

# ME 115(a,b): Introduction to Kinematics and Robotics

(Winter/Spring 2007-2008)

**Lecturer:** Prof. Joel Burdick, Thomas 319, x4139, jwb@robotics.caltech.edu

**T.A.:** TBD

**T.A. office hours:** TBD

## Class Meeting Time

The schedule class time is tentatively scheduled for MWF 10:00 a.m. - 10:55 a.m.. If many students have a conflict with the scheduled time, we will try to find a new meeting time that accommodates as many students as possible. If we can not find a better time, then we'll stick with the scheduled time.

## Scope and format of ME 115

*Theoretical Kinematics* is the study of motion, while *Applied Kinematics* is the analysis and synthesis of mechanisms which implement given motions. This course will attempt to present basic material in both theoretical and applied kinematics. However, the applied part of the course will deviate somewhat from its historical focus on mechanical linkages (e.g., Stewart platforms, redundant manipulators, and grasping mechanics). In contrast to previous years, ME 115(b) will focus more on mobile robots, and basic motion planning for wheeled mobile robots. The heuristic goals of this course are to:

- introduce some of the basic problems and methodology of theoretical kinematics and kinematic analysis.
- give an introduction to those areas of robotics which rely heavily upon kinematics.
- Introduce sufficient kinematic terminology so that interested students can read the kinematics and robots research literature.
- Introduce students to the kinematics of wheeled mobile robots, and the basic methodologies for planning their motions.

The first quarter of the course largely reviews the fundamentals of kinematics at a measured pace. The second quarter is largely devoted to applications of the theory. This year we will focus on wheeled mobile robots, in addition to a brief introduction robot manipulator arms.

## Course Prerequisites

The course assumes some basic knowledge in linear algebra (such as eigenvalues and eigenvectors). Most other mathematical concepts will be reviewed or introduced as needed. Students who have completed Math 2 or the equivalent should have adequate preparation.

### **Course Mechanics and Grading**

The course-work will consist entirely of homework and a take-home final exam. A modest final project, approved by the course instructor, can be substituted for the final exam. The course grade will be computed as follows:

<b>Homework</b> (approximately 6 sets)	70%
<b>Final Exam</b> (or project)	30%

The homework is not intended to be difficult, but rather to reinforce the topics presented in the lectures and the book.

**Course Web Site:** The web site for this course can be found at:

*<http://robotics.caltech.edu/~jwb/courses/ME115/ME115.html>*

This site will contain copies of homework assignments, homework solutions, and most class handouts. Important information about the class, such as changes in due dates, homework errata, etc. can be found on the “Bulletins” page. You should visit this site if you miss class, as there will be no excuses for being uninformed.

### **References**

The main text for this course is: A Mathematical Introduction to Robotics by Murray, Li, and Sastry. There is a second edition with some of the errata from the first edition corrected. Either edition is fine for the course (i.e., a used copy of the book, which might be the first addition, is perfectly fine). Material not found in this book will be distributed in class, and posted on the course website.