2SC5192 – Definition and design of a launcher mission

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Language of instruction: FRANCAIS
Campus: CAMPUS DE PARIS - SACLAY
Workload (HEE): 40
On-site hours (HPE): 27,00

Description
In this challenge week, the student will experiment the multidisciplinary sizing and design of a launcher.
It consists in the understanding the interactions between the different technical fields involved in this design.
Another issue is also to understand the associated challenges of each involved technical field and adopt the different sizing methods for a first sizing procedure.
For this propose, the challeng week is organized in several modules of a realistic sizing loop for which students will be supported by CNES DLA engineers.

Quarter number
ST5

Prerequisites (in terms of CS courses)
The course "Guidance and control of a launcher" of the specific course "performance and flight trajectories".

Syllabus
This Challenge Week will be structured around the following modules:

- Mission analysis - launcher staging
- Trajectory
- Liquid propulsion
- Solid Propulsion
- Aerodynamics and mechanical loads
- Sizing of structures
- Launcher control

Each module will be the subject of a dedicated session (half a day per module) during which the students, working in pairs, will design and consolidate a launcher ,meeting specific specifications.

Class components (lecture, labs, etc.)
Engineers from CNES DLA will supervise this Challenge Week.
They will provide a detailed work plan with questions to the students in order to help them to make design choices while ensuring a good understanding of the challenges (technical, programmatic) and the related physical problems.
Analytical and numerical tools should be used by students to address the issues raised.
The hypotheses and data considered should be questioned in order to understand the issues of a multi-disciplinary design loop; these elements will lead students to iterate on their design choices in order to obtain relevant technical solutions.

Grading
The evaluation will include a final report, project progress notes at the end of each module, and an oral presentation.

Course support, bibliography

- Detailed workplan structuring the developments to be carried out by the students.
- Simplified preliminary sizing tools (under WINDOWS 10).

Resources

- Specifications and a workplan of the developments to be carried out by the students.
- Simplified preliminary numerical sizing tools
- Teaching team : engineers of CNES - Direction des Lanceurs.
- Working in pairs.

Learning outcomes covered on the course
At the end of this project, the student will have an operational understanding of the design tools of a launcher via:

- good knowledge of the requirements and constraints for the design of a launcher,
- good knowledge of different systems constituting a launcher,
- understanding the interactions between the different technical disciplines involved in the design of a launcher and the associated challenges.

He will be able to:

- Model the trajectory of a launcher and implement launcher sizing methods,
- Choose and deploy launcher control strategies,
- Evaluate the launcher's flight performance and propose efficient and economical solutions to improve it.
- Know how to meet the requirements of a launcher's multi-disciplinary design.

Description of the skills acquired at the end of the course

- Analyze, design and implement complex systems with scientific, technological, human and economic components (C1).
- Develop in-depth skills in a scientific or sectoral field and a family of professions (C2).
- Act, undertake and innovate in a scientific and technological environment (C3).
- Have a sense of value creation for his company and his customers (C4).
- Be operational, responsible, and innovative in the digital world (C6).
- Know how to convince (C7)