NUST School of Electrical Engineering and Computer Science

Faculty Member:______________ Date: ______________

Semester:_____________ Section: ______________

Department of Electrical Engineering

EE-379: Control Systems

LAB 11: PID controller Implementation for QNET DC Motor (Hardware)

Student name	Reg. No.	Log book Marks / 5	Lab completion Marks / 5	Lab report Marks / 5	Total/15

Prepared by: Dr. Ammar Hasan

LAB 11: PID controller implementation for QNET DC motor

Objectives

- Design and implementation of controllers for speed control of DC motor
- Design and implementation of controllers for position control of DC motor

Exercise 1: Design of proportional controller for motor speed

Using the techniques learnt in lab 10 and the model of QNET DC motor found in lab 3, design a simple proportional controller for the speed control of the DC motor. The controller should meet the following specifications

- $\%OS<25$
- Settling time is less than 0.5 second

Exercise 2: Implementation of proportional controller

Using the techniques learnt in previous labs implement the proportional controller on the actual plant (i.e. the QNET DC Motor).

Using data acquisition, acquire the response of the control system to a step input and see whether the design specifications have been met or not.

Load the motor by applying a slight friction with your hands. Observe if it maintains the speed or not? How does this differ from open loop control? Comment on your observations in your lab report.

Exercise 3: Design of PI controller for motor speed

Design a PI controller for the speed control of the DC motor. The controller should meet the following specifications

- $\%OS<25$
- Settling time is less than 1 seconds
- Zero steady state error for step input

Exercise 4: Implementation of PI controller

Using the techniques learnt in previous labs implement the proportional controller on the actual plant (i.e. the QNET DC Motor).

Using data acquisition, acquire the response of the control system to a step input and see whether the design specifications have been met or not.

Load the motor by applying a slight friction with your hands. Observe if it maintains the speed or not? How does this differ from open loop control? Comment on your observations in your lab report.

Exercise 5: Design and implementation of proportional controller for motor position

Design a simple proportional controller for the position control of the DC motor, such that the closed loop systems is critically damped. Implement this controller on the QNET DC Motor.

Using data acquisition, acquire the response of the control system to a step input and see whether the design specifications have been met or not.

Load the motor by applying a slight friction with your hands. Observe if it gets to the desired position or not? How does this differ from open loop control? Comment on your observations in your lab report.

Exercise 6: Design and implementation of a PD controller for motor position

Design a PD controller for the position control of the DC motor, to meet the following specifications.

- %OS<25
- Settling time is less than 0.5 seconds

Exercise 7: Design and implementation of a PID controller for motor position

Note that in the transfer function of motor position vs voltage there is a pole at the origin. Therefore, the system type is 1. Consequently, the closed loop system will have zero steady state error for a step input. If the requirement is to have zero steady state error for step input, then we do not need a PI controller.

If the input is a ramp, then there will be a non-zero steady state error. In that case we may have a PI compensator to increase the steady state error. Design a PID controller to meet the following specifications

- %OS<25
- Settling time is less than 0.5 seconds
- Zero steady state error for ramp input

Using data acquisition, acquire the response of the control system to a ramp input and see whether the design specifications have been met or not.

Load the motor by applying a slight friction with your hands. Observe if it maintains the position or not? Comment on your observations in your lab report.