ED SMAER

Thesis subject 2014

Laboratory: Institut des Systèmes Intelligents et de Robotique: ISIR CNRS UMR 7222
University: Université Pierre et Marie Curie UPMC
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Title of the thesis: Upper limb Prosthetics: technology appropriation and extension of sensorimotor capabilities.

Collaboration within the thesis: J. De Graaf, Institut des Sciences du Mouvement Etienne Jules Marey (ISM), UMR 7287, Aix Marseille Université, CNRS; Institut Régional de Médecine Physique et Réadaptation de Nancy (IRR).

Program affiliation:

This subject can be published on the doctoral school’s website: Yes

Thesis’s summary (Abstract)

There remains a surprising and growing gap between the upper limb robotic prosthetics structures and the approaches available to control such devices. On one hand, devices are becoming more and more anthropomorphic with an increasing number of degrees of freedom (and thus more parameters to control), and on the other hand, only a few limited myoelectric control techniques are currently available to patients. Among the forthcoming approaches, invasive techniques are making their way. Nevertheless, these techniques, as they require a complex surgical intervention and are currently lacking experimental results, are not to be considered as viable alternatives yet. The main objective of this thesis is therefore to develop and evaluate some alternative control approaches for patients fitted with an upper limb prosthesis that are non-invasives, robust and offer a more natural command. To achieve this, we will use the latest tools developed in the field of robotics in order to design a control approach based on human body joint measurements that are externally available, robust and non-constraining (head and scapula movements), in addition to myoelectric signals available on the stump. More generally, we will investigate approaches to reduce the dimensionality of the control through the use of knowledge on human joint synergies inside the control and through the biomimetic adaptation of some control parameters. The objective is to reduce the cognitive load on the patient. Experiments will be performed both with amputated patients fitted with experimental prosthesis and healthy subjects controlling an external robotic manipulator. Finally, throughout this project, careful attention will be paid to conduct researches in close collaboration with therapists and with ongoing exchanges with patients.