ME451: Control Systems Laboratory

Lab Coordinator: Professor Clark Radcliffe
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Laboratory Location: 1532EB
Website: http://www.egr.msu.edu/classes/me451/radcliff/lab

Objectives:

- Learn to simulate dynamic systems in the Matlab environment,
- Familiarize the student with theoretical and practical aspects of making physical measurements,
- Introduce the student to a variety of transducers and instrumentation used by mechanical engineers,
- Familiarize students with the behavior of control systems and enable them to understand the role the system parameters in control system response,
- Develop skills in writing technical reports.

Experiments:

1 Modeling and Experimental Validation of a First-Order Plant: DC Servo Motor

2 Modeling and Experimental Validation of a Second-Order Plant: Mass-Spring-Damper System

3 Sinusoidal Response of a First-Order Plant: Operational Amplifier Circuit

4 Sinusoidal Response of a First-Order Plant: DC Servo Motor

5 Sinusoidal Response of a Second-Order Plant: Torsional Mass-Spring-Damper System

6 Control of a System with Process Delay

Laboratory Grading:

Short Forms (9) 60%

Matlab Workshop, (6) Experiments, (2) Design Projects

Formal Reports (2) 40%

(**Note:** to pass ME451, you must pass the laboratory portion of the course)

Laboratory Schedule:

Each section will be divided into three groups: Groups A, B, and C. Group assignments will be posted outside room 1532EB before the second week of the semester. All groups of a particular section will attend the laboratory at their scheduled time, and perform experiments using the schedule shown below.

Week	Date	Group A	Group B	Group C
1	1/11	Writing Workshop	Writing Workshop	Writing Workshop
2	1/18 Mon: MLK Day	Math & Matlab	Math & Matlab	Math & Matlab
3	1/25	Modeling: 1st Order System		---
4	2/1	Modeling: 2nd Order System	Modeling: 1st Order System -	
5	2/8	Report Period (no lab)	Modeling: 2nd Order System	Modeling: 1st Order System
6	2/15	Sinusoidal Model: Op Amp	Report Period (no lab)	Modeling: 2nd Order System
7	2/22	Sinusoidal Model: DC Servo	Sinusoidal Model: Op Amp	Report Period (no lab)
8	3/1	Report Period (no lab)	Sinusoidal Model: DC Servo	Sinusoidal Model: Op Amp
	3/8	**Spring Break**	**Spring Break**	**Spring Break**
9	3/15	Sinusoidal Model: Torsional System	Report Period (no lab)	Sinusoidal Model: DC Servo
10	3/22	Air Temperature w/ Process Delay	Sinusoidal Model: Torsional System	Report Period (no lab)
11	3/29	Report Period (no lab)	Air Temperature w/ Process Delay	Sinusoidal Model: Torsional System
12	4/5	---	Report Period (no lab)	Air Temperature w/ Process Delay
13	4/12	**Design Project 1**	**Design Project 1**	**Design Project 1**
14	4/19	**Design Project 2**	**Design Project 2**	**Design Project 2**
15	4/26			
*	5/3	Finals week---	Finals week---	Finals week---

Laboratory Reports:

Short Forms: After performing each experiment, students must complete and turn in their respective short forms to the laboratory TA before the end of the laboratory period. These forms will be graded and returned in the next class. The short forms are included in the laboratory handout at the end of each experiment description.

Formal Reports: Each student will have to write two formal reports during the semester. Students writing their report will turn in their rough draft one week after completing the lab (For example, a week 5 lab report is due at the beginning of the lab in week 6). The draft reports will be reviewed by your laboratory TA and Craig Gunn, and suggestions for improvement will be provided to the student at the following week's lab period. The revised, final, version of the report is then due at the beginning of the lab period 3 weeks after the lab. The final version of the report will be graded.

Draft: Two copies of the report must be submitted

Final: One final report copy, two marked up drafts and electronic copy (emailed to TA)

Notes:

(1) 100% laboratory attendance is mandatory.

(2) Laboratory work accounts for 25% of the overall grade for ME451

(3) Students can reschedule their laboratory time only in special situations, through PRIOR arrangements made with TA' s. If a laboratory is missed without prior arrangement, the student will receive a zero.

(4) Short forms have to be submitted at the end of the laboratory

(5) Late formal reports will not be accepted unless PRIOR arrangements have been made with the laboratory coordinator.

(6) Laboratory handouts are available in the course web pages

(7) Read the laboratory handout for each week's lab BEFORE coming to the laboratory. You may otherwise face difficulty completing your experiment.

Section Times:

Section	Day	Lab Time	Lecture Time	Enroll
001	Tu	8:00a - 10:50a	MWF 9:10	9
002	Tu	11:30a - 2:20p	MWF 9:10	8
003	W	3:00p - 5:50p	MWF 12:40	9
004	W	7:00p - 9:50p	MWF 12:40	9
005	Th	11:30a - 2:20p	MWF 12:40	9
006	M	7:00p - 9:50p	MWF 9:10	9