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Course: Advanced Dynamics

3 credits

Prerequisite: Dynamics

Lecture: Mon. 2:10 - 5:00PM

Room: E510

Office hours: Mon, Tue, Thr, Fri: 11:00AM ~ 6:00PM or by appointment

Textbook:

Haim Baruh, *Analytical Dynamics*, McGraw-Hill, 1999. (Imported by 滄海書局)

References:

1. Donald T. Greenwood, *Advanced Dynamics*, Cambridge University Press, 2003.
2. Donald T. Greenwood, *Principles of Dynamics*, 2nd Ed., Prentice Hall, 1988.

Course Objective:

From the classical methods to the newer techniques used in today's complex and multibody environments, this course shows how those approaches complement each other.

The course begins by introducing the reader to the basic concepts in mechanics, introduced at the particle mechanics level. It then extends these concepts to systems of particles, rigid bodies (plane motion and 3D), and lightly flexible bodies. The cornerstone variational principles of mechanics are developed and they are applied to particles, rigid bodies, and deformable bodies. Through this approach, students are exposed to a natural flow of the concepts used in dynamics. The course emphasizes both the derivation of the describing equations and the response. The describing equations are developed using force and moment balances, as well as variational principles. Different approaches of obtaining equations of motion are discussed and compared. The nature of the motion is explored by means of energy and momentum concepts, stability, as well as motion integrals. Small motions around equilibrium are discussed, together with the response of linearized systems.

Kinematics of motion, particle dynamics, Lagranges equations. Rigid body dynamics including Eulers equations, the Poincot construction, spin stabilization, the rotation matrix. Vibrations of coupled systems, orthogonality relationships, generalized coordinates and generalized system parameters.

Hamiltons equations, canonical transformations, and Hamilton-Jacobi theory. Applications to orbital problems.

Grading Police:

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| 1. Homeworks, Participation | 50% |
| 2. Midterm Exam: | 20% |
| 3. Final Exam: | 30% |