

EE-580

Introduction to the design of space mechanisms

Feusier Gilles

| Cursus | Sem. | Type |
|---|----------|------|
| Electrical and Electronical Engineering | MA2, MA4 | Opt. |
| Space technologies minor | E | Opt. |

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| Language of teaching | English |
| Credits | 2 |
| Session | Summer |
| Semester | Spring |
| Exam | Oral |
| Workload | 60h |
| Weeks | 14 |
| Hours | 2 weekly |
| Lecture | 2 weekly |
| Number of positions | |

Summary

Space environment is different from what we can experience on Earth, requiring specific design approaches in order to achieve reliable operations. Engineers must hence face new challenges stimulating their creativity to tackle those particular constraints.

Content

The course will start with a general overview of the space environment, including vacuum, radiations, thermal, micro-gravity and vibrations constraints. All these elements have a large impact on the design of space mechanisms as well as space hardware during their entire life span.

The next topic that will be addressed will be the selection of materials, taking into account their properties as well as their compliance to the space environment.

The design of space mechanisms being a vast subject, the present course will then tackle specific topics related to structure, components (including motors and actuators), bearings, sensors, and their reliability. The methods used for managing space projects will also be addressed in the frame of the course.

The course will be based on practical examples and will also introduce the students to the management of space mechanism projects.

Exercises will support the understanding of the concepts.

The main objective of the course is not to encompass the design of mechanisms in all its details, but to get an overall view of what are the constraints and challenges related to the design, manufacturing and operations of space equipment, and potentially to unleash the creativity of the students. It is aimed at the future space mechanism designers but also at engineers who will have to deal with space mechanisms or are simply curious, in order for them to understand the strengths and limitations of such mechanisms.

Keywords

Space, mechanism, design, vacuum, radiation, space environment, structure, tribology, vibration, ball-bearings, actuators, sensors, reliability, materials, project management, systems engineering.

Learning Prerequisites**Required courses**

Core EPFL courses in physics, mechanic, materials, mathematic

Learning Outcomes

By the end of the course, the student must be able to:

- Sketch a mechanism that shall operate in the space environment
- Take into consideration the requirements of a space mechanism

- Assess / Evaluate the key characteristics of the design of a space mechanism
- Describe the key milestones required to manage a space mechanism project

Expected student activities

Attend and follow the lectures

Do the exercises, which support the concepts described in the course

Be active during the lectures, asking questions

Assessment methods

Comments to the exercises.

Oral exam.

Supervision

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| Office hours | Yes |
| Assistants | No |
| Forum | No |

Resources

Moodle Link

- <https://go.epfl.ch/EE-580>