Take Home Project #4

(Due Monday, April 30, BEFORE the class session).

The moving average technique is used to remove the high frequency noise and oscillations from a recorded signal, by finding the actual lower frequency "trend" that's underlying the added noise.

The moving average has many forms, and two of the major forms are the "look-forward" and the "look-backwards" schemes, with a pre-defined moving window size.

For a signal $x(n)$ with M data points, the general form of the **look-backwards** moving averaging window is:

$$y(k) = \sum_{n=1}^{N} x(k+n-N)$$

where $N \leq k \leq M$, $y(k)$ is the new filtered signal, $x(n)$ is the original signal, N is the size of the window.

Similarly, the **look-forward** moving averaging window is:

$$y(k) = \sum_{n=1}^{N} x(k+n-1)$$

where $1 \leq k \leq M-N$, $y(k)$ is the new filtered signal, $x(n)$ is the original signal, N is the size of the window.

Requirements:

1) Using the raw right leg EMG_R1 and EMG_R2 signals provided on Moodle, plot the EMG signal versus time, knowing that the data is collected at 256 samples/sec. Provide axis labels, and signal legends.
2) What is the size in the signal? What is the duration of the signal in seconds?
3) Using the definition of the RMS, find the RMS value of the noise in the original signal.
4) Using the definition of the forward-looking and backward-looking moving averages, remove the noise in signal. Choose

the best window size, *N*. Plot the two signals on the same figure. Remember to remove the DC shift in the signal.

5) Show the new RMS values of the noise after filtration for *N*=10, *N*=20, *N*= 30, *N*=50, *N*=100. Also, show the noise attenuation in dB.

For all the requirements above, show the MATLAB code in .m and plots. Send ALL .m files and figures to my school e-mail: mohammad@hu.edu.jo.

Bonus:
Plot the time required for filtering signal versus the averaging window size, *N*. Keep in mind that large window sizes will attenuate the original signal.

Late submissions will NOT be accepted.

Good Luck!