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**SUBPROGRAMA RAMON Y CAJAL  
CONVOCATORIA 2011**

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**Referencia:** RYC-2011-09367

**Area:** Ingeniería Eléctrica, Electrónica y Automática

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**Título:**

Opto-electro-microfluidic systems for real time monitoring of (bio)molecules

**Resumen de la Memoria:**

This application proposes the design, optimization and characterization of lab on chip systems combining optical and electrochemical transduction (both for stimulating and/or measuring) with suitable microfluidic architectures for the detection of (bio)molecules (or more complex structures) of interest. The lack of appropriate control systems is responsible of important economical (and even personal) losses annually in several areas. For instance, food contamination is regularly reported on TV and newspapers with dramatic effects on both the economy of the company and the costumers' health. Significant efforts have been done by the scientific and technological communities in the development of suitable systems to solve it. Unfortunately, although showing good performance in the laboratory, most of them failed when applied at real systems. This fact was mainly associated to the lack of robustness of the systems, which could not adapt to the complex and changing environmental conditions, and the fragility of the devices. The possibility of integrating several microfabrication technologies in simple, compact and micrometric platforms containing both the electro-optical setup (light sources, lenses, mirrors, photo-diodes, microelectrodes, etc) and the fluidic systems (which can include purification, separation or pre-concentration processes) would establish the base for a new generation of instruments applicable to some fields with significant impact in research and industry. Thus, the present proposal pretends to develop high performance lab on chips as control/alarm systems in several strategic areas. For this purpose, several objectives have been identified: 1. Development of lab on chip architectures adapted to real changing environments. 2. Integration of micro-optical and micro-electrochemical setups in polymeric microfluidic structures containing stimulation and measuring elements. 3. Study of cross-talk and performance of the stimulation-measurement systems. 4. Monitoring of relevant (bio)molecules under real environmental conditions. 5. Identification of the industrial potentiality of the developed systems.

**Resumen del Curriculum Vitae:**

During his career the candidate participated in 9 research projects (6 national projects and 3 EU projects) producing 24 regular papers published in referred journals (3 more already submitted), 2 book chapters, 4 patents (all of them already expanded to the EC and two in process to be expanded to the US and China) and 14 contributions in international congresses (12 posters and 2 oral presentations). The candidate also participated in the formation of 5 PhD students, 2 master students and 1 visiting student in different prestigious research centers. Along this period, the candidate's activity was focused in both technology and knowledge transference to biological sciences, combining fabrication technologies (photolithographic methods and softlithography), promising and emerging transduction methods (impedance and SPR) and relevant biological applications (e.g. bacterial counting, bacteriophages detection, glutamate monitoring, among others). The candidate is already involved in the generation of a spin-off (Screen/mAb) in collaboration with other researchers of the Universidad de Sevilla and the IMB-CNM. Thus, the candidate demonstrates know-how and expertise in: 1. Design, characterization and optimization of electrochemical and optical biosensors for industrial, environmental and clinical applications. 2. Physico-chemical characterization and microbial testing of antibacterial products (powder, liquids and polymerized on surfaces). 3. Construction of setups for cell analysis (patch clamping and patch amperometry). 4. Capacity of technology transference: organization of biotechnological workshops, development of patents and generation of spin-off companies. 5. Supervision of PhD, master and visiting students.



Nombre: **PRODANOVIC , MILAN**

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**Título:**

Intelligent Power Interfaces for Real-Time Management of Future Power Networks

**Resumen de la Memoria:**

Solution for further network integration of renewable energy sources and, in particular, improved energy capture from intermittent sources should be sought in development of novel, intelligent and flexible active network management algorithms along with an increased deployment of energy storage devices. By taking advantage of improved access to measurement and control data, future power networks (often referred to as SmartGrids) will be able to operate in grid-connected or islanded modes, to actively manage generation, storage and demand, enable integration of electric vehicles, accommodate diverse contractual agreements in a deregulated energy market and at the same time provide real-time energy trading functionality between all the participating entities. The main research objective is to devise, develop and validate algorithms for new intelligent power interfaces that will provide smooth integration of any network component to future power networks. The areas of particular interest are decentralised active network management algorithms, interface for energy storage devices, energy efficiency improvement in industrial applications, control of distributed generation (including virtual power plants), integration of electric vehicles and creation of a real-time energy market in distribution networks. Various power electronics converters will be used in future power networks to interface generation and the grid, control energy storage devices, provide active front-end for smart consumers and electric vehicles, drive various actuators and lighting applications in smart buildings, enable DC power distribution in densely populated areas etc. Research in novel converter control strategies based on intensive use of communication technologies will be conducted to enable coordination of control actions across power networks and provide any necessary arbitration over access rights to network resources. The levels of energy generation, consumption and network power flows will be then determined in a process of real-time negotiation and information exchange between all the intelligent entities connected to the network.

**Resumen del Curriculum Vitae:**

RESEARCH EXPERIENCE: 2010-Present IMDEA Energía, Madrid, Spain Senior Researcher in Electrical Processes Unit The Hotel of Future (THOFU) (2010-present); Integration of renewable energy sources and energy storage to hotel network; Smart algorithms for real-time energy management for future hotels Energy Saving in Systems for Vibration Testing (2010-present); Optimisation of energy consumption in vibration testing; Creating integrated thermo-electro-mechanical models of vibration systems Energy Management in Systems for Water Purification (2010-present); Identification of power loss distribution in systems for capacitive deionisation; Investigation in energy management techniques to improve energy efficiency 1999-2010 Department of Electrical and Electronic Engineering, Imperial College, UK PhD Degree Research Topics: Power Electronics, Distributed Generation, Power Quality, Digital Control Systems, Grid Interface, Parallel Connection of Three-Phase Inverters, System Modelling Thesis Title: Power Quality and Control Aspects of Parallel Connected Inverters in Distributed Generation; Research Associate in Control and Power Section Autonomous Regional Active Network Management System (2007-2010); Developing novel techniques for decentralized control and testing of future power systems (AuRA NMS project in collaboration with ABB, Scottish Power, EDF); Development of the real-time power network simulator for testing the control actions at the substation level by using IEC61850 communication protocol SuperGen Microgrids (2005-2007); Design and construction of a lab microgrid consisting of three 10kVA power inverters, programmable loads, model distribution network and instrumentation and control; Stability analysis and control of inverter based microgrids; Power optimization for photovoltaic systems (maximum power point tracking) DisPOWER (2002-2005); Research in modular designs for high power inverter based generation; Power quality improvement in inverter based generation VESEL project (Village e-Science For Life) (2006-2009); Assisting agricultural development in rural parts of Kenya by using digital technologies; Design of solar powered solutions for the off-line resource kit Industrial Collaboration; Implementation of energy saving techniques to vibration systems (active frontend, variable speed drives and DC/DC converters etc.); Design of modular high-power (10kVA per module) switching amplifier used in vibration testing 1999-2002 The TurboGenset Company, London, UK Research & Development Engineer / part-time; Hardware and control system design for 400kVA three-phase inverters for gas-turbine applications 1997-1999 Research, Development, Manufacturing Company; GVS; Belgrade, Serbia Research & Development Engineer; Hardware and software design for DSP controlled large UPS systems Membership of Professional Bodies, Advisory Boards; Member of The Institute of Electrical and Electronic Engineers (no. 41465764); 2009 External referee for wind energy lab at University of Ghent, Belgium PUBLICATIONS: 4 IEEE Transactions and 2 other international journal papers, 10 conference papers. PATENTS: 3 International patents registered