205224 - Robotic Exploration of the Solar System

Learning objectives of the subject

- 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).

Prior skills

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

Teaching methodology

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.

Teaching staff

Coordinator: Manel Soria
Others: Manel Soria

Opening hours

Timetable: Contact with the professor for any question: manel.soria@upc.edu

ECTS credits: 3  Teaching languages: English
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Study load

<table>
<thead>
<tr>
<th>Total learning time: 75h</th>
<th>Hours large group:</th>
<th>30h</th>
<th>40.00%</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Hours medium group:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Hours small group:</td>
<td>0h</td>
<td>0.00%</td>
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<td></td>
<td>Guided activities:</td>
<td>0h</td>
<td>0.00%</td>
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<tr>
<td></td>
<td>Self study:</td>
<td>45h</td>
<td>60.00%</td>
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</tbody>
</table>

Content

Module I: Introduction to the Solar System and its exploration

Learning time: 25h
- Theory classes: 10h
- Self study: 15h

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

Module II. Introduction to imaging instruments and image processing technology

Learning time: 25h
- Theory classes: 10h
- Self study: 15h

Description:

Module III. Introduction to NASA JPL SPICE library

Learning time: 25h
- Theory classes: 10h
- Self study: 15h

Description:
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**Qualification system**

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.

**Bibliography**

**Basic:**


**Complementary:**
