**ECE 4522/5514: DIgital Signal Processing**

# Computer Assignment (CA) No. 7: Spectral Analysis

The goal of this assignment is to demonstrate how the parameters used in spectral analysis influence your view of the spectrum. Record your voice at 8000 Hz speaking the phrase “We were away a year ago.” This is a famous phrase form the early days of speech research – it contains no consonants (just vowels and semi-vowels). Using your frame-based analysis program, analyze this signal using these parameters:

1. frame\_duration = 0.1 secs / window\_duration = 5 msec
2. frame\_duration = 0.1 secs / window\_duration = 10 msec
3. frame\_duration = 0.1 secs / window\_duration = 20 msec
4. frame\_duration = 0.1 secs / window\_duration = 40 msec
5. frame\_duration = 0.1 secs / window\_duration = 60 msec

For each analysis window, compute the log magnitude spectrum using a fast Fourier transform (FFT). In all cases, zero-stuff the window so that there are 512 points for the FFT. Compute the log magnitude spectrum.

You can use any publicly available FFT code. Later in the course we will explain this computation.

Let’s assume your file is 10 secs long. Each analysis will generate 100 frames per sec, or 1,000 frames total. Treat the resulting data as a matrix which is 1000 x 256. Normalize the matrix so that the largest amplitude is exactly 255, and the smallest magnitude is exactly 0.

Plot the matrix as an image. This is a very crude spectrogram.

Explain what you observe. If you are not clear, try repeating this experiment with a 250 Hz sinewave, a sum of three sinewaves (250 Hz, 300 Hz and 500 Hz) and white noise.