MAE 462: Space Vehicle Dynamics and Control

Syllabus

Instructor: M. Peet
Meeting Time: TTh 6:00-7:15 in SCOB 152 (Schwada 152)
Office Hours: TTh 11:00-12:00 in ERC 253

Volunteer Teaching Assistant Reza Kamyar. Office GWC 543.

Grader TBD

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

Textbook The textbook is "Orbital Mechanics" by J. E. Prussing and B. A. Conway. This book has several important errata which should be corrected prior to use. For a list or errata, see `https://netfiles.uiuc.edu/prussing/www/Errata.11.03.pdf`. This is an entry-level textbook. Anyone wishing to pursue the topics we cover in more depth should refer to "Fundamentals of Astrodynamics and Applications" by D. A. Vallado. 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. There will be an mid-term examination and a final examination. Assignments will be given approximately bi-weekly. **Exception:** I will be teaching a short class in Grenoble, France from January 29 - February 5. During this time, I will attempt to arrange substitute lectures.

Prerequisites MAE 318 with a grade of 'C' or better.

Format Lectures will utilize a constantly-evolving set of LaTeX slides. The slides developed in previous years can be found online at my website `http://control.asu.edu` under the classes heading - MMAE 441. As a new set of slides is developed, these will be posted on Blackboard.

Blackboard Lecture Notes will be posted on Blackboard, along with all assignments and supplementary material. Grades will also be posted on blackboard.

Evaluation Homework will be the basis for 30% of the grade. Problem sets will be given on a bi-weekly basis. Late homework will be graded for 50% credit. Submit late homework directly to the TA. An in-class midterm and an in-class final exam will be given, each for 35% of the grade. **Note:** These percentages are approximate and are subject to change based on performance. Grade distribution is at the discretion of the instructor.

Honest Policy Collaboration on exams will result in an F for the course. Copying of homework or duplication of material found online will result in a "0" on the homework and a referral to the ASU office of academic integrity. **Reminder:** Two referrals to the office of academic integrity is grounds for expulsion from the university. If in doubt about a specific case, ask me.

Classroom Behavior Disruptive noises are not allowed.

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

Lecture 16 - Orbit Determination

Lecture 17 - Rigid-Body Dynamics

Lecture 18 - Torque-Free Motion

Lecture 19 - Stabilization