EECE 258 Lab #1
LabView-based Identification of a DC Motor Transfer Function and Simulink-based Step Response
Spring 2011

OBJECTIVEs: Students will learn (1) how to use dataflow programming to model a DC motor to achieve various design specifications and (2) simulate the unit step response using Simulink

PRELAB: DC motor is one of the most commonly used actuating devices for control systems. Visit the 258 web site at http://eecs.vanderbilt.edu/courses/eecs258/ and investigate the characteristics of the DC motor.

INLAB: Students will use the National Instruments LabVIEW to model the Quanser QNET DC Motor and to experiment with PID (Proportional Integral Derivative) controller parameter tuning using Simulink.

REQUIREMENTS: You will be required to learn the virtual instrumentation approach using LabView and dataflow programming and another control system analysis tool Simulink to run the experiment and achieve the following design specifications:

1. Getting the transfer function of a DC motor
2. Marginal Stability (Square wave)
3. Best tracking of a triangle wave (~0 steady-state error, <4% overshoot, and <.4sec. settling time). Also, observe the effect of a disturbance (load) on the motor when Ki has a very low value.

PROCEDURE:

Complete the following steps to perform the lab:

1. Start Windows.

2. Log in as 276labuser (password resubal672).

3. Open and Run LabVIEW.

4. From 'File', open "SysID of QNET DC Motor.Vi" .

5. After Front Panel appears, save the file as "ex1_YOURNAME" under "C:/EE258_2010"

6. Save the newly opened file as "ex1_YOURNAME" to avoid overwriting the original file.

7. Press the Run button at the top tool bar.

8. In the front panel, the transfer function of model of the DC motor will appear in the "Transfer Function" window and the input and response curves will appear in the "Response" window. (The input of the transfer function is the voltage and the output of the transfer function is the rotation speed)

9. From 'File', open "DC_Motor_Simulation.vi".

10. Press the Run button at the top tool bar.

11. Change the PID parameters (Kp, Ki, and Kd) to achieve the design specifications. To view how your changes affect the system, complete these steps:
    a. Input the new PID parameters.
    b. Press Enter to see the changes.

12. You will see the result instantaneously on the graph in the front panel.

13. Open and run Matlab

14. After the initialization of Matlab completes, open Simulink.

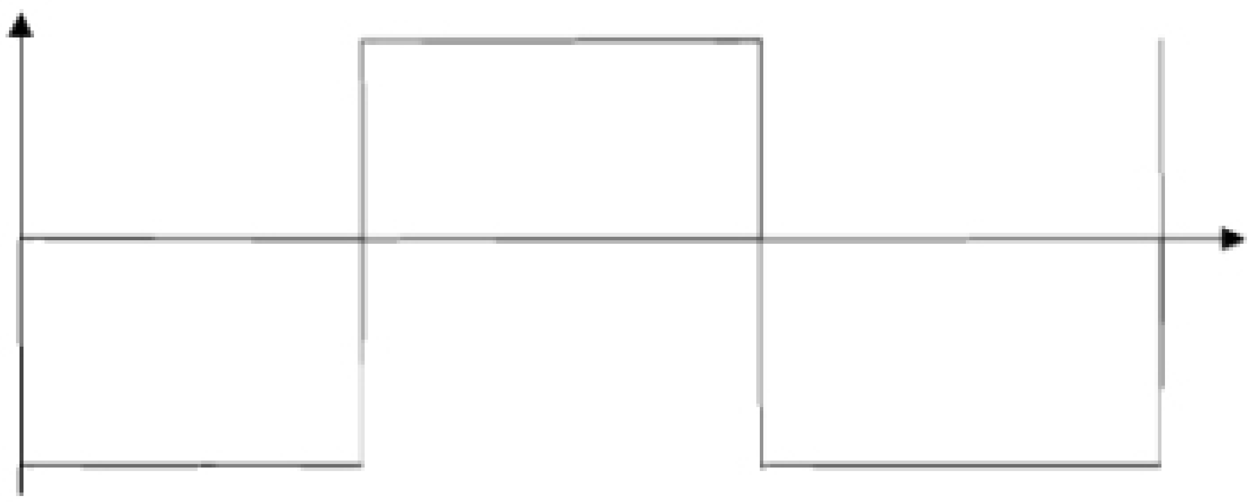
15. Design a close-loop position control system using Simulink. (The controller should be a PID controller, plant transfer function is obtained from step 8, and the feedback gain is 1. The output is connected to a scope.)

16. Change the PID parameters (Kp, Ki, and Kd) to achieve the design specifications.

17. You can see the result from the graph of the scope

18. Once you achieve each set of design specifications, save your plots for you lab report. To help in writing the report, fill out the information on the following sheets:

A) On the square wave plot below sketch how the output of a marginally stable system would look.



Trials 1 – 7 on the table below should hold some or all attempts (values) made to reach Final Trail. The "Effects on the output" column should tell why the values were wrong. Trial N should hold the values that achieved marginal stability. HINT: Start with Kp= 0.04, KI= 0.00000001, and KD= 0. A good technique to find the appropriate values is to hold two values constant and vary the other to see the effects.

	Kp	Ki	Kd	Effects on the output
Trial 1				
Trial 2				
Trial 3				
Trial 4				
Trial 5				
Trial 6				
Trial 7				
Final Trial				