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Emerging methods for measuring, modeling and instrumentation in medical applications

Abstract

In October, 1958, the first implantable pacemaker was implanted in Sweden. It lasted just a few hours. In February 3, 1960 in Montevideo, Uruguay, Dr. Orestes Fiandra and Dr. Roberto Rubio implanted another pacemaker in a patient. This pacemaker -also manufactured in Sweden- lasted several months. It was the first implantable pacemaker that was able to support the life of a human being. Previous to this implant, people with severe bradycardia had to be connected to a device fed by the mains.

The first implantable pacemakers were asynchronous; they just paced the right ventricle at a fixed rate. Some years were necessary to be able to sense ventricular activity in order to make pacemakers that only paced the right ventricle when it was necessary (on demand). Later, sensing of the atrium signal was included and even after that, sensing of different parameters (such as one of the most common, the acceleration) were included in order to know the physiological needs of the patients to adjust the heart pacing rate consequently.

From the first implanted pacemakers until today, some new implantable systems were released to the market. Implantable defibrillators, spinal cord stimulators for chronic pain, cochlear implants, and deep brain stimulators are examples of devices with a pretty mature technology.

At the same time a lot of new therapies involving an active implantable medical device (AIMD) are investigated every year. CCC Medical Devices (from now on CCC) is a company that designs and manufactures AIMD systems for third parties. CCC was created in 1976 by Dr. Orestes Fiandra with the purpose of manufacturing pacemakers. In 1998, CCC started working in a new field, the design and manufacture of AIMDs for third parties. . This field quickly became CCC's main business and since 2010 it is its only business area because it cancelled the pacemaker's production. During the last 15 years CCC has designed more than 25 systems for more than 15 different diseases. In almost all these systems the main component is an IPG (Implantable Pulse Generator). In about half of them the implantable device has biological signal measurements capabilities.

This presentation will have three parts. First, it will go through the history of the first pacemaker implant in Uruguay and the evolution of the implantable pacemakers, paying special attention to the Uruguayan ones. In the second part, it will describe the possible components of a complete AIMD system. Lastly, it will cover the disclosable experience of CCC regarding the kind of measurements that the AIMDs perform and its characteristics.