EEE351: Makmal Lanjutan (Advanced Lab)

Title: Control System - Modeling, Simulation & Analysis

Course Instructor: Dr. Mohd Rizal Arshad

Af the end of this section, student should be able:

1. To model a real physical system into a mathematical representation.
2. To implement the model in a software simulation environment, i.e. MATLAB/Simulink.
3. To understand the limitations and usage of control simulation software in representing real-world physical system.

Course Assessment:

a. Group Report / Presentation (50%):
Each group will have to prepare a report on the selected topics. The report should not be more than 10 pages (Font – 12, Times New Roman, 1.5 line spacing, Single Column). A short 10 minutes presentation of the results will be presented and discussed with the course instructor.

b. Individual Test – MATLAB / SIMULINK (50%):
A short, 1 hour, test will be given on the ability of the students to Use MATLAB and to solve simple mathematical problem. The ability to use Simulink tool will also tested. This is a closed book hands-on test.

Lab division:

Week 1:

1. To explore MATLAB and Simulink Software
2. To investigate few examples of controller implementations

Week2:

1. To model, simulate and analyse a real-world physical system using MATLAB/SIMULINK
2. To prepare a technical report on the simulation
3. To demonstrate the capability of using MATLAB/SIMULINK

Tasks for Week 1:

1. Matlab

Matlab, which stands for MATrix LABoratory, will be used extensively in the course. Matlab is available in the PC labs on campus. Tutorials that you try for yourself are an excellent way to teach you how to use this valuable tool. Some suggested web tutorials are:

- Controls Tutorial for Matlab: http://www.engin.umich.edu/group/ctm
- http://www.engin.umich.edu/class/ctms/

Note that you can also type "help x" at the command line to get more information about a particular command. "x" could be replaced by "plot", "subplot", "exp", etc.

Please go through all the steps/notes about MATLAB given in the Tutorial with filename: *" MATLAB_Tutorial.pdf"*.

2. Simulink

Simulink is a software package that enables you to model, simulate, and analyze systems whose outputs change over time. Such systems are often referred to as dynamic systems. Simulink can be used to explore the behavior of a wide range of real-world dynamic systems, including electrical circuits, shock absorbers, braking systems, and many other electrical, mechanical, and thermodynamic systems. Simulating a dynamic system is a two-step process with Simulink. First, you create a graphical model of the system to be simulated, using the Simulink model editor. The model depicts the time-dependent mathematical relationships among the system's inputs, states, and outputs. Then, you use Simulink to simulate the behavior of the system over a specified time span. Simulink uses information that you entered into the model to perform the simulation. Simulink is executed by typing 'simulink' at the Matlab command prompt. Here are some web tutorials for Simulink:

- http://www.owlnet.rice.edu/~mech343/schedule.html
- http://www.mathworks.com/access/helpdesk/help/toolbox/simulink/simulink.shtml
- http://rclsgi.eng.ohio-state.edu/~he/me481/simulink_tut.

Now, please go through the steps/notes about SIMULINK given the Tutorial with filename: *" simulink.pdf "*.

3. Assignment

This assignment explores Matlab's Simulink program as a useful aid in modeling, simulating and analyzing control systems. Some systems are extremely complex, and, therefore, digital modeling can be a fast effective way to practically represent and explore the characteristics of a system. By modeling an open loop field-control motor-load system with a known transfer function, the effect of different gains can be determined. Similarly, a closed loop system can be modeled to determine the characteristics of a PID (proportional integrator derivative) controller. Through a digital simulation, the effect of the different components could be found.

The aim is to become familiar with the Matlab digital simulation, Simulink, to analyze control systems. The gain, P, PI, PD and PID controllers applied on a motor-load system with a known transfer function are examined to accomplish this purpose, both in open and closed loop systems.