ECE147A Lab Report Template and Guide

Lab Number

September 27, 2017

	Score	Out of
Abstract		20
Introduction		10
Procedure		10
Results		30
Discussion		30
Raw Score		**100**

T-Score:

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1 Abstract

In a few sentences, describe your objective, method, observations, and conclusion. This serves as a short summary of your report, as well as to intrigue the reader.

2 Introduction

Here is where you elaborate on the problem to be investigated, including all relevant theory and background involved. If any formulae or design techniques are used, they should be explained here. Briefly present the expected and actual results, along with your interpretation (expand on this in the Discussion).

Ex.

Our dynamics resulted in the following differential equation:

$$2\ddot{y} = y + 4\dot{x} + 3x$$

Which using the standard Laplace transform: $\mathcal{L}\{f(t)\} = \int_0^\infty f(\tau)e^{-s\tau}d\tau$

gives us the transfer function:

$$2\frac{s+\frac{3}{2}}{(s-1)(s+1)}$$

Which is unstable due to a pole in the RHP

We expected this to result in a step response that went to infinity, but because of unaccounted for saturation within our actual system, this was not the case.

3 Procedure

In sufficient but succinct detail, describe how the experiment was performed. Make use of block diagrams, free body diagrams, circuit diagrams, etc. in your description. Any code should be clearly distinguished from the text.

Ex.

Figure 1 shows the components and setup of our experiment:

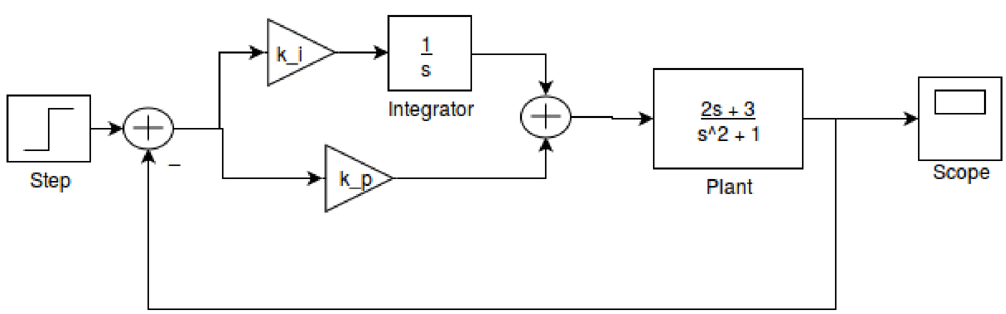

Figure 1: A block diagram of our system

We ran the following Matlab code to determine the rise time, settling time, and overshoot of our system with respect to a step input.

```
%get step response information of feedback system
H = feedback(G, 1);
s = stepinfo(H);
tr = s.RiseTime;
ts = s.SettlingTime;
mp = s.Overshoot;

%print result
fprintf('rise time = %.5f \nsettling time = %.5f \novershoot = %.5f \n', tr, ts, mp);
```

4 Results

In this section, the data you collected should be presented in a clear and organized manner. Try to avoid simply filling pages with graphs and charts. While every graph must have a label or caption for reference, it often helps to provide an introduction for each result, as well as remarks after it.

Ex.
The following graph (Fig. 2) shows the results of our experiment with both pure proportional and proportional-integrative control.

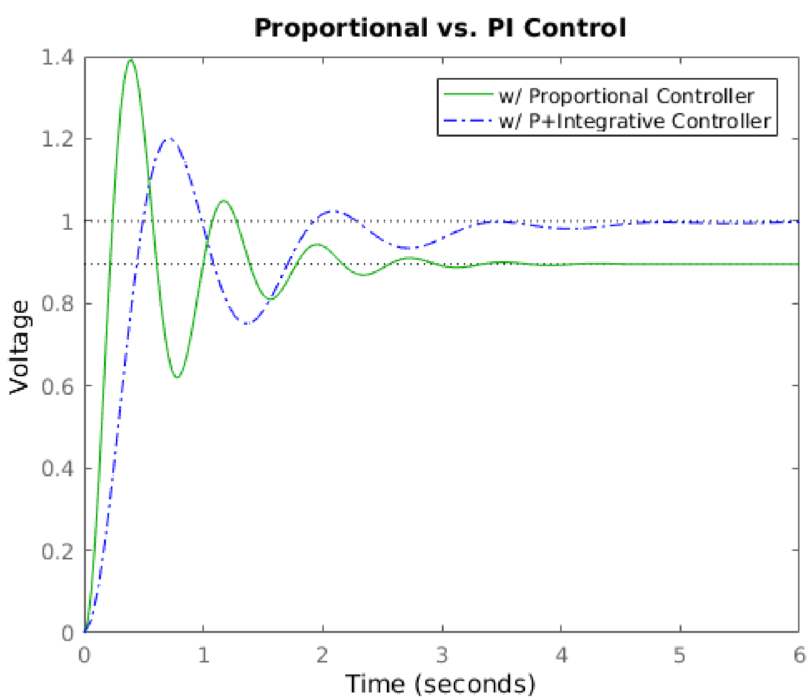

Figure 2: System step response with P and PI controllers

Note that in the PI case, while the settling time was slower, the steady state error, e_{ss}, was zero, and we were able to reduce the overshoot.

5 Discussion

Given our results, we must now interpret them in the context of our problem (see: Introduction). These results, whether expected or unexpected, have a meaning that you should discuss. In the case of unexpected results, you may sometimes point to sources of error (see: Procedure). In general, try to use theory to frame your arguments, and pose new questions based on your data. This section is the most important because it demonstrates your conceptual understanding of the experiment.

6 Tips and Tricks for Lab Reports

LaTeX is your friend, and on newer versions of Microsoft Word, the equation editing also works quite well. Note that nearly all serious technical papers are generated using these tools, and the recyclability of LaTeX source files will make your life easier in the long run. The LaTeX source (.tex file) for this document is available on the course website to use as a template.

If you are unhappy with your data or missed a section, do not wait until the last minute, and especially do not copy someone else's data. Come to office hours or coordinate with the TA, and you will be able to redo or complete the experiment. Copying is fairly easy to catch, and an inability to explain your data will result in a low grade.

When inserting figures into a report, make sure that they are large enough to be understood. If printing graphs with multiple lines, in black and white, make sure that the line type is differentiated (Hint: `https://www.mathworks.com/help/matlab/ref/linespec.html`). The quality and intelligibility of your figures will make a dramatic difference to your grade (when accompanied by insightful analysis, of course).

Finally, get used to a writing method that includes extensive proofreading. Rather than trying to corral all your thoughts on the first pass, it is more effective to go back over and reorganize ideas or fill in missing information. Keep in mind, good report writing requires practice, but is an essential skill in engineering.

A good TeX editor is **Texmaker:** `http://www.xm1math.net/texmaker/`
or **Texstudio:** `http://texstudio.sourceforge.net/`

Some Online TeX editors include:
ShareLatex: `www.sharelatex.com`
OverLeaf: `www.overleaf.com`
Which both allow for online collaboration (You can work together on papers/slides from anywhere!), and do not require you to download/install anything.

Diagrams can be generated in Simulink, but for those who find it difficult to use there is:
draw.io: `https://www.draw.io/`
which is an online application, and should also do the trick