University of California, Berkeley **Department of Mechanical Engineering**

ME 175/271: Intermediate Dynamics

Fall Semester 2024

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Lectures: MWF 3:10 - 4:00, 3107 Etcheverry Hall

Office Hours: MWF 4:00 - 5:00

Syllabus

1. Introduction

Basic concepts and laws of classical mechanics. Rectangular Cartesian, cylindrical, and spherical coordinate systems. Constraints. Examples of Lagrange's equations

2. Lagrangian Dynamics of a Single Particle

Lagrange's equations for a particle moving in a fixed plane. Curvilinear coordinates. Covariant and contravariant components of vectors. Particle moving on fixed and moving surfaces.

3. Lagrangian Dynamics of a Finite Set of Particles

Configuration space, Hertzian space. Holonomic (or integrable constraints) constraints. Configuration manifold. Generalized coordinates. Lagrange's equations. Power relations. Jacobi's theorem. Non-holonomic constraints.

4. Hamilton's equations

5. Eulerian and Lagrangian Dynamics of a Rigid Body

Rotation tensors. Euler's balance laws. Euler's differential equations. Representation of rotational dynamics in Hertzian space. Lagrange's equations for a rigid body. Euler angles.

Approximate Grading Scheme -- subject to adjustment based on class performance):

ME 175: Homework 45%, Midterm Examination 12%, Final Examination 43%.

ME 271: Homework 35%, Midterm Examination 12%, Final Examination 43%, Project 10%

In-Class Attendance: Expected

Final Examination: Tu, 17 December, 7:00 - 10:00 pm

Bibliography

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