EEL731 Major / 05-05-09 /SCDR

120 minutes, 100 marks

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1. Derive, if possible, a *canonical* lattice realization of the two transfer functions

$$H_2(z)=1+a_1 z^{-1}+a_2 z^{-2} \text{ and } G_2(z)= 1+a_1 z^{-1}+b_2 z^{-2} .$$

Also give a direct canonic structure which realizes both the transfer functions.[20]

2. Derive a canonical lattice realization of the transfer function $H_3(z)=[1+(1/2)z^{-1}+(1/4)z^{-2}+ z^{-3}]/[(1/4)+(1/8)z^{-1}+(1/12)z^{-2}+(1/4)z^{-3}]$. [20]

3. Given that the causal system with the transfer function

$$H(z)=[1+2z^{-1}+2z^{-2}+z^{-3}+3z^{-4}]/[1+a_1z^{-1}+a_2z^{-2}+a_3z^{-3}]$$

has an impulse response $h(n) = \{h_0,0,(1/2), 2, h_4, \ldots\ldots h_\infty\}$, find h_0, h_4, a_1, a_2, a_3, and h_∞. [20]

4. To an analog bandpass filter transfer function H(S) having a centre frequency Ω_0 and bandwidth B, if one applies the lowpass to highpass tranformation (i.e. $S=\alpha/s$), what would be the nature and important parameters of the transformed filter ? [10]

5. A digital first order lowpass filter has a cutoff frequency ω_c. This is to be transformed to a digital bandstop filter with passband edges at ω_1 and ω_2 where $\omega_1+\omega_2 = \pi$ and $\omega_2 - \omega_1 = \omega_c$. Find the required transformation in the *simplest form*. What would be the rejection frequency of the bandstop filter? [15]

6. Derive, from first principles of multiplier extraction approach, a canonical realization of the allpass transfer function

$$A(z)=(d+z^{-2})/(1+dz^{-2}).$$

[15]