



## Guia docent

# 205224 - 205224 - Exploració Robòtica del Sistema Solar

Última modificació: 29/05/2020

**Unitat responsable:** Escola Superior d'Enginyeries Industrial, Aeroespacial i Audiovisual de Terrassa

**Unitat que imparteix:** 748 - FIS - Departament de Física.

**Titulació:** GRAU EN ENGINYERIA EN VEHICLES AEROESPACIALS (Pla 2010). (Assignatura optativa).  
GRAU EN ENGINYERIA EN TECNOLOGIES AEROESPACIALS (Pla 2010). (Assignatura optativa).

**Curs:** 2020

**Crèdits ECTS:** 3.0

**Idiomes:** Anglès

### PROFESSORAT

---

**Professorat responsable:** Manel Soria

**Altres:** Manel Soria

### CAPACITATS PRÈVIES

---

General concepts of aerospace vehicles. Programming skills in any computer language (preferably, Matlab). Interest for space engineering.

It is advisable to have taken the course 220013 Vehicles Aeroespacials.

### REQUISITS

---

### METODOLOGIES DOCENTS

---

The course will be developed through theoretical lectures and hands-on sessions where the students will study previous robotic probes and their scientific results. In many cases, the students will need to develop small computer codes to process the large amounts of data available. Where possible, the original data such as RAW images or SPICE kernels will be used for the class examples, as well as the original journal papers.

### OBJECTIUS D'APRENTATGE DE L'ASSIGNATURA

---

- Have a basic knowledge of the main solar system bodies and the main present, projected and previous exploration probes such as Voyager or Cassini.
- Understand at an introductory level the main space engineering concepts involved in the design of the probes, such as attitude control system, electric power or propulsion.
- Understand the main remote sensing instruments and techniques such as multispectral cameras or radio occultation at an introductory level.
- Understand at an introductory level the digital image formats and main processing algorithms such as contrast adjustment or registration.
- Understand at an introductory level the NASA SPICE library (goal, main functions, kernels, etc) and be able to use it to calculate the position, velocity, camera orientation etc of different spacecraft.
- Be able to combine SPICE kernels with RAW images information to produce relevant information of celestial bodies (such as, for instance, volcanic eruptions in Io).

## HORES TOTS DE DEDICACIÓ DE L'ESTUDIANTAT

Tipus	Hores	Percentatge
Hores grup gran	30,0	40.00
Hores aprenentatge autònom	45,0	60.00

**Dedicació total:** 75 h

## CONTINGUTS

### Module 1: Introduction to the Solar System and its exploration

**Descripció:**

Solar system bodies (planets, asteroids, comets, Kuiper belt objects). Robotic probes and their missions: Flyby encounters, orbiters, landers, rovers, drones.

**Dedicació:** 25h

Grup gran/Teoria: 10h

Aprenentatge autònom: 15h

### Module II. Introduction to imaging instruments and image processing technology

**Descripció:**

Lenses. Image sensors. Monochrome, color and multispectral images. Introduction to image processing algorithms.

**Dedicació:** 25h

Grup gran/Teoria: 10h

Aprenentatge autònom: 15h

### Module III. Introduction to NASA JPL SPICE library

**Descripció:**

SPICE overview. Functions and kernels. MICE (SPICE for Matlab). Frames. Time. Obtaining spacecraft position and velocity. Time windows. Occultations. Camera kernels and application examples.

**Dedicació:** 25h

Grup gran/Teoria: 10h

Aprenentatge autònom: 15h

## SISTEMA DE QUALIFICACIÓ

Class participation and class exercises: 30%

Assignment: 30%

Project: 40%

Students with a grade below 5.0 in the project, or the assignments, or the classroom participation, will be able to take an additional written exam covering all the subject, that will take place in the date fixed in the calendar of final exams. The grade obtained in this exam will range between 0 and 10, and will replace the part or parts below 5.0 only in case it is higher, up to a maximum of 5.0 points.



## BIBLIOGRAFIA

---

### **Bàsica:**

- Ulivi, Paolo; Harland, David M. Robotic exploration of the Solar System. Part 2, hiatus and renewal, 1983-1996. New York: Springer Praxis Books, 2009. ISBN 9780387789040.
- Ulivi, P. Robotic exploration of the Solar System. Part 1, The Golden Age 1957-1982. Springer Praxis Books, 2007. ISBN 9780387493268.
- Ulivi, Paolo; Harland, David M. Robotic exploration of the Solar System. Part 4, The Modern Era 2004 –2013. New York: Springer Praxis, 2015. ISBN 1461448115.
- Ulivi, Paolo; Harland, David M. Robotic exploration of the Solar System. Part 3, The Modern era 1997-2009. New York: Springer Praxis Books, 2013.

### **Complementària:**

- Manning, R. [et al.]. Mars rover curiosity: an inside account from Curiosity's chief engineer. Smithsonian Books, 2014. ISBN 9781588344731.
- Stern, Alan. Chasing new horizons: inside the epic first mission to pluto. Picador, 2018. ISBN 9781250098962.