Centre de Nanosciences et de Nanotechnologies

Soutenance de thèse

Mardi 28 janvier

14h00
Centre de Nanosciences et de Nanotechnologies
10 boulevard Thomas Gobert
91120 Palaiseau
Amphithéâtre

Rafael CORDERO ÁLAVREZ

" Subcutaneous Monitoring of Cardiac Activity for Chronically Implanted Medical Devices"

Jury members :

Alfredo Hernandez	Directeur de Recherche	INSERM LTSI 1099	Rapporteur
Remi Dubois	Maitre de Conférences HDR	Université de Bordeaux, Liryc Centre de Recherche Cardiothoracique	Rapporteur
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Jacques Felblinger	Professeur des Universités Praticien Hospitalier	Université de Lorraine (Unité INSERM 1254)	Examinateur
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Pierre-Yves Joubert	Professeur des Universités	Université Paris-Sud (C2N UMR9001)	Directeur de thèse
Delphine Feuerstein	Ingénieure de Recherche	MicroPort CRM (Clinical Engineering)	Co-encadrante de thèse
Serge Cazeau	Cardiologue/Chief Medical Officer,	Hôpital Paris Saint Joseph /MicroPort CRM	Invité

Abstract :

The aim of this doctoral thesis was the development of sensors and algorithms for the improved monitoring of cardiac activity in the subcutaneous implantable cardioverter-defibrillator (S-ICD). More precisely, to improve the detection specificity of dangerous tachyarrhythmia such as ventricular tachycardia (VT) and ventricular fibrillation (VF) in the S-ICD. Two independent VT/VF detection schemes were developed for this: one electrophysiological in nature, and the other hemodynamic.
The electrophysiological sensing scheme relied on a special ECG that was recorded along a short dipole located above the lower left pectoralis major. This short dipole maximised R/T ratio and signal-to-noise ratio in a total of 9 healthy volunteers. In theory, it will reduce the risk of false positive VT/VF detections simply by consequence of the dipole size, location, and orientation and independently of any further signal processing methods.
The hemodynamic sensing scheme relied on cardiac vibrations recorded from two tri-axial accelerometer prototype sensors. These subcutaneous cardiac vibrations were characterised, physiologically validated, and optimised via their filtering along specific bandwidths and projection along a patient specific reference frame. The world's first independent cardiac vibration VF detection algorithm was developed operating on these optimised signals.
The same accelerometer prototypes were also shown to be able to record respiratory accelerations and detect apnoea.
A final subcutaneous lead prototype was developed capable of recording the short dipole ECG, cardiac vibrations, and respiratory accelerations. It consisted of three electrodes, a bi-axial accelerometer, and industry-standard device connectors. The prototype lead was implanted in a fourth and final animal

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