SCIENCE*SPRING*DAY

Physics

Current Waveform Modulation in Electrical Stimulation

Biomedical Engineerig

CEFITEC
Centre of Physics and Technological Research

pluX

Tiago Araújo

Advisor: Prof. Hugo Gamboa

2005-2010: MSc in Biomedical Engineering at FCT/UNL

2011 – Present: R&D Engineer at PLUX and PhD student

Objectives

This PhD project proposes to answer the following questions of scientific relevance, in the context of electrical stimulation:

- In the context of muscle stimulation: What are the changes induced when using different waveforms, concerning the strength pattern and contraction fatigue?
- In peripheral nerve stimulation: What's the influence of the waveform at different excitability of nerve fibers? The waveform may be a selective tool for the activation of different fibers?
- In bioelectrical impedance, what's the influence of the waveform on the current pulse penetration?

Methodology

To answer these questions, it is proposed to develop a miniaturized, portable and wireless controlled device, with electrical stimulations functions and full integration with generic biosignals acquisition platform. It is intended that the hardware allows a more complete parameterization of the stimulus applied, namely in terms of stimulus waveform, and a flexibility that allows the application of a stimulation session with different kinds of stimulus. Biosignals processing algorithms will be developed to provide feedback about the electrophysiology influence of the applied stimulus.
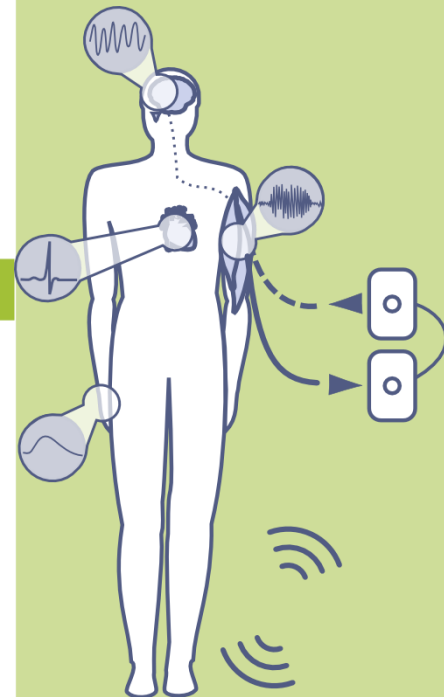
Expected Results

The developed solutions have high applicability in psychomotor rehabilitation, diagnosis of neuromuscular diseases and functional electrical stimulation (FES) context.

Publications:
- Araújo, T., Nunes, N., and Gamboa, H. (2012) Miniaturized Wireless Controlled Electrostimulator. In Proceedings of Biodevices - International Conference on Biomedical Electronics and Devices (BIOSTEC 2012), Vilamoura, Portugal.
- Araújo, T., Nunes, N., Quintão, C. and Gamboa, H. (2012) Localized Electroencephalography Sensor and Detection of Evoked Potentials. In Proceedings of MindCare 2012, 2nd International Workshop on Computing Paradigms for Mental Health (BIOSTEC 2012), Vilamoura, Portugal.
- Gamboa, H., Matias, R., Araújo, T. and Veloso, A.(2012) Electromyography onset detection: new methodology. In Proceedings of the 18th Congress of the European Society of Biomechanics (ESB2012), Lisboa, Portugal.
- Costa, N., Araujo, T., Nunes, N. Gamboa, H. (2012) Knowledge Acquisition System Based on JSON Schema: Implementation of a HCI for Actuation of Biosignal Acquisition Systems. In Proceedings of the 10th International Conference on Wireless Information Networks and Systems (ICETE-WINSYS2012), Rome, Italy.
- Costa, N., Araujo, T., Nunes, N., Gamboa, H. (2013) Multi-purpose Electrostimulator Software. In Proceedings of Biodevices - International Conference on Biomedical Electronics and Devices (BIOSTEC 2013), Barcelona, Spain.
- Araújo, T., Nunes, N., Gamboa, H. and Fred, A. (2013) Distance-based algorithm for biometric applications in meanwaves of subject's heartbeats. In Proceedings of International Special Session on Biometrics: Technologies, Systems and Applications (BTSA 2013), Barcelona, Spain.