

MECA 486: Motion and Machine Automation

Catalog description: 3.0 units

Machine automation concepts in electrical circuits, precision mechanics, control systems, and programming. Motor sizing, gearing, couplings, ground loops, effective use of step motors, servo control loops, regeneration, networking, I/O, power supplies, vibration and resonance, mechanical tolerancing, linear bearings and drive mechanisms, and troubleshooting. Labs simulate application concepts such as point-to-point coordinated moves, registration, following, camming, and CAD-to-Motion by combining various motor technologies with various mechanical drive types.

Prerequisites: EECE 211, EECE 211L, either EECE 482 or MECA 482

Course objectives: For students to

1. Understand how to choose and implement stepper systems
2. Gain knowledge of various aspects of intelligent machine automation
3. Understand how various servo tuning schemes affect system response
4. Learn how some of the more common motion control applications can be solved
5. Practice engineering skills such as project planning, information gathering, and documentation of the process

Course outcomes: Students shall be able to

1. Properly size motors without software, solve many fundamental sizing problems, and learn how to put those together to solve complex mechanical system problems
2. Setup and tune closed-loop servo systems
3. Setup and control resonance in open-loop stepper systems
4. Develop methods to query details of proposed engineering projects
5. Keep organized notes in an engineering lab book

Topics covered

1. Electrical safety
2. Power supplies
3. I/O circuits
4. Troubleshooting electromechanical systems
5. Amplifier enable circuits
6. Controlling vertical loads
7. Ground loops and electrical noise
8. Fun with brushed motors
9. Regeneration
10. Mechanical gearing
11. Coupler technology
12. Building mechanical systems
13. Things that hurt servo performance
14. Connectivity and networking
15. Matching mechanical power to electrical power

16. Resolvers vs. encoders

Class/Laboratory schedule

One hundred minutes of lecture and one hundred fifty minutes of laboratory per week

Contribution of course to meet the professional component

This course contributes to the students' ability to work professionally in the mechanical systems area including the design and realization of such systems.

Relationship of course to Mechanical Engineering Program Outcomes

This course contributes principally to the Program Outcomes A, B, and D.