

**COURSE OUTLINE – ECE 8690, Fall 2023**  
**Advanced Kinematics of Robots**  
I.D. Walker, EIB 320  
Phone 656-7209, Email [iwalker@clemson.edu](mailto:iwalker@clemson.edu)

**Room:** Riggs 223

**Time:** Tu/Th 2:00-3:15

**Modality:** in-person

**Required Materials:** text: Robot Modeling and Control, M. Spong, S. Hutchinson, and M. Vidyasagar, Wiley (optional, but strongly recommended)

**Student Hours:** By appointment

**Prerequisites:** ECE 6550 or consent of instructor

**Course Description:** Analysis of recent developments in robot modeling, with special focus on kinematics of continuum robot systems.

**Learning Objectives:** students will become familiar with the state of the art in continuum robot modeling and research.

**Topics:**

- Review
  - Review of Denavit-Hartenberg approach to robot kinematics
- Background
  - Robot velocity kinematics (Jacobian), statics, dynamics, and control
  - Kinematic redundancy
  - History of continuum robotics
- Continuum robots
  - Design
  - Modeling (kinematics, dynamics)
  - Control

**Organization:** Class lectures, project, in-class presentations.

Each student will give an in-class lecture, summarizing and discussing the results of a recent research paper related to the class topics above. The specific topics and papers for this lecture will be assigned by the instructor, following discussions with the student.

Each student will additionally complete an independent research project, analyzing and discussing possible extensions to recent research results related to class topics above. The results of each student project will be written up and submitted in report form (double column, 6-8 pages, template will be provided), and summarized for the class via an in-class presentation. Project reports are due (emailed as pdf files to the instructor) on the last day of class, at 5:00pm. Specific topics of projects and dates of in-class project presentations will be determined in discussions with instructor.

**Grading:** Overall student scores for the class will be assigned according to the following: project report 50%; in-class presentations 50% (25% research paper presentation, 25% project report presentation).

**Grading System:** 100%-90% A; 89%-80% B; 79%-70% C; 69%-60% D; 59%-0% F

**Attendance/Absences:** attendance is not mandatory, however students are responsible for all material covered in class regardless of absences.

**Time to Wait:** Students may leave if instructor is more than 15 minutes late for class.

### **Academic Integrity**

As members of the Clemson University community, we have inherited Thomas Green Clemson's vision of this institution as a "high seminary of learning." Fundamental to this vision is a mutual commitment to truthfulness, honor, and responsibility, without which we cannot earn the trust and respect of others. Furthermore, we recognize that academic dishonesty detracts from the value of a Clemson degree. Therefore, we shall not tolerate lying, cheating, or stealing in any form.

All infractions of academic dishonesty by undergraduates must be reported to Undergraduate Studies for resolution through that office. In cases of plagiarism instructors may use the Plagiarism Resolution Form.

See the [Undergraduate Academic Integrity Policy](#) website for additional information and [the current catalogue](#) for the policy. For graduate students, see the current [Graduate School Handbook](#) for all policies and procedures.

### **Accessibility**

Clemson University values the diversity of our student body as a strength and a critical component of our dynamic community. Students with disabilities or temporary injuries/conditions may require accommodations due to barriers in the structure of facilities, course design, technology used for curricular purposes, or other campus resources. Students who experience a barrier to full access to this class should let the instructor know and are encouraged to [request accommodations](#) through SAS (Student Accessibility Services) as soon as possible. To request accommodations through SAS, please see this link: (<https://www.clemson.edu/academics/studentaccess/register.html>). You can also reach out to SAS with questions by calling 864-656-6848, visiting SAS at the ASC Suite 239, or stopping by the office as a drop-in appointment.

### **The Clemson University Title IX Statement Regarding Non-Discrimination**

The Clemson University Title IX statement: Clemson University is committed to a policy of equal opportunity for all persons and does not discriminate on the basis of race, color, religion, sex, sexual orientation, gender, pregnancy, national origin, age, disability, veteran's status, genetic information or protected activity in employment, educational programs and activities, admissions and financial aid. This includes a prohibition against sexual harassment and sexual violence as mandated by Title IX of the Education

Amendments of 1972. This [Title IX policy](#) is located on the Campus Life website. Ms. Alesia Smith is the Clemson University Title IX Coordinator, and the Executive Director of Equity Compliance. Her office is located at 223 Brackett Hall, 864-656-3181 and her email address is [alesias@clemson.edu](mailto:alesias@clemson.edu). Remember, email is not a fully secured method of communication and should not be used to discuss Title IX issues.

*Clemson University aspires to create a diverse community that welcomes people of different races, cultures, ages, genders, sexual orientation, religions, socioeconomic levels, political perspectives, abilities, opinions, values and experiences.*

### **Emergency Preparation**

Emergency procedures have been posted in all buildings and on all elevators. Students should be reminded to review these procedures for their own safety. All students and employees should be familiar with guidelines from [Clemson University Public Safety](#).

Clemson University is committed to providing a safe campus environment for students, faculty, staff, and visitors. As members of the community, we encourage you to take the following actions to be better prepared in case of an emergency:

1. Familiarize yourself with all possible exits, safer locations, and other key information on the emergency evacuation maps in this building, and those that you visit regularly.
2. Make a plan for how you would Run, Hide, and Fight in case of an [active threat](#) in this building, and those that you visit regularly. For example:
  - a. Run – what are all the possible exits in this building, and the routes to them?
  - b. Hide – what are the potential hiding locations in this room and building that are out of sight of doors and windows, how do you lock the door(s), how would you barricade the door(s) and windows, where do you turn off the lights?
  - c. Fight – What tools are available in this room and building, should you have to fight?
3. Ensure you are signed up for [emergency alerts](#). Alerts are only sent when there is a potential threat to safety, a major disruption to campus services, and once-monthly tests.
4. Download the [Rave Guardian app](#) to your phone.  
(<https://www.clemson.edu/cusafety/cupd/rave-guardian/>)
5. Learn what you can do to [prepare yourself](#) for the hazards that affect our locations. (<http://www.clemson.edu/cusafety/EmergencyManagement/>)