

EE 599/MFS 599 – APPLIED CONTROL

Spring 2001

INSTRUCTORS:

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OFFICE HOURS:

Dr. Zhang: 2-4 p.m. M-F Dr. Walcott 3-4 p.m. MW Dr. Holloway: 10-12 MWF

PREREQUISITES: EE422G or EE571.

REFERENCES:

Liuping Wang and William R. Cluett, *From Plant Data to Process Control: Ideas for process identification and PID design*, Taylor & Francis, 2000

Lennart Ljung, *System Identification: Theory for the User*, Prentice Hall, 2nd Ed., 1999

Williams S. Levine (Ed.), *The Control Handbook*, CRC Press, 1996

COURSE WEBSITE:

<http://www.engr.uky.edu/~ymzhang/AppliedControl/AppliedControl.html>
<http://www.engr.uky.edu/~holloway/AppliedControl>

GRADING:

HW	30 pts
Projects	45 pts
Test 1	25 pts.
Test 2	25 pts.
Final Exam. (Test 3)	25 pts.
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Total.....	150 pts.

TEST ATTENDANCE:

Failure to take a test or the final exam during the assigned class period will result in a grade of zero being recorded for that test unless the student has personally contacted me PRIOR to the test and has received permission to take the test at an alternative time.

CLASS ATTENDANCE:

Students will be responsible for ALL business conducted during scheduled class periods, including any announcements which might be made.

TENTATIVE PLAN

0. Introduction
Lecture: 1/11/01
1. Identification and PID Controller Design: frequency sampling filters (FSF) based dynamical models; new frequency domain PID controller design method; tuning rules for PID controller.
Lecture: 1/16/01-2/13/01, Test: 2/15/01
2. Fuzzy Control: Fuzzy Sets and basic operations on fuzzy sets, axiomatic fuzzy set theory, relations/extension principle, linguistics/fuzzy IF-THEN rules, fuzzy logic and approximate reasoning, fuzzy inference engine, fuzzifiers and defuzzifiers, control applications of Fuzzy Logic
Lecture: 2/20/01-3/22/01, Test: 3/29/01
3. Discrete Controller Design: Discrete Control Models – event based and state based, Programmable Logic Controllers, Relay Ladder Diagrams, Grafset/Sequential Function Charts, synthesis of logic from models, hybrid control systems, gain scheduling methods
Lecture: 4/1/01-4/26/01, Final Exam.: 8:00 a.m., 5/1/01

Project 1 (30 pts): Development of Temperature Control System (Proposal due 2/9/01, Hardware System due 3/9/01, Identification Result due 3/30/00, Closed-loop System and Final Report due: 4/20/01)

Project 2 (15 pts): Development and Demonstration of Discrete Logic Control on PLC (due 4/27/01)

ABET LEARNING OUTCOMES:

Upon completion of this course students should be able to:

1. Understand the basic procedure for the development of closed-loop control systems.
2. Establish the dynamic models for the underlying industrial and manufacturing processes.
3. Design practical PID control systems for industrial and manufacturing dynamic processes.
4. Define control problems from industrial and manufacturing applications and then establish the corresponding control systems, including hardware and software.
5. Understand Basic Principles of Fuzzy Sets and Fuzzy Logic and apply Fuzzy Logic to a variety of control problems
6. Develop and demonstrate discrete control logic in relay ladder logic and sequential function charts.
7. Perform basic analysis of hybrid control systems incorporating continuous and discrete control.