

AV331: Digital Signal Processing

Labsheet 10

IIR Filters

1. (a) Design IIR digital low pass filter using i) Butterworth filter and ii) Chebyshev filter (Type I and Type II) with the following specifications:

Sampling frequency = 8 k Hz

Pass band cut off frequency = 2 kHz

Stop band cut off frequency = 2.8 kHz

Pass band ripple = 1 dB

Stop band attenuation = 60 dB

Plot the frequency response in each case and compare them.

(b) For the above filter specifications, design an analog Butterworth IIR low pass filter and plot the frequency response. Also determine the poles and zeroes of the transfer function.

2. We are interested in passing the term $\sin(1500t)$ from the input signal

$$x(t) = \sin(10\pi t) + \sin(1500\pi t) + \sin(5000\pi t)$$

Design a band pass IIR Cheby1 digital filter to accomplish this task.

Take sampling frequency as 8000. Take pass band frequency as 650 Hz to 850Hz, while the stop band is below 50 Hz and above 1450 Hz. Take pass band ripple of 1 dB and stop band ripple 50 dB. Plot, i) the magnitude response of the filter ii) the FFT of input signal and its filtered output.

3. A speech sampled at 8,000 Hz is corrupted by a sine wave of 360 Hz. Design a Chebyshev notch filter to remove the noise with the following specifications:

Center frequency: 360 Hz

Bandwidth: 60 Hz

Pass band ripple: 0.5 dB

Stop band attenuation: 5 dB at 355 Hz and 365 Hz, respectively.

Plot the frequency response. Also determine the transfer function.

4. Design appropriate digital filter to denoise the audio signal which is corrupted by a sinusoidal signal of certain frequency.