Internship / Thesis Proposal – 4/6 months

Title: Detailed thermal analysis for the IonSat nanosatellite

Context of the internship

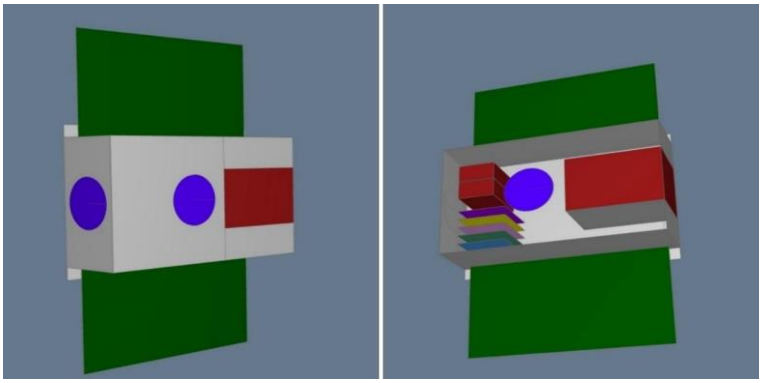
This internship proposal is focused on the IonSat nanosatellite project, which is a student space project currently being developed by the French Centre Spatial de l'École Polytechnique.

The Centre Spatial de l'École Polytechnique (CSEP), created in 2010, is the École Polytechnique's space center. It proposes and supervises educational space projects such as X-CubeSat (launched in 2017), which is one of the first French nanosatellites completely developed by students. Such educational space projects are the result of the efforts of students, teachers, researchers, industrial partners and experts from the French space agency (CNES). The CSEP and all its projects are financially and operationally supported by the École Polytechnique's education patronage program *Espace, science et défis du Spatial (*Space, Science and Challenges), led by Professor Pascal Chabert.

IonSat is an ambitious 6U CubeSat project that aims at demonstrating the feasibility of nanosatellite missions in Very Low Earth Orbit (altitude of about 300km). To do so, the IonSat nanosatellite embarks a new iodine electric propulsion engine developed by the French start-up ThrustMe. With a strong educational vocation, the project is currently led by twenty students, supported by numerous space actors: start-ups (ThrustMe), industries (Thalès Alenia Space) and French space agencies (CNES, Onera).

Internship description

During its mission, IonSat will experience periodical temperature modifications triggered by the varying amount of Earth's albedo and Sun radiations collected by the platform along the nanosatellite's orbit. To ensure the proper functioning of the satellite, the temperature modifications of the platform need to be compatible with the operating points of all the components of the satellite (e.g. batteries). In this context, the actual temperature range that IonSat will experience needs to be quantified. This is typically done using numerical thermal simulations of the nanosatellite to assess the survivability and operability of the platform's components during different phases of the mission. Although preliminary thermal simulations of IonSat have already been performed using the software SYSTEMA/Thermica, new specific and detailed simulations are required.



IonSat current thermal numerical model.

The objectives of this internship are:

1. The creation of a detailed numerical model of IonSat for the improvement of the thermal simulations of the platform.
2. The identification of the operating temperature of IonSat by means of numerical thermal simulations of the satellite for different environments. Note that this objective is composed of three steps. (i) The comparison of the new numerical results with past numerical simulations that were obtained using a simplified numerical model of the satellite. (ii) The identification of the critical environmental conditions that will define the temperature range experienced by IonSat. (iii) The identification of such temperature range.
3. The definition of the passive control approach for the critical components of the satellite, if required.

The intern will work under the guidance of one CSEP full-time engineer. During this internship, the student might be required to interact with experts from the Laboratory of Plasma Physics (LPP), which is a space laboratory specialized in the conception of space-ready magnetometers and on-board electronics. The student will also be required to take part to frequent interactions between the IonSat team and experts from French space agencies (CNES, Onera) and industrial partners of the IonSat Project (Thalès Alenia Space, ThrustMe).

Technical Requirements

- Enrolled student within Engineering (Aerospace/Mechanical/Control), applied Mathematics/Physics or similar field of study.
- Good understanding of physical phenomena in space environments.
- Basic knowledge in programming languages (Python, …)
- English language proficiency (French proficiency is a plus).
- Recent participation in projects developing space hardware/software is a plus.

Behavioral Requirements

- Self-Motivation and able to work independently.
- Team player, attentive to timelines.
- Excellent communication skills
- Affinity with the Space industry.

Internship duration: between 4 and 6 months.
Internship location: Palaiseau, France.

If you are interested, send your CV and a cover letter, clearly indicating your motivation and availability dates.

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