

**PhD: “Active control of sensors: RH sensors for Mars + chemical MOX gas sensors”**

**Position: PhD Thesis in Electronic Engineering with FI or FPU fellowships**

**Micro and Nano Technologies Group and Dept. of Mathematics & Institute of Industrial and Control Engineering, at:**

- **Technical University of Catalonia (UPC)**
- **in collaboration with the Astrobiology Center (CAB, INTA-CSIC).**

**Laboratory: UPC Campus Nord and Campus Sud. Barcelona. Spain.**

**Keywords: Sensors, control, planetary exploration, miniaturization.**

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**Date of Publication : the 20th of June 2019.**

## 1. CONTEXT OF THE PhD

### a. Candidate

He/She must have validated a master or engineer degree in order to be able to enroll in a PhD position by approximately September 2019. He/She must have a good knowledge in analog and digital electronics. Candidates willing to combine experimentality with theory/modeling are welcome.

### b. Supervision

The thesis will be made at the facilities of the MNT group in UPC Campus Nord, Jordi Girona 1-3. 08034 Barcelona, Spain. The thesis advisors are

Name	Institution	Role
Manuel Domínguez-Pumar	UPC <a href="mailto:manuel.dominguez@upc.edu">manuel.dominguez@upc.edu</a>	Co-supervisor
Josep M. Olm	UPC <a href="mailto:josep.olm@upc.edu">josep.olm@upc.edu</a>	Co-supervisor

## 2. TECHNICAL CONTEXT AND MOTIVATION

The MNT group has participated in the design, fabrication and calibration of the wind sensors in three NASA missions to Mars:

- **Rover Environmental Monitoring Station (REMS):** instrument for Mars Science Laboratory (Curiosity rover): launched in 2011 [1-3].
- **TWINS instrument for InSight:** launched in 2018.

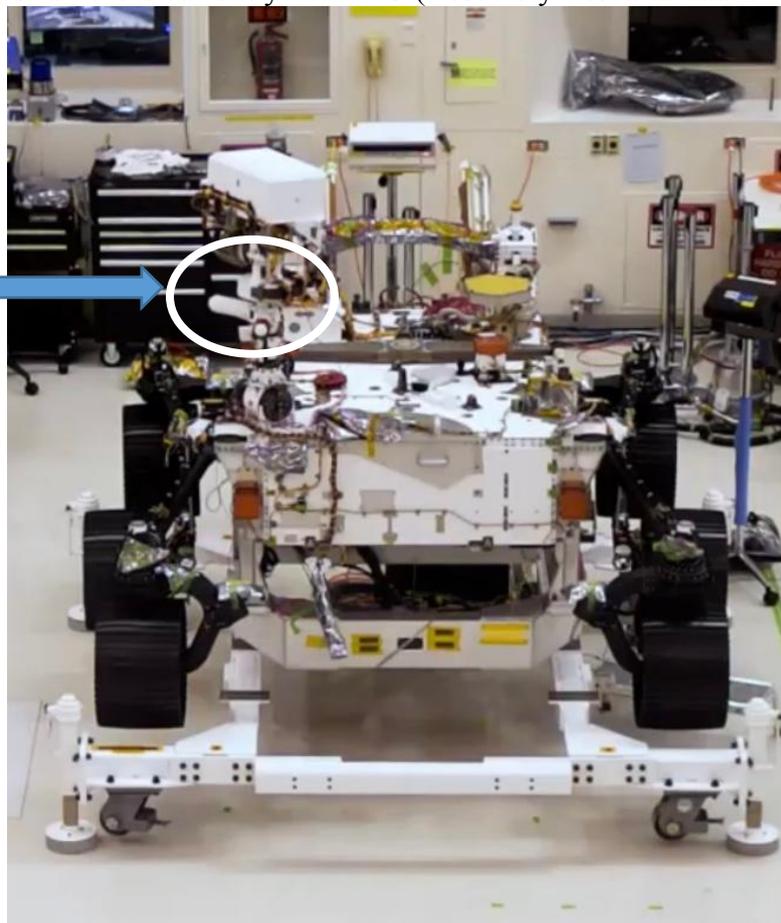
- Mars Environmental Dynamics Analyzer (MEDA) instrument to be launched in July 2020 within the Mars2020 mission.

The thesis is associated with a project recently granted by the Spanish Ministry for Science, RTI2018-098728-B-C33, with the title:

*“Instrumentation for characterizing the Martian environment in NASA missions: Wind Sensor for MEDA (conclusion of phases D and E)”*

The objective of the project is to carry out Phases D and E of the MEDA instrument (Mars Environmental Dynamics Analyzer) for Mars2020. Additionally, work will be developed for new miniaturized sensors working under smart controls, intended for future missions.

The MEDA instrument is currently in ATLO (Assembly Test and Launch Operations):



MEDA wind sensor:  
Two cylinders protruding in  
the mast

Figure: Picture of the Mars2020 rover in ATLO at JPL (Jet Propulsion Laboratory).

### 3. OBJECTIVES OF THE THESIS

The main objectives of the proposed thesis are related with the previous project:

- Development of **controls and system identification techniques for sensors designed for planetary exploration** in future missions, as well as terrestrial applications:

- The first target sensor technology is chemical gas sensors based on Metal Oxides (MOX). The UPC group, working with a group from URV, has designed a new mode of operation of these sensors called Constant Surface Potential Operation. The objective now is to continue this work in gas sensors.
- A second target is to expand the control principles to other types of sensors, such as humidity sensors (RH). **The main application is the detection of frost events in Mars atmosphere.**
- Finally, advanced control techniques will be explored. In particular, sliding mode control has revealed as an excellent tool to improve the response of wind [5] and chemical [7,8] sensors when switching surfaces are appropriately selected. The study will take advantage of the current state-of-the-art in control design, and new technical tools will be eventually produced when required. Hence, contributions to the control theory field are also expected in this thesis.

#### 4. FINANCIAL CONDITIONS

We expect the candidates to apply for the competitive FI and/or FPU fellowships. These fellowships, in case they are granted to the candidate, fund the PhD for **4 years**. The **net quantities** for the PhD candidate are in the range: **1000-1100 euros/month**.

The call for this fellowship is scheduled for **September 2019**.  
The detailed information for last year call is:

FI fellowship:

<http://agaur.gencat.cat/en/beques-i-ajuts/convocatories-per-temes/Ajuts-per-a-la-formacio-i-contractacio-de-personal-investigador-novell-FI-2019>

FPU fellowship:

<http://www.ciencia.gob.es/portal/site/MICINN/menuitem.dbc68b34d11ccb5d52ffeb801432ea0/?vgnnextoid=1ed8a1b39e186610VgnVCM1000001d04140aRCRD&vgnextchannel=107b2d4c1bf47610VgnVCM1000001d04140aRCRD>

The respective calls for this year are expected to be very similar.

If interested contact us asap

## References

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