Fall 2023   EE 313 Linear Systems and Signals   Prof. Evans

Homework #5 *Version 2.0*

Time and Frequency Responses of FIR Filters

Assigned on Saturday, October 7, 2023
Due on Friday, October 13, 2023, by 11:59 pm via Canvas submission

Late homework is subject to a penalty of two points per minute late.

Reading: McClellan, Schafer & Yoder, *Signal Processing First*, 2003, Sec. 5.4-5.9 and 6.1-6.6.
Companion Web site with demos and other supplemental information: http://dspfirst.gatech.edu/
Web site contains solutions to selected homework problems from *DSP First*.

E-mail address for Mr. Elyes Balti (TA) is ebalti@utexas.edu. Please consider posting questions on
our Ed Discussion site, which can be answered by anyone in the class. You can post anonymously.

Office Hours	*Monday*	*Tuesday*	*Wednesday*	*Thursday*	*Friday*
11:00 am		**Evans (ECJ 2.104)**		**Evans (ECJ 2.104)**	
11:30 am		**Evans (ECJ 2.104)**		**Evans (ECJ 2.104)**	
12:00 pm		**Evans (ECJ 2.104)**		**Evans (ECJ 2.104)**	
12:30 pm					
1:00 pm					
1:30 pm					
2:00 pm			**Evans (EER 6.882 and Zoom)**	**Evans (EER 6.882 and Zoom)**	**Balti (EER 3.648)**
2:30 pm			**Evans (EER 6.882 and Zoom)**	**Evans (EER 6.882 and Zoom)**	**Balti (EER 3.648)**
3:00 pm			**Evans (EER 6.882 and Zoom)**	**Evans (EER 6.882 and Zoom)**	**Balti (EER 3.648)**
3:30 pm		**Balti (EER 3.648)**			
4:00 pm		**Balti (EER 3.648)**			
4:30 pm		**Balti (EER 3.648)**			
5:00 pm				**Balti (EER 3.648)**	
5:30 pm				**Balti (EER 3.648)**	
6:00 pm				**Balti (EER 3.648)**	

Prof. Evans holds coffee/advising hours on Fridays 12:00-2:00pm in the EER café.

EE 313 tutoring is available 7-10pm on Sundays through Thursdays in person.

1. Averaging Filter and the Unit Step Signal. 28 points.

Signal Processing First, problem P-5.6, page 127.

2. System Properties. 24 points.

Signal Processing First, problem P-5.9, page 128.

3. System Properties and Deconvolution. 24 points.

Signal Processing First, problem P-5.12, page 128. When working the problem, assume that you do not know the filter coefficients. Using system properties to find the answer. This will be part (a).

For part (b), use the deconvolution formulas in homework problem 4.3(a) to manually determine the FIR filter coefficients given that the input signal is $x_1[n]$ and the output signal is $y_1[n]$ for $n \geq 0$. Check your calculations using utdeconvolve.m provided on the homework hints page. When running the code, use an equal number of input and output values for vectors x and y, which is what would happen in an experimental setup that would input a test signal x and observe the output y. Please see the comments in the code for more info. Check your answer for the filter coefficients using the filter command.

Please see Example #2 in the Tuneup #4 Assignment solution which worked through a solution for a problem similar to part (b).

This is an interesting case where the input signal is infinite in duration and the output signal is finite in duration.

4. Frequency Response. 24 points.

Signal Processing First, problem P-6.1, page 157. Please comment on the differences between the input and output signals. What parameter(s) changed? By how much? What parameter(s) didn't change?

As stated on the course descriptor, "Discussion of homework questions is encouraged. Please be sure to submit your own independent homework solution."

NOTE: In your solutions, please put all work for problem 1 together, then all work for problem 2 together, etc. Please see additional homework guidelines on the homework page.