

Course Number: **MAE C163C**

Course Name: **Control of Robotic Systems**

Submitting Faculty Name: **Veronica Santos**

Faculty Email: **vjsantos@ucla.edu**

COURSE CONTENT DESCRIPTION

- Description of specific societal impact topics or ethics issues that are addressed in the course:

This elective course is cross-listed for undergraduate students (MAE C163C) and graduate students (MAE C263C). The course covers actuators, sensors, and control schemes for robotic systems. The course has direct societal impact because of the increasing use of robotics in unstructured, dynamic environments that may include interactions with humans in addition to the traditional use of robots in structured manufacturing environments. By learning how controllers are designed for robotic systems, students will gain an understanding of how engineering choices affect the performance and safety of robots. Specifically, students learn about the implications of kinematic design, actuator capabilities, task-specific selection of the controller type, and gain tuning on closed loop stability, performance metrics, and safety factors for disturbance rejection. The impact of actuator and sensor selection on the cost and complexity of robotic systems is also considered.

- Time dedicated to cover this content through lecture and other in-class learning activities:

Each lecture begins with a “Video of the Day,” with which real-world examples are incorporated into the course. The videos are themed to the lecture content and incorporate robot applications that include manufacturing, entertainment, environmental conservation, search and rescue, surgery, assistive technology, and human-robot interactions from companies and research labs all over the world. Discussion sessions include hands-on tutorials for literature reviews, robotics software used in industry, and more.

Undergraduate students complete an individual literature review project in which they research, analyze, and report on controllers designed for robotic systems. Students are taught how to find, read, critically analyze, and interpret peer-reviewed robotics publications from international conferences and journals. Many of these publications address state-of-the-art approaches to grand challenges in robotics and cite applications to societal problems. For this cross-listed course, undergraduate students also attend the final project presentations of their graduate student classmates who design controllers for robotic systems to address real-world challenges.

Societal impact-related content is covered in at least 100 minutes of instruction time distributed across lecture and discussion sessions throughout the 10-week quarter.

OUTCOMES

- Aligned with the **ABET Student Outcome Criteria #4**: The ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

Outcome 1: Students learn the importance of task-relevant controller design for robotic systems that perform useful tasks for society in areas that include manufacturing and human-robot interaction.

Outcome 2: Students learn how to find, read, critically analyze, and interpret peer-reviewed robotics publications, and how to effectively present this content via written technical reports.