# PhD position @ ISAE-SUPAERO

## Development of steering law for On Orbit Servicing operation

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**Summary:** The orbit removal and servicing topics are expected to play a key part in future space missions, and the studied concepts often include robotic manipulators to carry out these missions. Robotic manipulators in space are already in use (in particular the SRMS Shuttle Remote Manipulator System) but are teleoperated given the complexity to steer them on a free-floating platform. The goal of the study is to perform a rendez-vous with a cooperative or noncooperative object, using an automatic manipulator arm to grasp the object.

Rendez-vous with noncooperative space objects can be divided into different phases:

- Close approach and coordination : Detection of the features of the object and control of the spacecraft to join the object at a common position and velocity.
- Grasping phase : Control of the end-effector, manipulator and platform to grasp the object.
- Post-grasping phase : The detumbling is carried out with the thrusters of the carrier satellite, and stabilization has to be achieved.

This thesis will first focus on the second phase of the rendez-vous. The goal is to use the previously studied allocator [1] in a closed-loop control law to grasp the obejct at the required position and velocity. The goal is not to design a manipulator but to steer the redundant degree of freedom platform and manipulator actuators. The control has to be robust to uncertainties and noise derived from the sensor data fusion, and some experiment will be realised on ground test bench.

[1] H. Evain, M. Rognant, D. Alazard and J. Mignot, “Nonlinear Dynamic Inversion for Redundant Systems Using the EKF Formalism”, Proceedings of the 2016 American Control Conference, pp. 348–353 (2016).