UCSB “Introduction to Robotics: Planning and Kinematics”
ME/ECE 179P, Winter 2023
Instructor: Francesco Bullo

This is the website for the UCSB course ME / ECE 179P “Introduction to Robotics: Planning and Kinematics”, Winter 2023. This information is available at the URL http://motion.me.ucsb.edu/ME179P-Winter2023. A pdf version of this documentation is available online.

Description

Motion planning and kinematics topics with an emphasis on geometric reasoning, programming and matrix computations. Motion planning: configuration spaces, sensor-based planning, decomposition and sampling methods, and advanced planning algorithms. Kinematics: reference frames, rotations and displacements, kinematic motion models.

Course Learning Outcomes

- An ability to apply knowledge of geometry, graph algorithms and linear algebra to robotic systems
- An ability to use a numerical computing environment, such as Matlab, to solve engineering problems
- An ability to formulate and solve planning problems in robotics
- An ability to formulate and solve kinematics problems in robotics

Prerequisites

Eng 3 and either ME 17 or ECE 130C (concurrent enrollment is allowed).
Knowledge of basic concepts in matrix theory (matrix multiplication, traces, determinants, eigenvalues), differential equations, and familiarity with Matlab and/or Python programming.

Lecture Time and Place

Tuesday and Thursday 9:30am-10:45am, HSSB 1228
(UCSB Winter quarter 2023: Tues Jan 4 - Thu Mar 10. Finals Mon Mar 14 - Fri Mar 18.)

Course credit

Units: 4, including 3 units of lecture, 1 unit of computer lab per week

Textbook

Lectures on Robotic Planning and Kinematics,
Francesco Bullo and Stephen L. Smith
v0.93, Jan 1, 2023.

Available in PDF and Slide PDF format.

Warning: the lecture notes may be updated during the course. I will inform you if and when a new version of the notes is available. (Exercise numbers will not change.)

Instructor

Professor Francesco Bullo
Department of Mechanical Engineering
Email: bullo-at-engineering.ucsb.edu
Website: http://motion.me.ucsb.edu

Office hours

Place: Zoom (see email for room ID)
Time: Monday, 4pm-5pm or 4pm-6pm as long as there are un-answered questions
If you have any questions about the course, please send me email. I will try to respond as quickly as possible. Additionally, I will share questions that are particularly good (and their answers) with the rest of the class by broadcasting my answer to the entire class.
If you plan to come to (= connect with my room) office hours for questions about homework, please be prepared to show attempts at solving the problem that you prepared before coming. Also, it would be desirable if you would please email me at least 1 hour in advance.

Teaching Assistant

Francesco Seccamonte, fseccamonte at ucsb.edu
Office hours Time: Wednesday, 9:00am-10:00am or 9am-11am as long as there are un-answered questions
Office hours Place: Eng. II, #3361.
Please come to office hours with prepared questions. Due to time constraints, only limited help will be given for coding and debugging problems.

Grading

Your grade will be assigned roughly according to the following percentages.

1. Homework and Projects = 15% and 15%
2. Midterm 35%
3. Final 35%

Partial credit might be given whenever the overall performance is low. If answers are not accompanied by satisfactory explanations (e.g., all intermediate steps, clearly readable handwriting), no credit will be given.
Exams and quizzes will be closed book and closed notes. You may prepare an exam aid (cheat sheet) in your own handwriting, consisting of one, one-sided sheet (letter size, 8.5x11in) for the midterm and one, two-sided sheet for the final exam. No calculators/tablets/cellphones are allowed during the exams (they would be useless anyway).
In exceptional cases, I reserve the right to give extra points for excellent performance on the final. Please, do not count on it as a way to avoid doing homework assignments.
Homework will is typically due on Wednesday afternoon. No late homework will be accepted without prior approval. Approval is automatic the first two times you ask: **to announce late homework you must send me email by midnight the day before.** Late homework will automatically lose 20% of the grade and no late homework will be accepted after 5pm on the following Monday.

Computer Access & Matlab vs Python

Some of the homework and all computer laboratory assignments will require working knowledge of Matlab or Python.
I expect all of you to have access to a Matlab or Python installation.
A matlab primer is available in the handout section of the course website.

Collaboration Policy

Collaboration Policy for this course & Academic Dishonesty @ Wikipedia

Resources for Students

The Division of Student Affairs provides a broad range of essential support services and resources to help UCSB students handle the challenges of university life.

Help during exams

Students with disabilities may request academic accommodations for exams online through the UCSB Disabled Students Program at http://dsp.sa.ucsb.edu.
Please make your requests for exam accommodations through the online system as early in the quarter as possible to ensure arrangement.

Managing stress

Personal concerns such as stress, anxiety, relationships, depression, cultural differences, can interfere with the ability of students to succeed and thrive.
If you find yourself, or another student, in need of support, please do not hesitate to reach out to Counseling and Psychological Services (CAPS), 24/7 at (805) 893-4411. http://caps.sa.ucsb.edu

Financial crisis response team

The UCSB Financial Crisis Response Team exists to assist UCSB students who may be facing a financial crisis or urgent financial need. In order to apply for emergency funding, please first email FinancialCrisis@sa.ucsb.edu. Within 1-2 business days, a Financial Aid Advisor will contact you for your next steps.

Gender and sex discrimination policy and student support

Under Title IX, university students are protected from harassment and discrimination based on gender and sex. If a student feels uncomfortable or in need of support at any time related to their gender, sex, and/or sexual orientation, please contact your TA and/or course instructor immediately. If a student would like to disclose information related to pronouns, name changes, or identities, we encourage you to do so. UCSB's Resource Center for Sexual and Gender Diversity on the 3rd floor of the Student Resource Building is also available to advocate and be of and support to students.

Food security

If you are facing any challenges securing food or housing and believe this may affect your performance in the class, you are urged to meet with a Food Security and Calfresh Advocate who is aware of the broad variety of resources

that UCSB has to offer (see their drop-in hours at food.ucsb.edu). You are also urged to contact the professor or teaching assistant if you are comfortable doing so. Please visit food.ucsb.edu for additional resources including Calfresh, the AS Food Bank, and more.

Responsible scholarship

Honesty and integrity in all academic work is essential for a valuable educational experience. The Office of Judicial Affairs has policies, tips, and resources for

- proper citation use,
- recognizing actions considered to be cheating or other forms of academic theft, and
- students' responsibilities.

This information is available on their website at: http://judicialaffairs.sa.ucsb.edu. Students are responsible for educating themselves on the policies and to abide by them.
Furthermore, for general academic support, we encourage students to visit Campus Learning Assistance Services (CLAS) early and often. CLAS offers instructional groups, drop-in tutoring, writing and ESL services, skills workshops and one-on-one consultations. CLAS is located on the third floor of the Student Resource Building, or visit http://clas.sa.ucsb.edu.

Copyright policy

All course materials (class lectures and discussions, handouts, examinations, web materials) and the intellectual content of the course itself are protected by United States Federal Copyright Law, the California Civil Code.

- The UC Policy 102.23 expressly prohibits students (and all other persons) from recording lectures or discussions and from distributing or selling lectures notes and all other course materials without the prior written permission of the instructor (See Policy on Student Conduct and Discipline).
- I have made the textbook available with a copyright-friendly policy (see page 2 of the text).
- Students are permitted to make notes solely for their own private educational use. Exceptions to accommodate students with disabilities may be granted with appropriate documentation.

To be clear, in this class students are forbidden from completing study guides and selling them to any person or organization.