HW#7 Low Pass IIR Filters

An IIR low pass filter is desired with the same characteristics as the previously redesigned FIR decimation filter. Specifically, the filter should have an analog passband cutoff frequency of 50 Hz and an analog stopband frequency of 75 Hz. For these critical frequencies, the 64-tap FIR filter achieved a passband ripple of 0.2 dB and a stopband attenuation or sidelobe level of 32.8 dB. Three IIR low pass filters are to be designed using these as the desired specifications.

I.   Butterworth IIR Filter Design

  A. Using a Butterworth filter design algorithm, design the required IIR low pass filter.

  B. Provide the following results:

  1. Listing of the numerator and denominator IIR filter coefficients.

  2. Pole/zero diagram of the IIR filter.

  3. Magnitude (dB) and phase frequency response plots of the IIR filter. Indicate the locations of the passband and stopband critical frequencies.

  For the magnitude plots, provide: (a) large dynamic range to illustrate the overall structure of the stopband region, (b) 50 dB dynamic range to better illustrate the stopband attenuation or sidelobe level, and (c) 1 dB dynamic range for just the passband region to look in detail at the passband ripple structure.

II.   Chebyshev IIR Filter Design

  A. Using Chebyshev Type I and Chebyshev Type II filter design algorithms, design the required IIR low pass filter (2 filter designs).

  B. Provide the same results as in IB.

III.   Elliptic IIR Filter Design

  A. Using an elliptic filter design algorithm, design the required IIR low pass filter.

  B. Provide the same results as in IB.

Comment on your results. Specifically, note the order of each IIR low pass filter.