ECE4522 Practicum 2: Frequency Response of FIR Filter

Receive 5 additional points by submitting before 10/31/19 11:59 pm
Penalty will be imposed after 11/7/19 11:59 pm (1 point each hour; 5 points each day)

In this practicum you will compute and plot the magnitude and phase response of finite impulse response (FIR) filters.

The z-transform of the FIR filter is described as $H(z) = 1 - az^{-8}$, where the value of a varies.

(a) When $a = 0.999$, compute the zeros of the FIR filter. You may use the roots function in Matlab. Plot the zeros using as 'o' marks in the z-plane, alone with a unit circle. Based on the zero positions, describe the expected magnitude response in layman language.

(b) Compute the magnitude and phase response of the filter. Plot them in the same plot with two vertically placed subplots (use subplot(211) to plot the magnitude, and subplot(212) to plot the phase). The horizontal axis should be radian frequency between $-\pi$ and π. The magnitude must be plotted using the dB values. Comment if the magnitude and phase responses match your expectation? Why so? [Important: Magnitude and phase must be computed by your own code. Do not use Matlab functions like freqz to make the plots.]

(c) Change the value of a to 0.8, repeat (a) and (b). How the magnitude and phase responses change from the results reported in (b)?

(d) [Optional] Comment how to understand why the phase become less linear in the case of $a = 0.8$ as compared to the $a = 0.999$ case.

(e) [Optional] For the case of $a = 0.8$, design an FIR with a similar magnitude response but the phase varies (approximately) linearly with frequency. Report the zeros plot (format similar to that in (a)), and the magnitude and phase responses (format similar to that in (b)). Please comment the possible reason if the magnitude response differs from that in (c), or if the phase response is not exactly linear.

Submit by e-mail to ece4522.temple@gmail.com

(a) A single Word or pdf file containing materials in the following order:

- Your name, Section, TUid
- All the required images, equations, and observations
- Key references (website, book, paper, or student name) if any (particularly if you reused a substantial portion of the Matlab codes)
- Matlab codes

(b) The name of the Word of pdf file must be in the following format with a proper file extension:
    Lastname_Firstname_practicum2_ECE4522

(c) All Matlab codes in .m format

Important: The Matlab code has to be included in the Word or pdf file report, AND as a separate attachment.

A student may seek help, but the report must be his/her work and thus he/she must understand every word and every line of Matlab code reported.