ECE-497/BME-491: Applied Biomedical Signal Processing
Laptop Day #10
Due at the end of class, February 2, 2007

Today we have the following goals

- write a program to compute the rms value over a finite window
- examine the effects of filtering on turns count calculations

At the end of class you should turn in seven plots.

1) Go to the class website and download *turns_count.m* and *emg_dog2.dat*.

2) Write a program that does the following:

- loads the file *emg_dog2.dat*
- computes the rms value of the signal for a window of length M, which is a parameter passed to the function. You should assume M is and odd integer. Your rms compuation should be a noncausal function. Specifically, the rms value of the signal at sample k should be the rms value computed over the interval $k - (M-1)/2$ to $k + (M-1)/2$.
- your program should plot the original signal in one panel, and then the rms value in the second panel. You should also have the value of the parameter M printed out in the title, and your x- and y axes should be neatly labeled (we don't know the scale of the signal, so we won't really be able to label the y axis for the original signal.)
- you don't have to worry about processing the signal at the beginning or ending of the file, where the length of the window would extend beyond the original signal
- run your program for $M = 101, 201$ and 401 and compare the results.

Turn in your code and your three plots.

3) The program *turns_count.m* implements a simple version of a turns count program. The arguments to the program are as follows:

- the number of points in the lowpass filter
- the cutoff frequency of the lowpass filter (in Hz)
- the delay introduced in the signal by differentiating and low pass filtering
- Δ, the y distance that must occur before we determine that a turns count has occurred

a) Use N_lp = 15, cutoff = 500 Hz, and $\Delta = 1$. By varying the delay, determine the best estimate of the delay between the processed signal and the original signal (the circles should align with locations of slope changes). Turn in your plot.

b) Use N_lp = 15, cutoff = 300 Hz, and $\Delta = 1$. By varying the delay, determine the best estimate of the delay between the processed signal and the original signal (the circles should align with locations of slope changes). Turn in your plot.

c) Use N_lp = 15, cutoff = 700 Hz, and $\Delta = 1$. By varying the delay, determine the best estimate of the delay between the processed signal and the original signal (the circles should align with locations of slope changes). Turn in your plot.

d) Use N_lp = 15, cutoff = 1000 Hz, and $\Delta = 1$. By varying the delay, determine the best estimate of the delay between the processed signal and the original signal (the circles should align with locations of slope changes). Turn in your plot.

e) How does the delay change as the cutoff frequency increases? How does the turns count change as the cutoff frequency increases?