12.714 Practical Section 02 **May 02, 2012**

Part 1: Analytic transforms versus FFT algorithm

(a) For a box car time domain signal with width 2*BW and amplitude BA, compare the analytic version of the Fourier transform with the numerical calculation from the Matlab fft function.

(b) Repeat the same analytic and numerical calculations for a triangle function.

Part 2: Repeating functions.

Generate a linear function (e.g., gt1 = [-4:0.125:3.99];). Compute the power spectrum (conj(fft).*fftj) and plot in dB.

Replicate the function so that there are two and four saw tooth functions. Compute the power spectrum of the replicated version and compare with the original

Part 3: Process noise example

(a) Generate a realization of a first order Gauss Markov process (an AR(1) model) and compute the auto-covariance sequence and the power spectral density. Compare the computed power spectral density with the theoretical expectation. Also generate a combined FOGM plus white noise model that has the same variance as the first model.

As a specific example: generate 10240 daily samples for a process with 100-day correlation time with a long-term variance of 2 mm^2. For the FOGM plus noise case assume the white noise has a standard deviation of 1 mm.

(b) Divide the data set into 10 segments, and compute the power spectra of each section. Average these power spectra and compare with the theoretical estimates.

Computing spectra from data samples and reducing the noise in these spectra will be covered in detail in the remaining classes.