

Job description offer for PhD student in biomedical/electronic engineering



1. Context of the study

The incidence of severe heart failure, optimally treated in the G7 countries, reaches today 200,000 patients per year.

Today, the mortality rate is dramatic and represents the first cause of death before cancer: 50% at one year of follow-up.

5,000 patients can benefit from a heart transplant each year in the world while only 7,000 can be implanted with a cardiac assist device (a cardiac pump) due to major limitations of the available technology. In other words, more than 150,000 patients per year have no efficient solution and this represents a true engineering challenge and a major public health issue.

The FlowMaker® that FineHeart® SA is developing is a new wireless concept along with a miniaturized intra-cardiac pump allowing an easy and rapid surgical procedure on a beating heart which is unique. The human application has been planned for next year.

The FlowMaker® benefits from a sophisticated software permitting to adjust the level of pump assistance to the condition of the patient, which does not exist up to now; accordingly, the device is adjustable by the physician or the engineer via a clinical programmer.

2. Description of project partners

2.1. FineHeart

FineHeart S.A. is an innovative start-up specialized in cardiology, based in Pessac, close to Bordeaux. Its new medical device, the ICOMS FlowMaker® (Implantable Cardiac Output Management System) is an intracardiac pump that helps severe heart failure patients to complete the ejected blood volume at each cardiac cycle.

This medical device mixes the expertise of 2 famous cardiologists and the know-how of talented engineers in the mechanicals, electronics, and automatics fields.

2.2. IMS-Bioelectronics group

The IMS laboratory at the University of Bordeaux deploys a broad spectrum of research in Systems Engineering and Technologies applied to the environment and to interactions with humans. The Bioelectronics group is multidisciplinary because it brings together researchers with initial skills in Life Sciences and Engineering Sciences. The methods in Biology range from molecules to small animals; the methods in Electrical Engineering range from physical biophysical modelling, design of specific circuits and systems to embedded computing. Previous researchers have been conducted in the field of cardiac implantable device, investigating bioimpedance spectroscopy to characterize cardiac tissue remodeling around electrodes.

2.1. IMS-Bioelectronics group

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The CELL group of ETIS-lab (*'Equipes de Traitement de l'Information et Systèmes'*) is a multidisciplinary team working in the field of electronics, signal and image processing for the modeling and design of reconfigurable, communicating, reliable and intelligent embedded systems. Previous research have been held on electrical characterization of in-vitro cultured cells. This work resulted in the design of embedded system for large band bio-impedance measurement as well as methods for extraction of quantitative models of tissues properties. ETIS can provide expertise in impedance modeling, and embedded measurement systems as well as computational resource for multi-physics modeling of bio-electronic interfaces

3. Description of the function

As part of a CDD, we are looking for:

PhD student in biomedical/electronics engineering

4. Responsibilities and hierarchy

5. Status

Classification level: /
PhD student

6. Missions

The main goal of the project is to develop a biosensor able to identify and monitor relative changes in cardiac volumes; such a sensor would allow the device to automatically modify the rotational speed regimens according to the level of cardiac blood filling (volume variations), which is determinant to simplify the device programming.

A state of the art of technologies for implantable volume sensors should be investigated, including the cardio-impedance in situ measurement. The chosen technology should be characterized in the specific context by using biophysical simulation and biological experiments. Finally, this should open the way to the design and test of a prototype of sensor, including synchronization algorithms.

7. Researched profile and skills

- Master's degree in electronics engineering or biomedical engineering
- Good knowledge in Signal Processing
- Knowledge of MATLAB coding and COMSOL simulation is appreciated
- Expertise in applied electronics design
- Microelectronics knowledge is a plus
- Team and initiative spirit
- Autonomous and strongly motivated
- English level reading and writing: Fluent
- Interest in the biomedical field

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8. Remuneration

- About 24k€

9. Hiring date

As soon as possible

10. Contact

Are you looking for new challenges, in an internationally oriented start-up? Do not hesitate to send your resume and cover letter to mirko.maldari@fine-heart.com and Chantal.rada@fine-heart.com naming the object description of your email as: CV_CIFRE22.