OLD DOMINION UNIVERSITY
Aerospace Engineering Department - Course Syllabus

AE 438/538, 695 - CONTROL SYSTEM DESIGN AND APPLICATIONS - SP2002

Instructor: Dr. Thomas E. Alberts
Office KDH 238-E, Kaufman Hall
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Class Mode: Regular
Lecture 3 hrs; 3 credits, Prerequisite
TR 11:00am-12:15pm, BAL 106

Grading:
- Homework and Lab Reports 30%
- Project 35%
- Midterm Exam 35%

Late Homework Is Not Accepted With Out Permission!
Makeup Tests Must Be Arranged In Advance!

Course Description: Analysis, computer aided design and implementation of practical control systems. Introductions/reviews of applied classical, state-space and digital control. Lab sessions/demonstrations include data acquisition, system identification, analog computing and implementation of analog and digital controllers. A written term project will be assigned in which both state space and classical methods are to be utilized. Ph.D. level students will also conduct an experimental investigation demonstrating their results. A solid background in classical controls (i.e. MEM 436 or ECE 461) is prerequisite. The class will meet for two 50 minute sessions each week and approximately 3 hour lab sessions will be held on alternate weeks.


Lab Manual: Provided by instructor as individual handouts.

Course Contents/Lecture Topics: (not necessarily in this order)
- Course introduction.
- Introduction/Review of state-space.
- Computer aided control system design and simulation.
- Computer based data acquisition and control.
- Control system design using classical methods.
- Practical modeling of DC servo systems.
- Analog computing.
- State space design.
- Practical design of PD, PI, PID controllers.
- DC servo control demonstrations.
- Optical Encoders and Quadrature.
- Introduction to discrete time analysis.
- Digital implementation of feedback control.
- Effects of discretization on system performance and stability.
Lab Report Format: Ordinarily, lab reports for this class will be no more than 5 typed pages in length (text), and can be prepared in 2 to 4 hours. Laboratory reports should be prepared using a word processor. The reports should be in a standard technical report format such as: COVER PAGE, INTRODUCTION, PROCEDURE, RESULTS, DISCUSSION, REFERENCES (when applicable) and APPENDIX. No section should repeat the material provided in the lab manual. In the INTRODUCTION section, give just enough background to show that you know why the experiment was done, what you were supposed to find out and briefly what your results showed. The PROCEDURE section names the equipment used and illustrates that you know what each component is for. Schematics may be helpful. Provide insight into any particular experimental procedures you found useful in properly conducting the experiment. DO NOT REPEAT THE MATERIAL IN THE LAB MANUAL. The RESULTS section includes presentation of results in the form of graphs or tables. Here you should describe your analysis method, make appropriate comparisons and summarize key results. Do not include the raw data here. Raw data (if it is to be presented at all) belongs in the Appendix along with Matlab code listings. The DISCUSSION section is where you evaluate the experiment and draw conclusions. This section compliments the material in the Introduction. Conclusions should be stated clearly and concisely, perhaps in a bulleted list format.

Project Report: The project report is a formal, word-processed, report including computer generated graphs and figures. The project is assigned in 3 parts. Each part is graded and returned before the subsequent part is assigned. Part 1 must be revised according to the instructor's comments before proceeding to Part 2, and likewise Part 2 must be revised before proceeding to Part 3. The report should read something like a very long example from a textbook with explanations of all derivations and procedures used. Do not include reams of data with the report. Lengthy calculations, Matlab file listings and data may be included in an Appendix.

Laboratory Projects:

1. Data acquisition/Lab familiarization. Introduction to Matlab Data Acquisition Toolbox.
2. Analog computer simulation.
3. Experimental transfer function identification.
4. DC motor control - Analog simulation.
5. DC motor control - Analog Implementation.
6. DC motor control - Digital Implementation.

Dates:

- Project Part 1 assigned: January 29
- Project Part 1 due: February 19
- Project Part 2 assigned: February 26
- Project Part 2 due: March 19
- SPRING BREAK March 11-16
- Midterm Exam: April 4
- Project Part 3 assigned: April 9
- Completed Project due: May 5, 5:00pm

The project grade takes the place of the final exam.