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# Expression of Interest

## Contact Person/Scientist in Charge

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## Instituto de Robótica e Informática Industrial

## Department / Institute / Centre

- **Name:** Institut de Robòtica i Informàtica Industrial, CSIC-UPC
- **Address:** Llorens i Artigas 4-6, 08028
- **Province:** Barcelona

## Research Area

- Information Science and Engineering (ENG)

### **Brief description of the institution:**

The Institut de Robòtica i Informàtica Industrial is a Joint Research Center of the Technical University of Catalonia (UPC) and the Spanish Council for Scientific Research (CSIC), that conducts research in Robotics and Automatic Control.

### **Brief description of the Centre/Research Group (including URL if applicable):**

The Institut de Robòtica i Informàtica Industrial (IRI) - [www.iri.upc.edu](http://www.iri.upc.edu) - is a Joint Research Unit (JRU) composed by members from the Universitat Politècnica de Catalunya (UPC) and the Spanish National Council for Scientific Research (CSIC).

CSIC is the largest public institution dedicated to research in Spain and the third largest in Europe. Belonging to the Spanish Ministry of Economy and Competitiveness through the Secretary of State for Research, Development and Innovation, CSIC has considerable experience in both participating and managing R&D projects and training of research personnel.

UPC is a public university dedicated to research and higher education, specialized in the fields of architecture, science and engineering. It is a university committed to excellence, a driver of economic and social change, and an institution that is extremely well connected to the industry.

IRI has three main objectives: to promote fundamental research in Robotics and Control, to cooperate with the community in industrial technological projects, and to offer scientific education through graduate courses.

Its **AUTOMATIC CONTROL** line develops basic and applied research in automatic control, with special emphasis on modelling, control and supervision of nonlinear, complex and/or large-scale systems.

The group has acquired specific expertise in the application of advanced control techniques to environmental resources management, specifically in the water and energy fields.

[http://www.iri.upc.edu/research/automatic\\_control](http://www.iri.upc.edu/research/automatic_control)

### **Project description:**

Title: **Design of controllers for energy systems based on hydrogen technologies**

Description: With the final aim to design controllers for energy systems based on hydrogen technologies, one fundamental objective is to obtain dynamic models of these complex non-linear systems that involve electrochemical, fluidynamic, electrical and mechanical processes. First principle models that reinforce the comprehension of all the internal phenomena are required in order to design the most appropriate control strategies. Within the modeling objectives, distributed parameter models, model order reduction, parameter identification and experimental characterization techniques combining time and frequency responses are included. Special importance is given to the design of observers that can estimate the internal states of the energy systems for their better control and permit to minimize the number of sensors. Regarding control system design, different advanced control techniques are possible: Passivity-Based Control, Optimal Control, Model Predictive Control, Robust Control, Variable Structure Control or Linear Parameter Varying Control. In the higher control level, supervisory controllers that are in charge of the efficient power flows distribution have to be designed. They need to take into account the system life time and prevent from degradation. Also, diagnosis systems can support the supervisory controller in case that special operation is necessary because of failure or critical degradation.

## **Applications**

CV and letter of interest