

## Lab 9 – Motor Speed Follower

**You should complete and demo your solution to this problem by the end of Lab 10. However, there will be the opportunity for demos during Finals Week if necessary, at some small (10%) penalty.**

### Overview

In this lab you will design a motor speed controller using PID control that senses the speed of one motor and drives a second motor to run at exactly the same speed. Your design will have two inputs, the phototransistors for two motors, yours and the master motor, and one output, the driver for your motor. You will be driving and sensing the speed of your (the slave) motor and sensing the speed of our (the master) motor. You already have programmed all the circuits that you need for this design. You will use the motor drive circuit as designed, and two copies of the motor speed sensor circuit. The job of your program is to keep the speed of your motor as close as possible to the speed of the master motor, under all conditions, including external forces.

Design a PID control program to solve this control problem. As discussed in class, we can use an empirical method to discover good values for the control variable without knowing control theory, or developing an accurate model of the motor. You might want to use my Excel spreadsheet to experiment with PID controllers, but keep in mind that it does not correspond to the motor you are using.

You must use a timer interrupt for sampling the motor speed, using a sample frequency of 100Hz. (You may experiment with other values, but use this value for your demo and turnin.)

You will not be able to test your circuit at home with the master motor. Instead you should use a program that changes the motor speed set point at intervals, and measures how well your motor follows this speed. You can start with a manual system using the Serial Monitor, but this will not be fast enough, nor will it allow you to generate gradually changing motor speeds.

When you demo your design, we will supply the second motor and a driver for it. ***Make sure the grounds of the two systems are tied together before connecting the power!!*** Our board will take as input the speed of both motors and determine how well your controller performs.

Final Project Checkoff \_\_\_\_\_ Date \_\_\_\_\_