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

(Winter/Spring 2011/2012)

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

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Class Meeting Time

The class is officially scheduled for MWF 10:30 a.m. - 11:55 a.m. in Thomas 306. If sufficiently many students have a conflict with the scheduled time, we will try to find a new meeting time that accomodates as many students as possible.

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 presents basic material in theoretical kinematics, while the applied portions of the course focus on robotic mechanisms. Time permitting, we will also look at some recent developments in *compliant mechanisms*.

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 the main classes of robotic mechanisms (serial and parallel), as well as the kinematics of grasping and quasi-static locomotion.
- introduce some recent developments in the practice of kinemaitc mechanisms (such as compliant mechanisms and parallel mechanisms) to give students a feel for how basic kinematics can be applied to new problems.

ME 115(a) mainly reviews the fundamentals of kinematics at a measured pace. ME 115(b) is largely devoted to applications of the theory, with a particular emphasis on multi=fingered robotic grasping.

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 final project, whose content is approved by the course instructor, can be substituted for the final exam. The second quarter format will be similar. Many students opt to extend their first quarter final project to the second quarter final project.

The course grade will be computed as follows:

Homework (approximately 6 sets)	70%
Final Exam (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:

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 in the "'Announcements" section. 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 (the acronym "MLS" will be used to refer to the this text). This book is now available on-line. There is a link to the on-line text on the course website. Some of you may wish to buy the book (e.g. it's available from Amazon). If you wish to buy a used version of the text, note that there is a second edition with some of the errata from the first edition corrected. Either edition is fine for the course. Most of the other course reading material not found in this book will be distributed in class, and copies posted on the course website. A very few handouts may not be available electronically–copies will be kept in the office of Mrs. Maria Koeper (Room 321 Thomas).