**Exercises Fourier analysis**

**Exercise 1: Fatigue Deltoideus**

A subject is holding a weight of 2.5kg with his arm in horizontal position. During this exercise of 120 s, the activity of the M.Deltoideus is measured with EMG. The sampling frequency of the EMG is 2000 hz.

1. Plot the EMG signal.
2. Remove the offset from the EMG signal. You can do this by subtracting the mean activity from the EMG signal.
3. Plot the frequency spectrum of the signal. You can use the function *make\_freq\_spect*.
4. Remove the 50Hz noise from the signal with a bandstop filter (use butter and filtfilt)
5. Calculate for each second the average frequency of the signal, use the function *get\_mean\_freq.*
6. Calculate for each second the average activity of the M. Deltoideus.

**Exercise 2: Activity Gastrocnemius walking (Home)**

The activity of the gastrocnemius is measured when a subject is walking on the treadmill for several seconds. The sampling frequency of the EMG is 1000 Hz.

1. Plot the Frequency spectrum of the muscle activity.
2. Implement a band pass filter with 50Hz and 400Hz as cutoff frequencies, and compare the frequency spectrum of the original signal with the band pass filtered signal.(use the function butter and filtfilt)
3. Implement a lowpass filter with a cutoff frequency of 200 Hz and compare the frequency spectrum of the original signal with the lowpass pass filtered signal.
4. Implement a highpass filter with a cutoff frequency of 100 Hz and compare the frequency spectrum of the original signal with the highpass filtered signal.
5. Compare the raw EMG signal with the filtered EMG signals.

**Exercise 3: Sound (Home)**

Matlab allows you the display a sound with the function *sound*. In this exercise, you will analyze the influence of lowpass and highpass filtering on a sound signal.

1. Load a signal and frequency that give a gong sound (load gong.mat)
2. Use the function sound
3. Remove the low frequency content of the signal to create a high sound.
4. Remove the high frequency content of the signal to create a low sound.