

EMG assignment (soft deadline) Before November 25.

Exercise 1

Goal of the assignment: learning the basis of EMG pre-processing

Description of the assignment:

- Filter (band pass 30-450 Hz) advise FIR filter, recover phase delay 2 with 'filtfilt'.
- Rectify
- Compute the envelope of the muscle signals (low pass 3-6 Hz)
- now (Question A -why now?) you can down-sample the signal.

Question B- When does the muscle activation starts with respect to the movement (see motion signal)?

What should you send us (upload on teams)?

The Matlab code (with comments) that generates the following figures (better if 1 it is ONLY 1 figure with 3 panels):

- EMG raw signal with on top the filtered signal plotted with a different color.
- EMG rectified with on top the Envelope plotted with a different color.
- The movement signals with on top the envelope (+ answer to question A and B)

You can (not a must) use the live scripts (upload the code and print a pdf).

Exercise 2 – Simulink

Goal of the assignment: learning the basis of (super simple example of EMG-based control):

- Using the .wrl file with the VRsource input block to display 8 targets and a cursor
- Pre-processing the EMG data (noisy signals)

Description of the assignment:

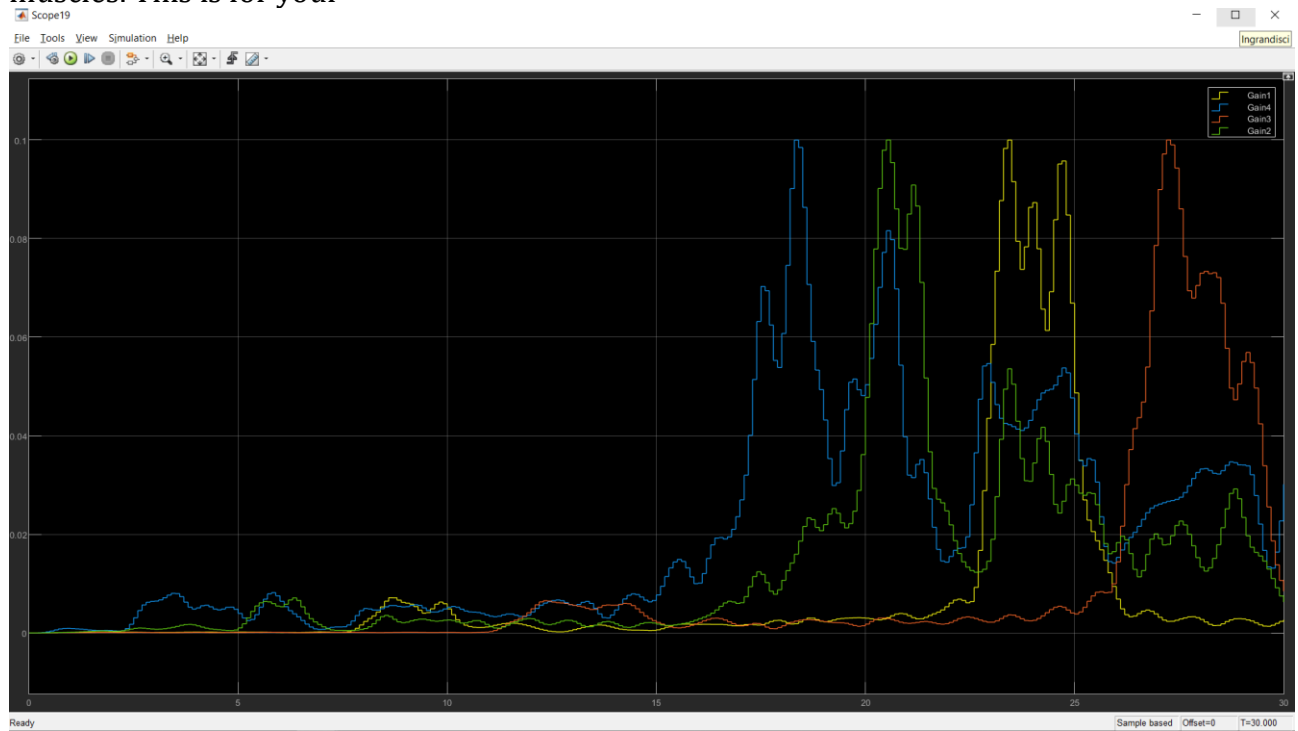
- 1-Move a cursor on the screen controlled by the reading of the four muscles in the mat file 2 (raw_emg_es2.mat Data are normalized for the maximal voluntary contraction - average value over 5 max contractions). You should reach the targets in the 4 cardinal directions i.e. when the muscle contraction is greater than a defined threshold the EMG signal is **mapped into the position of the cursor** in the four cardinal directions (tip: use one muscle to go up, another down etc.). The target is reached when the muscle contraction is above a selected threshold
- 2- How can you reach the other 4 direction displayed on the screen?
- 3- Can you think about a different way to map the muscle and being able to reach all the 8 targets with the activation of these muscles? What are the drawbacks, if any?
- 4- Can you think to a different way of mapping the EMG activity on the control of the cursor (not need to implement...just answer the question motivating your answer)

What should you send us (upload on teams)?

The Simulink files and the answer to the previous questions.

We will run them, and we want to see the cursor moving and reaching the targets simulating a real time acquisition of the muscle activity and a related real time control of the cursor in case 1,2 and 3.

Optional – You can ask the TA to use the EMG system and try in real time with your muscles. This is for your



enjoyment. It would not influence your marks.