Biofeedback by using Electrical Stimulation

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Man-machine interfaces are leading into an era where the intelligent devices are becoming part of our every day lives. In our laboratory we work in the development and implementation of a biofeedback interface for an electrically powered electromyography (EMG) controlled prosthetic hand (Fig.1). One of the major problems for the prosthetic devices is the lack of feedback to the human body that will help in the recognition of the device, facilitating its control. Having only visual feedback, and lacking of any form of proprioception, the prosthetic's users requires of a conscious effort in order to control the device.

We believed that providing with an interface that allows the user to interact directly with the device will increase its controllability. In our laboratory we use functional electrical stimulation (FES) (Fig 2) to supply the user with tactile information by translating pressure into electrical stimulation. In the current development, we use conductive rubber based pressure sensors that provide the interaction between surrounding environment and the machine. The signal acquired is then translated into a duty cycle controlled pulse based stimulation signal to interact with the human body. We expect that the biofeedback signal applied directly to the system's user will allow the subject to have direct interaction with the environment, reduce the effort generated by the use of only visual feedback, and increase the acceptance rate in the prosthetic hand use. Our research also includes the measurement of the biofeedback effects using fMRI.

Keywords: EMG control, Biofeedback, subconscious control, extended proprioception.

References

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Fig. 1 EMG controlled Prosthetic Hand

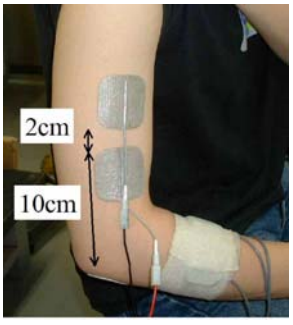

Fig. 2 Electrical Stimulation

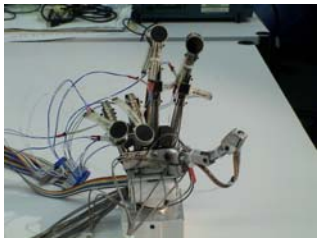

Fig. 3 Pressure Sensors