EE2801/EE5802: DSP Lab

Assignment 1

Problem:

Design of digital filters such as Low Pass Filter (LPF), Half Band Filter (HBF).

Technical details:

1. **LPF or Half band filter** with $f_c = 400\ Hz$, $\omega_c = \pi/2$, $N = 39$

$$h_d[n] = \begin{cases} \dfrac{Sin(\omega_c\, n)}{\pi\, n}, & -(N-1)/2 \le n \le (N-1)/2 \\ \dfrac{\omega_c}{\pi}, & n = 0 \end{cases}$$

2. **LPF** with $f_c = 400\ Hz$, $\omega_c = \pi/4$, $N = 39$, $h_d[n]$ is same as above.

Window functions

- Hamming window

$$W_H[n] = \begin{cases} 0.54 - 0.46\cos\left(\frac{2\pi n}{N-1}\right), & if\ 0 \le n \le N-1 \\ 0, & otherwise \end{cases}$$

Instructions:

- In case of 1 and 2 decide the sampling frequency f_s as discussed in lecture.
- Generate the N samples of $h_d[n]$ in time domain for the filter you want to design.
- Multiply the window function $W_H[n]$ with $h_d[n]$ to get practical impulse response $h[n]$.

Submission Details:

- Write Matlab code to implement above system.

- **Coding format:** Write a main code and one function for LPF and one function for window generation. Either you can write main code and function definitions on same file or you can make separate files for each function.
- For both LPF 1 and LPF 2 you need to call same LPF function with appropriate parameter. Input to any filter functions are f_c, f_s and N. Output of any filter function is $h[n]$.
- Take this output $h[n]$ plot impulse response and magnitude response for both cases using 'fvtool' command.
- Write your understanding about above filters in your own words in MS word or latex.
- Upload the below files in a single zip file with your id, Example: EE20MTECH11010_**A1**.zip.
    - Matlab code files (.m files)
    - 4 pdf file of plots saved from Matlab
    - Pdf of your MS word or latex document.

Grading:

- Output - 50%
- coding format - 30%
- writting submission(pdf file) - 20%
- late submission - (-5)%