Signal Image/Processing, GEO 5320/6320, Spring 2013

Instructor: Dr. Keith Koper, koper@seis.utah.edu, 585-3669 (voice)
Lectures: MWF, 10:45-11:35 am, FASB 234
Office Hours: by appointment, FASB 217

Topics
1. Introduction: analog vs. digital, finite vs. infinite, linear time invariant systems, dimensionality, overview of transform methods, review of complex variables and integration by parts

2. Laplace Transform: definition and properties, relevance to differential equations, transfer functions, idealized seismometer response, discrete version (Z-transform)

3. Continuous Fourier Transform: definition and properties, convolution and correlation

4. Fourier Series: decomposition of periodic functions (continuous, finite time series), spectral analysis, Gibbs/windowing/tapering

5. Discrete Fourier Transform: definition and properties, FFTs, sampling issues (aliasing, Nyquist, etc.)

6. Digital Filters: lowpass, highpass, bandpass, notch, Butterworth, poles and zeros, time domain vs. frequency domain

7. Seismological applications of 1D digital signal processing involving cross-correlation and deconvolution

Reading
- The Fast Fourier Transform, Brigham
- handouts and parts of: Of Poles and Zeros, Scherbaum; An Introduction to Seismology, Earthquakes, and Earth Structure, Stein and Wysession; Time Series Analysis and Inverse Theory for Geophysicists, David Gubbins

Grading
- Homework: 50%
- Midterm: 20%
- Final: 20%
- Class participation: 10%