DSP Fall 2020

Quiz #3 makeup, Filter Design

Name:

Question 1:

Consider the system below, where H(ejω) is a bandpass filter, with passband ripple δ1 = .001 and stop band ripple δ2  = .001 and band edges ωs1  = .2π ωp1  = .4π, ωp2 = .6π. ωp2 = .8π. The sampling rate for the idea C/D and D/C is 1/T = 10,000 samples per second. Furthermore, it is known that the filter H(ejω) has a maximum group delay of 34 samples.

Diagram

Description automatically generated

1. (1 point) What property should the input signal have so that the overall system behaves as an LTI system with Yc(jΩ) = Heff(jΩ) Xc(jΩ) ?
2. (1 point) For the conditions found in part a), sketch |Heff(jΩ)|, include as much detail as possible.
3. (2 points) Based on the information given, could the filter H(ejω) have been designed using the impulse invariance method? If so, specify the analog prototype filter Hap(jΩ). If not, explain why not.
4. (2 points) Based on the information given, could the filter H(ejω) have been designed using the blinear transformation method? If so, specify the analog prototype filter Hap(jΩ). If not, explain why not.
5. (2 points) Based on the information given, could the filter H(ejω) have been designed using the Kaiser window method? If so, specify the ideal impulse response used in the design. If not, explain why not.
6. (2 points) Based on the information given, could the filter H(ejω) have been designed using the Park-McLellan algorithm? If so, specify possible values for the group delay. If not, explain why not.