UNIVERSITY OF GENOA
DEPARTMENT OF INFORMATICS, BIOENGINEERING, ROBOTICS AND SYSTEMS ENGINEERING
MASTER'S PROGRAM IN BIOENGINEERING

Thesis Project Form

Title (tentative): Fabrication and characterization of magnetically-connectable epidermal electrodes for EEG applications

Thesis advisor(s): Raiteri Roberto, Maura Casadio, Annalisa Bonfiglio, Andrea Spanu

E-mail: Roberto.Raiteri@unige.it

Address: Via Opera pia 11a 16145 Genova

Phone: (+39) 010 33 52762

Description

Motivation and application domain

In the era of wearable electronics, the concept of seamlessly and unobtrusively monitor biopotentials from the surface of the skin is rapidly taking over the biomedical field. In particular, being able to acquire high-quality EEG signals while at the same time maximizing the subjectâ€™s comfort, and thus reducing the stress induced by the usually cumbersome measuring setups, is of the utmost importance in order to record clean and unbiased data. To this aim, tattoo electrodes have recently attracted considerable attention in the field, thanks to their imperceptibility, optimal conformability to the skin, and versatility. However, the interconnection between these ultrathin electrodes and the readout electronics is typically challenging, due to the mechanical and structural mismatch between the two components.

General objectives and main activities

The goal of this activity is to investigate innovative ways to contact these epidermal electrodes without disrupting their conformity to the skin, while at the same time being able to acquire high-quality biopotentials.
The activities involve the fabrication of epidermal electrodes based on the conductive polymer PEDOT:PSS loaded with ionic liquids (ILs) or deep eutectic solvents (DESs), and ferrimagnetic particles. The role of the IL or DES is fundamental for the improvement of the PEDOT:PSS conformability, as well as the optimization of the skin/electrode contact impedance. Additionally, the ferrimagnetic particles enable the obtainment of isotropically conductive free-standing films that can be easily contacted from the backside using magnetic connectors. The activities include the fabrication and complete characterization of the electrodes and their validation for the acquisition of EEG signals.

Training Objectives (technical/analytical tools, experimental methodologies)

Fabrication of epidermal electrodes for biopotentials acquisition, by means of large-area techniques
Electrical characterization of epidermal electrodes for biopotentials acquisition
EEG acquisition using commercial polygraphs
Software tools for data analysis

Place(s) where the thesis work will be carried out: DIBRIS â€“ DEAlab (University of Cagliari) â€“ MEDSP (University of Cagliari) â€“ FLOWLab (IUSS)

Additional information

Maximum number of students: 1