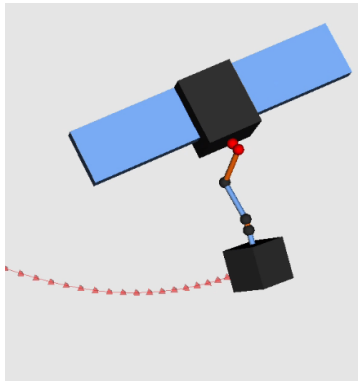
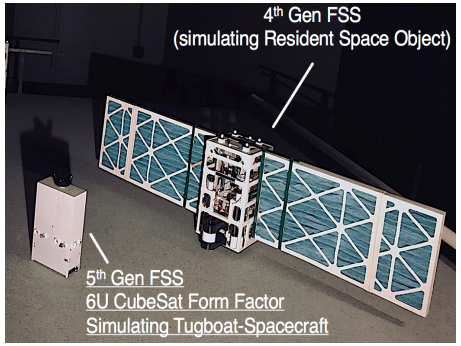
Dynamics and Control of an Autonomous "Tugboat-Spacecraft" to maneuver a passive Resident Space Object

CRUSER
Consortium for Robotics and Unmanned Systems Education and Research





A Autonomous 6-U CubeSat Simulator (left) acts as tugboat-spacecraft of a RSO Simulator (right) during follow-on tests at the Spacecraft Robotics Lab

- Analytical dynamic modeling
- State-of-the-art control design
- High-fidelity numerical simulations
- Technological study of new actuators
- Participation of Thesis and NPS Course Student Officers

- **Focus:** dynamics and control of the combined system consisting of a Tugboat-Spacecraft connected to a Resident Space Object, with emphasis on rotational aspects.
- **Primary tasks:** 1. To formulate, analyze and solve the equations of motion; 2. To design the "ideal" torque control command that enables the maneuver; 3. To investigate the use of current state-of-the-art space actuators; 4. To propose and investigate the use of novel and untraditional actuators with possible increased performance.
- **Deliverables:** results of the analytical studies and numerical simulations, technical reports (articles, thesis, patents), copy (with source code) of all software code developed.

- **Main objective:** to investigate the feasibility and perform initial studies on the concept of a "tugboat spacecraft", consisting of a small autonomous spacecraft taking over the control of a larger passive Resident Space Object. The Resident Space Object , which might be tumbling, can be for instance a failed spacecraft to be serviced, or an orbiting space debris to be removed from orbit, or other object. The goal of the "tugboat spacecraft" is to control the Resident Space Object as regards its rotation, e.g. to detumble it, and its translation, e.g. to change its orbit.
- **Operational impact:** original cutting-edge research effort, proposing a new concepts of operation for Unmanned Systems. This research is contributing to the goal of maintaining/achieving Unmanned System superiority in particular in Space.

NPS
FY19 Call for Proposals

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