

Workshop on Functional Electrical Stimulation

FUNCTIONAL ELECTRICAL STIMULATION (FES) uses electrical impulses to invoke motor functions in the body whose voluntary control has been lost through nervous system impairment (e.g. after spinal cord injury or stroke). For this purposes, the electrical impulses are applied to peripheral nerves that control specific muscles or muscle groups, ideally via surface electrodes placed on the skin.

The present hands-on workshop will allow students from engineering and clinical areas to understand the principles of this technology and to apply it on human subjects. Students will participate actively along the workshop. They will work together in small groups and get the chance to experience the potentials and limits of electrical muscle stimulation from a first-person perspective.

In particular, the workshop will focus on theoretical and practical aspects of (1) upper extremities electrical stimulation to allow fingers and wrist activation for grasping, (2) lower extremities electrical stimulation to support lifting of the lower leg and foot while walking (peroneal stimulation for drop foot), (3) the use of EMG feedback to achieve closed loop movement control.

Time Table (3 hours)

Fundamentals of FES – 45 min

- Basic principle of FES (15 min)
- Influencing stimulation parameters (15 min)
- Potentials and limits in application (15 min)

FES for Upper Extremities – 55 min

- Particularities of upper limb stimulation (10 min)
- Exercise demonstration (5 min)
- Group exercise: fingers and wrist motor control (40 min)

FES for Lower Extremities – 55 min

- Particularities of lower limb stimulation (10 min)
- Exercise demonstration (5 min)
- Group exercise: peroneal nerve stimulation (40 min)

Closing the Loop – 25 min

- The importance of motion feedback in FES control (10 min)
- Demo: EMG feedback in FES (15 min)