Physics 2513: Dynamical Systems

Fall 2019

- Recommended textbooks:
  H. Goldstein, C. Poole and J. Safko: "Classical Mechanics," 3rd edition
  A. L. Fetter and J. D. Walecka: "Theoretical Mechanics of Particles and Continua"
- Instructor: Ayres Freitas
- Lectures: MWF 10:00-10:50am (106 Allen Hall)
- Office hours: M 2:30-4:00pm (403 Allen Hall) or by appointment

Course description

This is a graduate core course which reviews and further develops the theory of classical mechanics and its formal theoretical underpinnings. Participants are assumed to have taken an undergraduate mechanics course and are familiar with the basics of the Lagrangian formalism and the use of differential equations to solve equations of motion.

The structure of this course is aligned fairly closely to the textbook by Golstein et al. However, the textbook by Fetter and Walecka has a better treatment of continuum mechanics. The lecture will be based on several sources, including but not limited to these two books. I do not require that you buy any one particular book, but you should seek out additional material beyond what is covered during class time.

Learning goals

After completing this course, students are expected to be able to

- apply the Lagrange and Hamilton formalisms to solve mechanics problems with different degrees of freedom and with possible constraints;
- understand and apply conservation laws in different contexts;
- calculate the properties of rotating objects and of objects in rotating coordinate systems;
- analyze a large variety of physical systems by approximating them as multi-dimensional coupled harmonic oscillators;
- develop fundamental insight into continuum mechanics and the foundations of field theory;
- master the mathematical tools for solving relevant linear algebra and differential equation problems.

Homework

Homework is an essential part of learning the material of this course. Homework will be assigned each week on Friday and collected next week on Friday. You are encouraged to discuss the homework problems with each other after you have tried them to the best of your ability, but you cannot copy the solutions from each other. The homework assignments and solutions will be available for download on CourseWeb.

If there are extraordinary circumstances that prevent you from completing an assignment on time, please contact me *before* the due date so that we can find a suitable solution.

Some of the homework problems will be discussed in class (after they have been graded and returned). For this purpose I will occiasionally pick one student at random to present her/his solution on the board. In this way, you can learn from each other's solutions, and also practice your presentation skills.

Grading scheme

There will be one mid-term exam and a comprehensive final exam. The dates for the exams will be announced several weeks in advance. The final grade will be determined by the homework submissions (30%), and mid-term (25%) and final exam (45%).

Academic integrity

All students are expected to adhere to the standards of academic honesty. Any student engaged in cheating, plagiarism, or other acts of academic dishonesty would be subject to disciplinary action. Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to the confiscation of the examination of any individual suspected of violating the University Policy.

Disability resources

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and Disability Resources and Services, 216 William Pitt Union, (412) 648-7890/(412) 383-7355 (TTY) as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.