Syllabus

Contact information

Carolin Frueh (pronounced: free), ARMS 3309, cfrueh@purdue.edu

Course Content

The course teaches the basic techniques and concepts relevant to Space Traffic Management (STM) and Space Situational Awareness (SSA) in the near earth realm. from a rigorous engineering perspective.

Starting with the understanding of how measurements are collected and processed, astrodynamics specific to the space around the earth inhabited by the vast majority of all operational satellites. The class introduces the challenges of sparse data per object, initializing orbits without a priori information and how to maintain custody of objects in the highly non-linear fastly changing orbital regime.

At the end of the course the students are equipped with a fundamental matlab tool set to investigate own STM or SSA problems.

Required Course Materials

No book required, course script will be made available on blackboard.
Matlab student version, helpful packages are the statistics and image processing package.

Grading

Grading is based on homework assignments and the final project.

no final exam

Topics to be covered:

1. two line elements and SGP4
2. sensors, CCD response in astrometric observations
3. influence of the optics in astrometric measurements
4. Coordinate systems space fixed: right ascension, declination, geocentric, topocentric
5. Coordinate systems Earth fixed: elevation, azimuth, aberration
6. Coordinate systems: time systems, hour angle computation
7. Coordinate systems: J2000, nutation and precession models simple and complex
8. Initial orbit determination classical methods, Gauss, Herrick Gibbs etc
9. Initial orbit determination modern methods: admissible regions
10. IOD: Admissible regions: connection of two regions
11. first orbit improvement: least squares, introduction linear least squares
12. first orbit improvement: least squares, non-linear least squares
13. first orbit improvement: covariance discussion
14. orbit propagation: spherical expansion of the gravity field and pines implementation
15. orbit propagation: third body effects
16. orbit propagation: SRP and drag
17. 2nd orbit improvement: Kalman filter, introduction linear Kalman Filter
18. 2nd orbit improvement: extended Kalman filter
19. covariance in non-linear dynamics, orbit improvement and orbit propagation

Boilermaker Pledge, Diversity and University Resources

As a boilermaker pursuing academic excellence, I pledge to be honest and true in all that I do. Accountable together - we are Purdue.

Purdue University is committed to maintaining a community which recognizes and values the inherent worth and dignity of every person; fosters tolerance, sensitivity, understanding, and mutual respect among its members; and encourages each individual to strive to reach his or her own potential. In pursuit of its goal of academic excellence, the University seeks to develop and nurture diversity. The University believes that diversity among its many members strengthens the institution, stimulates creativity, promotes the exchange of ideas, and enriches campus life. Purdues nondiscrimination policy can be found at: http://www.purdue.edu/purdue/ea_eou_statement.html.

CAPS Information: Purdue University is committed to advancing the mental health and well-being of its students. If you or someone you know is feeling overwhelmed, depressed, and/or in need of support, services are available. For help, such individuals should contact Counseling and Psychological Services (CAPS) at (765)494-6995 and http://www.purdue.edu/caps/ during and after hours, on weekends and holidays, or through its counselors physically located in the Purdue University Student Health Center (PUSH) during business hours.

Academic integrity is one of the highest values that Purdue University holds. Individuals are encouraged to alert university officials to potential breeches of this value by either emailing integrity@purdue.edu or by calling 765-494-8778. While information may be submitted anonymously, the more information that is submitted provides the greatest opportunity for the university to investigate the concern.