EMTR 2017-FA

Robotics and Automation I

Instructor: Dr. Wilson Wang

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Lectures: 5:30-7:00PM, Tuesday & Thursday, RC-1003

Office hours: 1:00-2:00pm, Friday or by appointment

Labs: TBA

Teaching assistant: TBA

Textbook: (1) Robot Modeling and Control, M. Spong, S. Hutchinson, M. Vidyasagar, 2nd Edition, John Wiley & Sons, 2020.

(2) Reading materials and notes

Objective:

This course introduces the fundamental theories of robot manipulator modeling and control, as well as their applications in automation. The topics covered in this course include: structures of robot manipulators, rotational transformation, motions of rigid manipulators, forward kinematics, velocity kinematics, inverse kinematics, trajectory planning, independent joint modeling and control using PID controllers.

Grading policy:

Assignments: 15%
Labs: 15%
Midterm Exam: 25%
Final Exam: 45%

Student Learning Outcomes

At the end of this section, students will be able to:

1. Define and describe robotic manipulators as well as the different types and their characteristics.
2. Define the relative position and orientation of serial links using homogeneous transformation matrices.
3. Compute the forward kinematics of serial manipulators.
4. Compute the inverse kinematics of serial manipulators using the algebraic and geometric approaches.
5. Calculate the Jacobian Matrix of serial manipulators using various approaches.
6. Identify the location of kinematic singularities.
7. Use the Jacobian matrix, to calculate velocities, and forces/torques, and to characterize manipulability.
8. Apply appropriate methods for creating a smooth path in joint space.
9. Formulate the equations of motion of serial manipulators.
10. Implement different proper control systems to control a robot.
11. Demonstrate personal responsibility and accountability in conducting the related assignments and labs.
12. Demonstrate the ability to communicate ideas, issues and conclusions clearly and effectively related to assignments and lab reports.