EE 351L Linear Systems and Control Lab

Credits: 1

Categorization of credits: engineering topic

Instructor(s): G. Arslan, T. Kuh.

Textbook and Other Required Materials: No required materials. Lab assignment documents and equipment are provided.

Designation: Elective

Catalog Description: (1 3-hr Lab) Provides experience in applying theoretical tools to analyze linear systems. Extensive use is made of computer-aided analysis and design packages study system performance. Pre: 315. Co-requisite: 351.

Pre- and Co-requisites: Pre-requisite: EE 315 "Signals and Systems Analysis". Co-requisite: EE 351 "Feedback-Control Systems".

Class/Lab Schedule: One 3-hour lab session per week.

Topics Covered:

This is the laboratory course for EE 351 "Feedback-Control Systems". The following are the laboratory assignments.

1. MATLAB Structure and Use

2. State variable modeling and Introduction to MATLAB Control System Toolbox

3. Modeling and Digital Simulation Case Studies

4. Introduction To Data Acquisition and Real-Time Control

5. Op-amp, A/D-D/A converters and Compensator Emulation

6. Servo Position Control Design Project (Position and Rate Feedbacks)

7. Speed control Design Project (Velocity Feedbacks)

8. Position Control Design Project (PD controller Root-locus Design)

9. Position Control Design Project (Phase lead controller Root locus Design)

10. Ball and Beam Design Project

Course Objectives and Relationship to Program Objectives:

This is the laboratory course for EE 351 "Feedback-Control Systems". The main objective of this lab is to give the students many opportunities to put the controller design principles that they learn in EE 351 into use to develop controllers for a set of interesting electromechanical hardware and

software based applications. In particular, the students gain hardware experience in controller design. They also gain experience in computer-based implementation of feedback-controllers. They practice iterating on their initial design which involves debugging software, troubleshooting, and redesign until satisfactory performance is obtained. [Program Objectives addressed by this course: 1, 2.]

Course Outcomes and Their Relationship to Program Outcomes

The following are course outcomes and the Program Outcomes (numbered 1-7 in square brackets "[ ]") they address:

- The students should be able to turn into practice the theoretical concepts and computational tools that they learn in EE 351 to design controllers for a given hardware application. The students should gain experience using modern software tools to design and implement feedback controllers to control physical system and meet given performance specifications. The students should understand the iterative nature of a successful controller design, which requires careful interpretation of the collected data and subsequently tuning their design. [1, 2, 6]
- The students should be able to work in teams to conduct the design experiments which in particular requires effective oral communication between the team members. [3, 5]
- The students should be able to effectively report the results of their lab experiments to the instructor in written form. [3]

Contribution of Course to Meeting the Professional Component

Engineering topics: 100%

Computer Usage: There is extensive computer usage since the students use the following computer aided design tools: Matlab/Simulink (system design and simulation software tool) and word processing for lab reports. The students are required to use Matlab/Simulink for most of their lab experiments. They also write laboratory reports using word processors.

Design Credits and Features: Other than the first few weeks of introductory laboratory assignments, the assignments are design oriented, either reviewing a design method, understanding design tradeoffs, or an actual design. There is 1 design credit.

Person(s) Preparing Syllabus and Date: G. Arslan, Sept. 29, 2014. Y. Dong, June 14, 2021