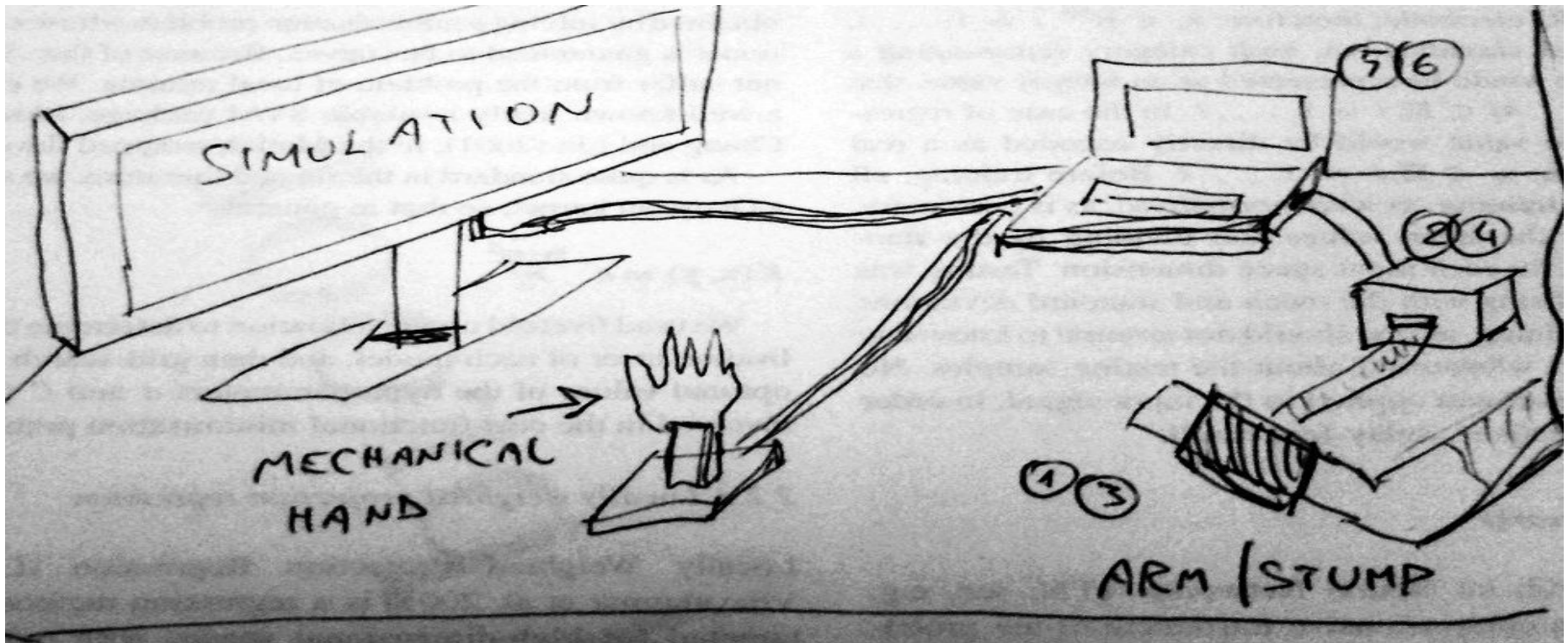


# surface-emg control for hand prosthetics and neuro-rehabilitation

claudio castellini<sup>a</sup>, angelo emanuele fiorilla<sup>a,b</sup>

a university of genova, italy

b italian institute of technology, genova, italy



## how it works

- after **patient / system adaptation** phase,
- the patient **controls** in force and position either
- **a prosthetic hand** (not included in this project!), or
- **an on-screen simulation of a human hand**

*surface emg is cheap and totally non-invasive*

## implementation

1. 5 basic surface emg electrodes suffice for fine force / position feed-forward control of a hand [1,2,3]
2. custom emg amplif. / rectif. / filtering block
3. force feedback via vibrotactile and / or simple innovative device
4. custom dc motor control block
5. entry-level computer and usb
6. patient / system adaptation via machine learning

# applications

- rehabilitation (control of simulated hand on a screen)
  - post-stroke
  - amyotrophic lateral sclerosis
  - muscular disorders / injury
  - phantom limb pain
- prosthetics (control of mechanical hand)
  - active, multi-DOF prosthetic hands
- teleoperation, orthotics control, robotic surgery, haptics,...

# estimated cost

|                        |       |
|------------------------|-------|
| 5 electrodes + leads   | € 25  |
| custom emg ampli block | € 200 |
| daq                    | € 150 |
| dc motor control block | € 50  |
| feedback device        | € 25  |
| <hr/>                  |       |
| total                  | € 450 |

## references

- [1] C. Castellini, E. Gruppioni, A. Davalli and G. Sandini, *Fine detection of grasp force and posture by amputees via surface electromyography*, Journal of Physiology (Paris), to appear, 2009.
- [2] C. Castellini and P. van der Smagt, *Surface EMG in Advanced Hand Prosthetics*, Biological Cybernetics, 100(1), 2009.
- [3] C. Castellini, A. E. Fiorilla and G. Sandini, *Multi-subject / Daily-Life Activity EMG-based control of mechanical hands*, Journal of Neuroengineering and Rehabilitation, under review, 2009.