Madan Mohan Malaviya University of Technology, Gorakhpur

Electronics and Communication Engineering Department

DIGITAL SIGNAL PROCESSING (BEC-303)

ASSIGNMENT -III

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1. Compare an FIR system with an IIR system.
2. Define phase delay and group delay. Further discuss about linear phase filter.
3. Explain the Fourier series method of designing an FIR filter.
4. Design a Finite Impulse Response low-pass filter with a cut-off frequency of $1kHz$ and sampling rate of $4kHz$ with eleven samples using Fourier series.
5. Design an ideal highpass filter with a frequency response

$$H_d(e^{j\omega}) = \begin{cases} 1, & \frac{\pi}{4} \leq |\omega| \leq \pi \\ 0, & |\omega| \leq \frac{\pi}{4} \end{cases}$$

   Determine $h(n)$ and $H(z)$ for $M = 11$ and plot the magnitude response. Determine $h(n)$ and $H(z)$ for $M = 11$ and plot the magnitude response.

6. What are the desirable features of the window functions? Further discuss the effect of windowing. Discus different window functions used in designing FIR filters. Obtain their frequency-domain characteristics. Further compare them.

$$H_d(e^{j\omega}) = \begin{cases} 1, & \frac{\pi}{4} \leq |\omega| \leq \pi \\ 0, & |\omega| \leq \frac{\pi}{4} \end{cases}$$

   Find $h(n)$ and $H(z)$ for $M = 11$ using (a) Hamming Window (b) Hanning Window and plot the magnitude response.

7. Design an FIR digital filter to approximate an ideal low-pass filter with passband gain of unity, cut-off frequency of $850Hz$ and working at a sampling frequency of $f_s = 5000Hz$. The length of the impulse response should be 5. Use a rectangular window.
8. What is a Kaiser window? Why is it superior to other window functions? Explain the procedure for designing an FIR filter using the Kaiser window.
9. Explain the Type-I Frequency sampling method of designing an FIR filter.
10. Determine the filter coefficients $h(n)$ obtained by Frequency sampling technique

$$H_d(e^{j\omega}) = \begin{cases} e^{-j(M-1)\omega/2}; & 0 \leq |\omega| \leq \frac{\pi}{2} \\ 0; & \frac{\pi}{2} \leq |\omega| \leq \pi \end{cases}$$

   for $M = 7$