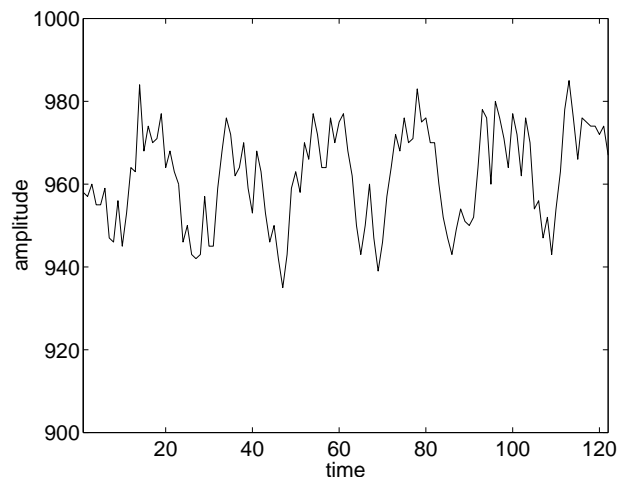


ELEC 431
Digital Signal Processing
Homework 3

Due Friday, January 25, 2002

Note: Homework, tests and solutions from previous offerings of this course are off limits, under the honor code.

The signal depicted below comes from a functional magnetic resonance imaging (fMRI) brain mapping experiment (more on this in later lectures). The signal reflects the variation of the blood oxygenation level in a certain region of the brain over time. This variation is correlated with neural processing. In this case, the subject being studied was performing repetitive finger tapping, and the oscillation in the fMRI signal (recorded from a region in the motor cortex) correlates with this repetitive exercise. The signal is available at the course website (www.ece.rice.edu/~nowak/elec431/fmri_sig.mat).



Analyze the spectral content of the fMRI signal using the DFT (more specifically, use Matlab's FFT function to compute the DFT of the signal).

- a. Plot the magnitude of the DFT.
- b. Identify the dominant sinusoidal component.
- c. Assuming a sampling rate of 4 samples/sec, what is the frequency (in Hz) of the dominant sinusoidal component?
- d. Find a good DC offset plus sinusoidal fit to the data using the magnitude *and* phase of the DFT coefficients associated with the dominant component. Plot and compare your fit with the raw data.