ASEN 5519-001 Analytical Astrodynamics

TTh, 10-11:15, AERO 114

I : Daniel Scheeres, scheeres@colorado.edu
AERO 454
Office Hours immediately after class

Introduction to astrodynamics with an emphasis on analytical approaches — alternative to ASEN 5050. General solution of the 2-body problem. Orbital trajectories, transfers, targeting, and time of flight. Orbit perturbations and averaging analysis. Restricted 3-body problem.

**I - ** : Undergraduate orbital mechanics course (equivalent to ASEN 3200) or permission of the instructor.

**C ** :
Selected excerpts from "Orbital Motion in Strongly Perturbed Environments" will be distributed, selected papers will be distributed.

:
A.E. Roy, Orbital Motion 4th edition, Institute of Physics Publishing, 2005.

B :
D.J. Scheeres. "Orbital Motion in Strongly Perturbed Environments: Applications to Asteroid, Comet and Planetary Satellite Orbiters," Springer-Praxis Books in Astronautical Engineering. 2012. ISBN 978-3-642-03255-4, e-ISBN 978-3-642-03256-1, DOI 10.1007/978-3-642-03256-1
J.E. Prussing and B.A. Conway, Orbital Mechanics, 2nd Ed., Oxford University Press, 2012.
J.M.A. Danby, Fundamentals of Celestial Mechanics, 2nd Ed., Willmann-Bell, 1992.
V.I. Arnold, V.V. Kozlov, A.I. Neishtadt, Mathematical Aspects of Classical and Celestial Mechanics, 3rd edition, Springer, 2006.
C. Marchal, The Three-Body Problem, Elsevier, 1990.
F.R. Moulton, An Introduction to Celestial Mechanics, 2nd edition, Dover, 1970.
V. Szebehely, Theory of Orbits: The restricted problem of three bodies, Academic Press, 1967.

C :
Use of Matlab (or other computer languages) in homework.

C :
Homework and computer problems should be written as informal reports.

G :
    HW problems: 25%
    Computational problemss: 25%
    Mid-term exam: 25%
    Final exam: 25%

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    Principles of orbital mechanics.
    Orbital trajectories, transfers, time of flight.
    Trajectory propagation and targeting.
    Orbit perturbation formulation and analysis.
    Restricted 3-body problem with applications.

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Orbital mechanics
    Formulation of two-body, three-body and n-body problems
    The two-body problem solution
    Elliptical and circular orbits
    Parabolic and hyperbolic trajectories
    3-D trajectories and orbit elements
    Time of flight and orbit propagation

Orbital transfers
    Impulsive maneuvers
    Lambert's theorem
    3-D Targeting