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Bachelor Thesis

Announcement

Überblick über Kollisionsvermeidungsstrategien und Analyse derzeitiger sowie historischer Konjunktionen

Review on collision avoidance strategies and analysis of current and historic conjunctions

Motivation:

With a raising number of satellites launched into Low Earth orbits, the number of close encounters increases and threatens operative satellites. Especially those without chemical thrusting capabilities face the problem of not being able to perform impulsive avoidance manoeuvres. A possible solution to that are manoeuvres exploiting natural forces. At the IRS, the use of aerodynamic forces for collision avoidance is currently researched.

Collision avoidance strategies differ in various aspects. Besides chemical thrusters, low-thrust propulsion systems may be used for evasive manoeuvres, showing significant differences to impulsive manoeuvres. Moreover, natural perturbations, such as aerodynamic forces or solar radiation pressure may be used for manoeuvring. Manoeuvres are strongly affected by mission constraints and may be optimized with regard to specific parameters.

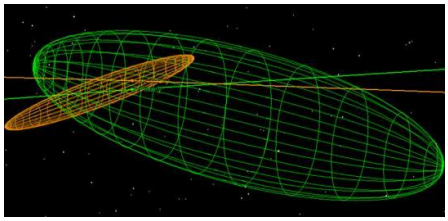

Fig. 1 Close encounter between two objects and respective uncertainty [agi]

During this thesis, a comprehensive literature research on collision avoidance strategies and manoeuvres shall be performed to gain an accurate overview of state-of-the-art methods. A focus will be on the use of natural perturbing forces and low-thrust manoeuvres. Besides the applicability of the various strategies, important boundary conditions and limitations are of importance. Suitable criteria shall be defined in order to perform a classification of the several strategies. Furthermore, the current conjunction environment shall be analysed. Using publicly available conjunction data, conclusions shall be drawn regarding the boundary conditions and requirements for manoeuvre strategies. All findings shall be properly documented.

Task description of the Bachelor thesis work:

- Comprehensive literature research on collision avoidance strategies and manoeuvres (natural perturbing forces and low-thrust manoeuvres)
- Definition of classification criteria (e.g. exploited forces, time frame, optimality, …)
- Classification of the identified strategies according to criteria
- Analysis of current conjunction environment
- Documentation

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