# Laboratory 0: Laboratory Introduction

The purpose of this laboratory is to introduce you to the equipment, so that you are familiar with the servomotor system, the computer hardware and software, and your TA before attempting Lab 1. There is no lab report, and nothing to submit, but you must demonstrate to your TA that you know

- how to wire the servomotor system;
- how to compile and run the real-time software; and
- how to load experimental data into MATLAB and plot it.

## 1 Preparation

If you have not done so, read the *Introduction to the Control Systems Laboratory*, before beginning the Laboratory. Obtain a copy of the C program `lab.c`, available on the network in GB347, or on the WWW at url

`http://www.control.toronto.edu/~bortoff/410.html`,

This program is a template, used to implement all the controllers for Labs 1-3. You should read through it and understand generally how it works. You will not need to modify `lab.c` for Lab 0.

## 2 Laboratory Procedure

1. Make sure the servomotor system is wired correctly. Your job is to connect the servomotor box, the power amplifier, and the bench-top interface board. **PLEASE DO NOT ATTEMPT TO CONNECT THE RIBBON CABLE FROM THE BENCH-TOP INTERFACE BOARD TO THE COMPUTER. IT IS VERY EASY TO INSERT THE RIBBON CABLE BACKWARDS, WHICH DAMAGES THE A/D CARD, MAKING THE ENTIRE WORKSTATION UNUSABLE. LET THE TA CONNECT THE RIBBON CABLE TO THE COMPUTER.**

2. Compile and run `lab.c`. It is not necessary for the power amplifier to be driving the motor here, i.e., you may disconnect the output of the power amplifier from the servomotor input, although the power amplifier must be "on," so the POT is biased. While the software is running, move the servomotor back and forth. After about 5 seconds, type 'X' to stop the software.

3. Load the data collected in Step 3 into MATLAB and plot it. As distributed, `lab.c` produces a data file called `coollab.m,` which is in the proper ASCII format to load into MATLAB. Its format is

```
0.000  0.000  0.000
0.004  0.000  0.000
 ...    ...    ...
4.000  1.000  0.988
```

where, the first column is time, the second column is $r$ at this time, and the third column is $y$ at this time. Each row is for a different sample time, with time increasing from top to bottom, at increments of 0.004 seconds. To read this data into MATLAB, start MS Windows, then start MATLAB, use the `cd` command to change to the current directory, and type

```
>> load coollab.m
```

(the name of the data file, complete with the .m), at the prompt. This creates array called `coollab`. Then, the commands:

```
>> tdata=coollab(:,1);
>> ydata=coollab(:,3);
```

create vectors that can be plotted. (Note that the `>>` is the MATLAB prompt, and is not typed.) The plot can be generated as follows:

```
>> plot(tdata,ydata);                      % plot
>> xlabel('Time (seconds)');               % time-axis label - Very Important
>> ylabel('Shaft position (degrees)');     % data-axis label - Very Important
>> title('Servomotor Response');
```

# 3 Before Leaving Lab

Before leaving lab, make sure to do the following.

- Show the TA your wired servomotor system.
- Show the TA the MATLAB plot of the servomotor angle.

# 4 Laboratory Report

There is no laboratory report for this lab. Although Lab 0 is not counted toward your final grade, it is important to become familiar with the equipment. Otherwise, you will have a difficult time completing Lab 1.