**ECE 3512: SignalS – Continuous and Discrete**

# Recitation No. 12: DifferenCE Equations REVISITED

In this recitation, we will explore many of the concepts we have learned in this course using two simple discrete-time systems:

y[n] = 0.8 y[n-1] + 0.4 y[n-2] + x[n] + 0.5 x[n-1]

y[n] = 0.25 x[n-2] + 0.4 x[n-1] + 0.75 x[n] + 0.4 x[n-1] + 0.25 x[n-2]

For each of these systems, perform the following computations:

(1) Compute the impulse response.

(2) Compute the frequency response of the impulse response using a Fourier Transform.

(3) Compute the frequency response of the impulse response using a Z-Transform.

(3) Compute the transfer function.

(4) Compute the frequency response of the transfer function.

(5) Plot the poles an zeroes of the transfer function in the z-plane.

(6) Apply a sum of sinewaves at frequencies of 500 Hz, 1000 Hz, and 1500 Hz to these filters and compute the output.

(7) Filter the speech signal from Recitation No. 1 using these filters. Demonstrate that the filter performed as expected using spectrograms, long-term averaged spectra, etc.

Compare and contrast these methods. Explain how they are similar and how they differ. Demonstrate that your results make sense.

You are expected, as always, to compute both analytic answers (manually) and numeric answers in MATLAB to independently verify your results.