May 11, 2021

EE 433 Intro. to DSP, Computer HW Part #1
(due to May 24, 2021)

NOTE: For plotting the amplitudes in **time**-domain, use **LINEAR** scale. For plotting the amplitudes in **frequency**-domain use **LOGARITMIC** scale.

1. Design a Butterworth filter with following specifications using impulse invariance method. Check the achieved gains at the critical frequencies. Plot the magnitude of frequency response.

$$\begin{aligned} 0.9 \leq |H(e^{j\omega}| \leq 1, \qquad & 0 \leq \omega \leq 0.25\pi \\ |H(e^{j\omega}| \leq 0.1, \qquad & 0.4\pi \leq \omega \leq \pi \end{aligned}$$

2. Utilize Kaiser window method in order to design a filter which meets the same specifications given above. Check the achieved gains at the critical frequencies. Plot the magnitude of frequency response.

3. Utilize built-in programs of MATLAB or OCTAVE to design an FIR filter which meets the same specifications given above. Check the achieved gains at the critical frequencies. Plot the magnitude of frequency response.

4. (a) Plot the phases of the frequency responses corresponding to the filters designed in questions 1,2 and 3. What are your observations?

   (b) Plot the impulse responses of the filters designed in questions 1,2 and 3. What are your observations?

Instructions:

- Submit as a pdf-file report.
- Show your work. Give intermediate results where you think it useful.
- Also supply computer routines in an appendix.