega=0$ then $|z| = 1$

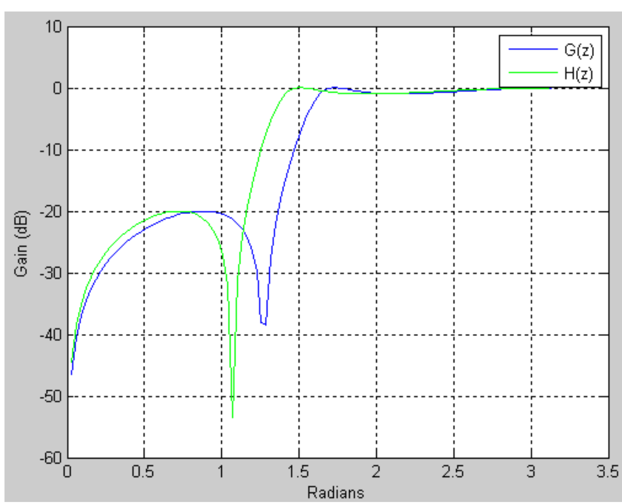
9.20 A zero/pole at $z=z_k$ has a factor $(z-z_k)=0$. Substituing a lowpass to highpass transformation into This equation we will have $(\check{z}-\lambda)/(1-\lambda\check{z})-z_k=0$ we will get $\check{z}=(\lambda+z_k)/(1+\lambda z_k)$. If $z_k=1$ then $\check{z}=1$.

9.25 A third order elliptic highpass filter with a passband edge of $\omega p = 0.52\pi$ has a T.F.
$G_{HP}(z)=0.2397(1-1.5858z^{-1}+1.5858z^{-1}-z^{-3})/(1+0.3272z^{-1}+0.7459z^{-2}+0.179z^{-3})$

Using a lowpass-to-lowpass spectral transformation we will have:

$H_{LP}(z)=G_{HP}(z)|z^{-1}=(\check{z}^{-1}-\lambda)/(1-\lambda\check{z}^{-1})$

$H_{LP}(z)=0.2397(1.1948-2.3407z^{-1}+2.3407z^{-2}-1.1948z^{-3})/(0.9728-0.1530z^{-1}+0.6688z^{-2}+0.0997z^{-3})$



9.25 An ideal integrator frequency response is: $Hint(e^{j\omega})=1/j\omega$.

A rectangular numerical integration is given by $Y(z)/X(z)=Tz^{-1}/(1- z^{-1})$. Where integration step T=1.

A trapezoidal numerical integration is given by $Y(z)/X(z)=(T/2)(1+ z^{-1})/(1 - z^{-1})$. T=1.