AEE 462: Space Vehicle Dynamics and Control

Syllabus

Instructor: M. Peet
Meeting Time: TTh 6:00-7:15 in PSF 101
Office Hours: F 4:45-5:45, T 7:15-8:15 in ERC 253
UGTA Office Hours: TBD

Instructor Matthew M. Peet, Associate Professor of Aerospace Engineering. Office: ERC 253. `email:` mpeet@asu.edu.

Undegraduate Teaching Assistant TBD, email: TBD, Office Hours: TBD

Grader Spencer Jensen, email: sjensen793@gmail.com.

Content *Spacecraft Dynamics:* Orbits and Orbital Elements. Orbital Insertion and Transfer. Interplanetary Mission Planning. Spacecraft Tracking and Targeting. Rigid Body Dynamics and Control.

Textbook The textbook is "Orbital Mechanics" by J. E. Prussing and B. A. Conway, 2nd edition. This book has several important errata which should be corrected prior to use. For a list or errata, see `http://prussing.ae.illinois.edu/Errata.2ed.pdf`. This is an entry-level textbook, however, it is relatively terse. Some students prefer "Orbital Mechanics for Engineering Students" by Curtis, and I encourage you to consult this optional textbook. In addition, anyone wishing to pursue or apply the topics we cover in more depth should refer to "Fundamentals of Astrodynamics and Applications" by D. A. Vallado. This textbook has detailed descriptions of many of the algorithms used in modern orbital mechanics and astrodynamics. Unfortunately, there is no textbook for the attitude dynamics portion of this course. However, students may consult "Spacecraft Attitude Dynamics" by P. C. Hughes - an inexpensive Dover publication.

Schedule Class will meet TTh 6:00-7:15 PM. There will be a mid-term examination and a final examination. Assignments will be given approximately bi-weekly.

Prerequisites MAE 318 with a grade of 'C' or better. Access to Matlab (ASU has a site-license).

Internet Resources All lecture slides will be posted on blackboard. All homework assignments will be posted on blackboard. Announcements will be posted on blackboard and transmitted via email. A complete (but unofficial) set of lecture notes for the previous incarnation of this class is available online at `http://control.asu.edu`.

Evaluation Homework will be the basis for 30% of the grade. Problem sets will be given on a bi-weekly basis. An in-class midterm and an in-class final exam will be given, each for 35% of the grade. **Note:** Grade distribution will be relative to the performance of the class as a whole and cutoffs are at the discretion of the instructor.

Academic Integrity Policy Discussion of the homework problems is permitted, although the writing must be independent - NO COPYING. Use of a SOLUTIONS MANUAL is prohibited and violations will be reported to ASU. Warning - solutions manuals have built-in errors to detect copying. Cheating on exams will result in automatic failure of the course and referral of the student to Designated Dean for Academic Discipline and MAE Chair of the Academic Honesty Committee. Cheating is BAD. Do not cheat.

Classroom Behavior The use of laptops, iphones, ipads, or other personal electronic devices is prohibited during class unless explicitly allowed by the instructor.

Participation Attend class. Attendance will be taken daily. Attendance counts as one homework grade. Ask questions. Even mildly off-topic questions. If you don't understand something, ask me to explain it again. If you don't understand, most likely, YOU ARE NOT ALONE.

Absences and Late Homework Homework turned in late, in general will not be graded. However, there may be exceptions to this rule if none of the problems have been discussed in class. In this case between 50% (2-3 days late) and 70% (0-1 days late) credit will be awarded.

Violence See the Student Services Manual, SSM 10402, Handling Disruptive, Threatening, or Violent Individuals on Campus

Disabilities A reminder to students that when requesting accommodation for a disability, they must be registered with the Disability Resource Center (DRC) and submit appropriate documentation from the DRC

Lectures Lectures will cover the following topics.

Lecture 1 - History of Orbital Mechanics

Lecture 2 - The N-body problem: Invariants

Lecture 3 - The Two-Body Problem: Elliptic Orbits

Lecture 4 - Position and Velocity

Lecture 5 - Hyperbolic Orbits

Lecture 6 - The Orbital Plane

Lecture 7 - Converting to and from r and v

Lecture 8 - Relative Motion

Lecture 8 - Rocketry: Δv

Lecture 9 - Impulsive Orbital Maneuvers

Lecture 10 - Targeting

Lecture 11 - Targeting

Lecture 12 - Bi-elliptics and Out-of-Plane Maneuvers

Lecture 13 - Orbit Perturbations

Lecture 14 - The Effect of a Non-Spherical Earth

Lecture 15 - Interplanetary Mission Planning