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Formation flying using low thrust propulsion

ESR at University of Turku
Claudiu-Lucian Prioroc
Supervisor: Dr. Seppo Mikkola

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University of Rome Tor Vergata

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Personal background

- 2009 Aerospace Diploma Engineer
  - Basic courses in mathematics, physics, chemistry, calculus, numerical analysis;
  - Courses related to aerospace: fluid dynamics, propulsion systems, mechanics, fine mechanics, flight mechanics, flight dynamics, avionics, electrical system engineering, neural networks, control theory, optimal control and aeronautic navigation.
  - The final thesis topic was on the study of formation flying of unmanned aerial vehicles. In particular, the behavior of different formation flying architectures subjected to disturbances and modeling uncertainties.

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Personal background

- 2011 Master of Science Degree in Avionics and Aerospace Navigation at University Politehnica of Bucharest.
  - Courses in: optimal navigation, optimal control of nonlinear systems and stochastic filtering.
  - The final thesis was: “Stochastic Attitude Determination Method for the ESMO Satellite”.

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Personal background

- ESMO AOCS-2 (software) team leader;
  - Developed a sloshing model for ESMO.
  - hardware modelling.
  - Attitude controller design for attitude and orbital manoeuvres.
  - Had to deal with constrains due to attitude hardware limitations, the spacecraft center of mass position uncertainty, center of mass drift due to fuel consumption, sloshing and modelling uncertainties.
  - Controller robustness analysis.
  - Develop attitude determination estimator.
  - Software development, testing and implementation on ESMO.
- 2011 Visiting researcher at the University of Strathclyde in the Advanced Space Concepts Laboratory:
  - Integrated flight dynamics analyses for the European Student Moon Orbiter.

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Personal background

- PhD Candidate at University Politehnica of Bucharest;
  - Micro satellite attitude determination algorithms;
  - PhD work focuses on spacecraft attitude determination using nonlinear filtering methods;
  - Attitude control;
  - Spacecraft attitude dynamics modelling;
  - Attitude perturbations modelling;
  - ADCS hardware modelling.

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- A restricted 3-body problem will be derived that incorporates current low-thrust propulsion solutions.
- A Lindstedt-Poincaré series expansion will then be used to derive equations for families of periodic orbits in the libration zones.
- Numerical continuation methods will be used to find exact families of periodic orbits of fixed period.
- Suitable control algorithms will be developed to ensure that these formations remain rigid and stable.

Thank you!