

MATLAB Assignment 6

Spring 2019, Section B

This homework deals with digital filters in a low-level sense. You are expected to know a bit about the z-transform, but if you are not in Signals and Systems, please contact me separately for some additional information on this homework. This homework requires you to produce a few plots; I want nice plots! Axis labels and titles are a must.

Please submit this homework as a `.m` file, with suppressed output. Remember that all lectures and homeworks may be found at github.com/guybaryosef/ECE210-materials. Homework is due on ——— to guybymatlab@gmail.com.

1. Z it up! For this question, you will be working with the discrete system described by the transfer function:

$$H(z) = \frac{\frac{1}{2} + \frac{2}{3}z + \frac{3}{7}z^2}{2 + \frac{1}{3}z + \frac{1}{2}z^3}$$

- Store this transfer function in MATLAB as numerator and denominator vectors, then find the poles and zeros.
- Plot the poles and zeros of H .
- Use ***impz*** to obtain the first 50 points of the impulse response and plot them using the appropriate plotting function.
- Let $x[n] = (-\frac{3}{4})^n$, and take n from 0 to 99. Apply the digital filter H to x using ***filter*** and plot the result.
- Now let us apply the filter analytically using convolution. Apply the digital filter to x using ***conv***. You will have to throw out some values to get the same result. Make another plot to show that the results are the same.

2. You Gotta be Fibbin' Me! The Fibonacci sequence is the sequence of numbers such that every number after the first two is the sum of the two preceding numbers. The first two numbers are both 1. It is cute to imagine a discrete-time system whose impulse response is the Fibonacci sequence!

- Use a for loop to generate the first 100 values of the Fibonacci sequence and plot these values using MATLAB and plot them using ***semilogy***.
- Assuming this is the impulse response of a system, find the output of the system with input $x[n]$ from the above problem and plot it using an appropriate function.