

Spring 2019

MECA 470: Intro Robotics Engineering

Class time and location:	OCNL 438; MW 1-1:50am, F 1-2:50pm
Instructor:	Daisuke Aoyagi , daoyagi@csuchico.edu, 898-4619 Office: OCNL 428, Office Hrs.: MW 2-4pm
Prerequisites:	CSCI 111 or MECH 208, MECH 320 (co-requisite)

Course Usage of Blackboard Learn

The course syllabus and other material will be posted on Blackboard Learn. You are responsible for regularly checking the online resources, which is accessed through the Chico State Portal.

Course Description

“An introductory course in robotic manipulator design and control. Overview of manipulator configurations, rigid-body mechanics fundamentals, forward and inverse kinematics, Jacobians, motion planning and trajectory generation, feedback control in joint space. Emphasis on application in low Degree-of-Freedom systems. Includes computer simulations and hands-on projects.”

Student Learning Outcomes

Students will learn fundamental concepts in robotic manipulator design and control. Students will apply the concepts in computer simulations and a physical system.

Upon successful completion of this course, students will be able to:

1. Classify common types of serial-link robotic manipulators based on geometric configuration
2. Understand joint-level feedback control and analyze its basic characteristics
3. Understand forward and inverse kinematics in a simple low-DoF system
4. Understand basic trajectory generation algorithms
5. Apply and implement understandings in computer simulations and a physical system

Textbook

- Niku, “Introduction to Robotics: Analysis, Control, Applications”, Wiley, 2011 (e-book is acceptable.)

Other suggested books/reference:

- Spong, Hutchinson, and Vidyasagar, “Robot Modeling and Control”, Wiley, 2005
- Craig, “Introduction to Robotics: Mechanics and Control”, Pearson, 2004

Software

- Mathworks MATLAB, Student version Base \$49, Suite \$99, (recommended)

- OMRON/Adept ACE (recommended)

Assignments and Grading

(Note: subject to change with fair notice.)

40% Take-home and in-class assignments including MATLAB simulation

15% Midterm

45% Final project

Course Topics / Tentative Schedule

(Note: subject to change with fair notice.)

Week	
1	Course Overview, Robotic systems, Common configurations and architecture, MATLAB Intro
2	Feedback control concepts, actuators, sensors, and servo systems, Independent joint control, MATLAB simulation
3	Coordinate systems, Rigid-body mechanics fundamentals, Investigate Omron/Adept SCARA robot, Discuss Final Project Requirements
4	Forward kinematics Translation and Rotations, Explore the SCARA robot and investigate ACE software
5	Forward kinematics Homogeneous transformations, Final Project Idea Research
6	Forward kinematics MATLAB simulations, Final Project Concept Development
7	Inverse kinematics Concept and examples, DUE: Final Project Proposal
8	Inverse kinematics MATLAB simulations Midterm
9	(spring break)
10	Motion planning and trajectory generation in Joint space, MATLAB simulation, Final Project Design
11	Motion planning and trajectory generation in Joint space, ACE simulation, Final Project Design
12	Motion planning and trajectory generation in Cartesian (end-effector) space, MATLAB simulation, Final Project Debugging
13	Motion planning and trajectory generation in Cartesian (end-effector) space, ACE simulation, Final Project Experiments
14	Jacobian Final Project Experiments
15	Inverse Jacobian Final Project Experiments
16	Brief overview of robotic manipulator dynamics and more advanced control concepts DUE: Final Project Report
Final	Project Video Presentation and Q&A

Dropping and Adding

You are responsible for understanding the policies and procedures about add/drops, academic renewal, etc., found in the CSU Chico University Catalog. You should be aware of the new deadlines and penalties for adding and dropping classes.

Classroom Protocol

During class, please do not engage in any activities that are not related to the class, e.g. personal web surfing, online shopping, e-mail, Facebook, etc.

University Policies and Campus Resources

Academic Integrity

Students are expected to be familiar with the University's Academic Integrity Policy. Your own commitment to learning, as evidenced by your enrollment at California State University, Chico, and the University's Academic Integrity Policy requires you to be honest in all your academic course work. Faculty members are required to report all infractions to the Office of Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities). The policy on academic integrity and other resources related to student conduct can be found on the Student Judicial Affairs (Office of Student Conduct, Rights & Responsibilities) web site.

Student Services

Student services are designed to assist students in the development of their full academic potential and to motivate them to become self-directed learners. Students can find support for services such as skills assessment, individual or group tutorials, subject advising, learning assistance, summer academic preparation and basic skills development. Student services information can be found on the [current students page of the CSU Chico web site](#).

Americans with Disabilities Act

If you need course adaptations or accommodations because of a disability or chronic illness, or if you need to make special arrangements in case the building must be evacuated, please make an appointment with me as soon as possible, or see me during office hours. Please also contact Accessibility Resource Center (ARC) as they are the designated department responsible for approving and coordinating reasonable accommodations and services for students with disabilities. ARC will help you understand your rights and responsibilities under the Americans with Disabilities Act and provide you further assistance with requesting and arranging accommodations.

[Accessibility Resource Center](#)

530-898-5959, Student Services Center 170, arcdept@csuchico.edu

Student Learning Center

The mission of the Student Learning Center (SLC) is to provide services that will assist CSU, Chico students to become independent learners. The SLC prepares and supports students in their college course work by offering a variety of programs and resources to meet student needs. The SLC facilitates the academic transition and retention of students from high schools and community colleges by providing study strategy information, content subject tutoring, and supplemental instruction. The University Writing Center has been combined with the Student Learning Center. You can also visit the [Student Learning Center web site](#).