University of Stuttgart
Collaborative Research Center 1667 ATLAS

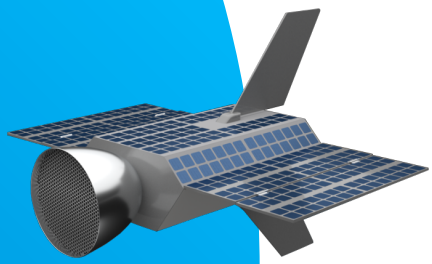
Studying the impact of thermospheric uncertainty on aerodynamic orbit control

Master Thesis Opportunity

The Collaborative Research Centre 1667 "Advancing Technologies of Very Low-Altitude Satellites (ATLAS)", funded by the German Research Foundation DFG, addresses the fundamental scientific and engineering challenges of rendering Very Low Earth Orbit (VLEO, about 200 km to 450 km altitude) accessible. These orbits are particularly beneficial for indispensable satellite services of our modern knowledge, information and communication society.

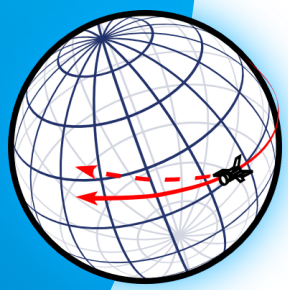
Latest research shows that aerodynamic forces are a practical option for propellant-less orbit control of satellites in VLEO. Aerodynamic control authority is highly dependent on environmental conditions, primarily the atmospheric density. For assessing the manoeuvre outcome, atmospheric models have to be employed to obtain density estimates. The underlying physical processes are highly complex meaning even sophisticated models are subject to significant uncertainties. This creates a critical challenge for the planning of robust aerodynamic manoeuvres.

Within this thesis, the effects of thermospheric density uncertainties on the precision, predictability, and outcome of controlled aerodynamic satellite manoeuvres shall be investigated.



Your tasks:

- Familiarization with aerodynamic orbit control and thermospheric uncertainties;
- Identification of suitable mathematical approaches to describe the uncertainties;
- Implementation of selected processes in an orbit propagator;
- Investigation of effects on different aerodynamic manoeuvre types, focussing on differences between the selected approaches;
- Assessment of results and documentation.



Applicants should have a background in some of the following topics: orbital mechanics, robust and optimal control, optimization algorithms.

Contact:

Fabrizio Turco
turcof@irs.uni-stuttgart.de
+49 711 685 62394

Constantin Traub
ctraub@irs.uni-stuttgart.de
+49 711 685 60820

Responsible Professors:

Prof. Stefanos Fasoulas (IRS) **Prof. Andrea Iannelli (IST)**

ATLAS CRC 1667

Legal Restrictions: The thesis author/s is/are generally not entitled to make any work and research results generated in process accessible to third parties without the permission of their supervisor. Already achieved research results respect the Law on Copyright and related rights (Federal Law Gazette I / S. 1273, Copyright Protection Act of 09.09.1965). The thesis author has the right to publish his/her findings as long as no findings of the supervising institutions and companies have been incorporated. The rules issued by the branch of study within which the Bachelor's or Master's thesis is created must be considered in addition to the exam regulations.