

ECE431 Homework 10 Filters and Poles/Zeros

Submit to ECE431 MOBI cabinet in WisCEL by TUESDAY, November 20 at 3pm.

10.1 OS 5.28

10.2 OS 5.45 a-d, f, g, i

10.3 OS 5.50

10.4 A discrete-time filter has a pole at $z = -2/3$ and two zeros: one at $z = 0$ and the second at $z = 1$. The ROC is $|z| > 2/3$ and the frequency response satisfies $|H(e^{j\pi})| = 1$.

- a) Find the transfer function for this filter.
- b) Find a difference equation that implements this filter.
- c) Find the frequency response of the filter.
- d) Sketch the magnitude of the frequency response and comment on what this filter does to signals.

10.5 You are asked to design a section of a communication system. The goal is to detect the presence of a 500 Hz narrowband signal. The data is sampled at 4 kHz and processed by bandpass filtering followed by comparing the power at the filter output to a threshold. The filter removes interfering signals that may be present at other frequencies. Your task is to design a bandpass filter using pole/zero placement.

- a) Sketch a pole/zero plot of your design.
- b) Find the transfer function and difference equation for your filter.
- c) Plot the magnitude of the filter frequency response using MATLAB.