ME-407 Measurements and Control
Spring 2014

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Office hours: TuTh 2-4 PM. (You can visit me at other times, and if I am free, I will answer your questions. Use email for short questions only [I should be able to answer your questions in few words]. For other questions, visit me during my office hours.)
Note: These hours are tentative. After finalizing the class times, I may change these hours.

Lecture Classroom: Engr. A111, Class hour: Th 4-4:50 PM
Lab.: Engr. B138

Section #	Lab. Hours
Sec 1.	M 2-4 PM
Sec 2.	M 4-6 PM
Sec 3.	W 2-4 PM
Sec 4.	W 4-6 PM
Sec 5.	F 12 AM-2 PM
Sec 6.	F 10 AM-12 Noon

Experiments:

1. Experiment_1_Rectilinear_Plant
2. Experiment_2_Torsional_Plant
3. Experiment_3_Gear_System_Part1_Parameter_Identification
4. Experiment_4_Beam_Vibration
5. Experiment_5_Multi_Degree_of_Freedom
6. Experiment_6_Gear_System_Part2_Control
7. Experiment_7_DC_Motor_Part_1_Modeling
8. Experiment_8_DC_Motor_Part_2_Speed Control

Note: These are tentative experiments. I may add or replace these experiments with other experiments.

Grading tools and their weights:

Reports:	50%
Simulink part:	10%
Assignments	10%
Two Tests:	30%

Notes:

1. Tests will be based on the theories, experiments and Simulink models.
2. Reports may include Simulink models and the results based on Simulink models. However, this part will be graded separately.

3. If the analysis of the experimental results involves Simulink modeling, then this part must be done separately (and individually) by everyone in the team.
4. You must read the appropriate handout before coming to the lab. The TAs may give Pre-lab work.

Grade Scale: 90-100 A, 80-89 B, 70-79 C, 60-69 D, 0-59 F.

Attendance:

1. You must come to the lab on time. You will be penalized each time you come to the lab more than 5 minutes late. The penalty would be 2% point each time you are late. You will also have to do the lab individually and submit an individual report.
2. You must be present in the lab at all time until your group has completed the experiment. If you leave the lab before your group has completed the experiments, then you will be penalized 5% points each time you conduct this action.
3. You should have your cell phone off all the time while you are in the lab.

Incomplete: Incomplete grades will be given only in extreme cases such as a serious accident or illness.

Tests:

I will give 2 tests, and they will be based on the lectures covered in class, the experiments performed and simulations. You should also be able to identity the sources of errors and how you would improve the experimental results.

Report:

1. The report must be typed.
2. Use the following format for the report:
   a. Page 1: Experiment number, Title of the experiment, Names of the Team members, and the date the report was submitted
   b. Following pages:
      i. Purpose of the Experiment
      ii. Procedure. Write the procedure that you followed. You can reproduce the procedures given in the handouts. Try to write the procedure in a condensed form. If your procedure was different form what is listed in the handout, then describe that part.
      iii. Experimental Results (Present the results in the form of Tables, Graphs, and Charts. If the data list is long, then do not present them in one or two column form, but present them in multiple columns. Also, present only a sample representation of data in tabular form. Other data could be presented in graphical format. A simple guideline is that each data set must fit in less than half a page. Note: The entire team will be penalized if the report includes a table that exceeds half a page. If you believe that some tables must be longer than half a page, then consult your instructor. To compare the simulation and experimental results, present the simulation and the experimental results in the same table. You should also plot the experimental and the simulation results on the same graph.)

iv. Calculations. Everyone in the team must do at least 1 calculation for all parts. Show the calculations. If a parameter is being computed multiple numbers of times, then show only one calculation for that parameter. This part must be at the end of the report, and it could be handwritten. Do not forget to write your name on it. Note: One set of calculations must be included in the report. This part must be typed.
v. Analysis of data and sources of errors (Everyone must perform this separately.) Be specific. Specify what may have caused an error. (Note: Do not write just human error. Be specific. Do not write human errors that could be avoided. Give details of the errors that could not be avoided.)
vi. How could the experiment be improved?
vii. Conclusions: Based on your analysis of the data and your experience with the experiment, write a conclusion section.
viii. Acknowledgments: If someone has helped you in anyway, then acknowledge his/her help.
ix. References: Write the references that you have consulted in writing the report. Cite them in the main body of the report.

3. Before each section, write the name of the person who prepared that part of the report. If this is not stated then you may loose some points. Note that each student must submit at least one set of calculations, and analysis of their data. The report my have additional analysis if the data reflect something new.
4. Typing equations and the solutions could be time consuming; therefore, you need to include only one typed version. Calculations by other members of the team could be submitted in hand written form. However, the writing should be clear. You may lose points for poor handwriting.
5. Except for Experiment 4, you must submit Simulink results. Simulink results must be included in the word file.
6. You must submit the typed part of the report via email. You must include the following in the subject heading of the email: ME407-Group#-Experiment#-Title of the experiment.

Textbooks, Reference Books: None
Websites: http://en.wikipedia.org/wiki/Damping, http://en.wikipedia.org/wiki/PID_controller, http://www.engin.umich.edu/group/ctm/

Emergency Procedures
Southern Illinois University Carbondale is committed to providing a safe and healthy environment for study and work. Because some health and safety circumstances are beyond our control, we ask that you become familiar with the SIUC Emergency Response Plan and Building Emergency Response Team (BERT) program. Emergency response information is available on posters in buildings on campus, available on BERT's website at www.bert.siu.edu, Department of Safety's website www.dps.siu.edu (disaster drop down) and in Emergency Response Guideline pamphlet. Know how to respond to each type of emergency.

Instructors will provide guidance and direction to students in the classroom in the event of an emergency affecting your location. It is important that you follow these instructions and stay with your instructor during an evacuation or sheltering emergency. The Building Emergency

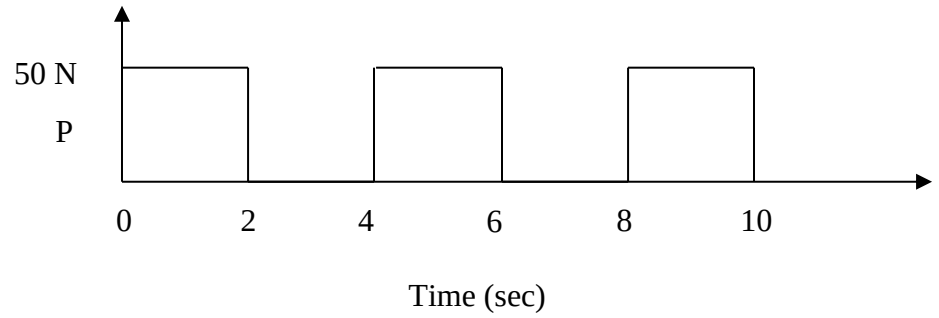
Response Team will provide assistance to your instructor in evacuating the building or sheltering within the facility.

Assignment: Simulink modeling and control of translational, torsional, and gear systems.

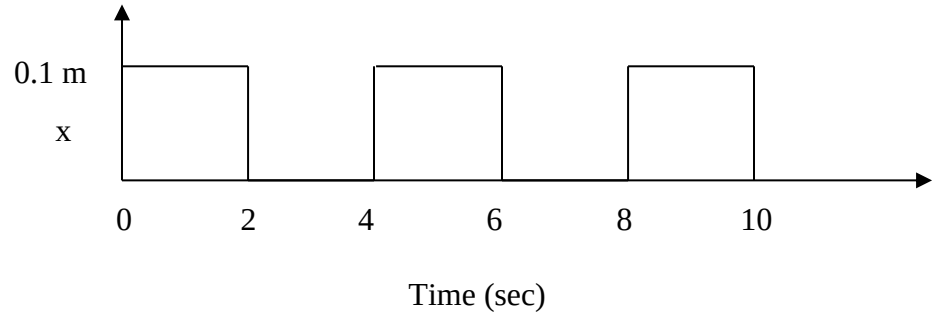
Part 1: Simulation.

Problem 1: You have been asked to design a controller for a vertical pendulum so that the pendulum always returns to its vertical position after it has been disturbed. Suggest a simple control scheme. Draw a block diagram for this.

Problem 2: A spring mass system is subjected a force P as shown in the figure below. Find the response of the system for 10 sec. using the Simulink program. Use the following parameters: mass m = 2 kg, k = 20 N/m, x(0) = Dx(0) = 0.



Problem 3: The motion of a 2 kg mass is controlled using a PD controller. The desired output is given below.



Design a PD controller to obtain this output, i.e. find a set of suitable values of k_p (proportionate gain) and k_d (derivative gain). Vary these two parameters and observe the response. Report your findings.