

Rotating Lab 1

Time & Frequency Plots

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1 Introduction

1.1 Free-Form Lab Investigation

The last five labs of the semester are “free-form” rather than “cook-book” style. I provide you the equipment to investigate different phenomena, and you decide how you are going to explore the questions. Many of these labs are new, so I am looking for you to be creative and come up with interesting methods.

Since the equipment for these five labs is specialized and expensive. *Please take good care of the equipment.* I only have one set-up for each lab. This means that for week #1, five teams will be working on five different labs, and then we will rotate. There will be a sign-up sheet to determine the rotation.

1.2 Equipment Warnings

As mentioned above, some of this equipment is hi-tech, and very expensive. Please be very careful; pay attention to all equipment warnings. *If you have a question, please ask.* Anyone who is electrocuted or explodes will receive a failing grade for that lab segment.

- **Make sure the cooling vents on the Scientific interface box are not blocked.**

1.3 Required Reading

The following passages from your textbook explain the material for this lab and prelab.

- Graphs p.25-26
- Resonance Curves—Capillary Excitation p.81-83
- Analysis of Musical Instrument Tones p.115-118

Bring one instrument per group.

2 Experiment

In this lab, we will use a PC computer to make time-domain and frequency-domain plots of various sound waves. The software we are using produces these plots using a Fast Fourier Transform (FFT). The FFT is an algorithm that converts a signal from one domain—either time or frequency—to the other. The plots can be made in real-time, and then frozen. This allows you to analyze and print them out.

The list of experiments below is just a suggestion. *Feel free to experiment and come up with other interesting measurements.*

- Play an instrument both soft and loud.
- Play different notes on a single instrument.
- Play the same note on two different instruments.
- Play one of the copper or PVC tubes used in Lab 3.
- Play two tuning forks that are almost (but not quite) in tune.
- Sing a note that is “good” and “bad”. Can you use these plots to distinguish a “good” singer from a “bad” singer?
- Make up your own. . .

For all of the above, compare plots of both the time-domain and frequency-domain. How do they differ? What patterns do you notice?

To save time, please hand in one set of plots per group, stapled together, and with notations on the plots so the TA can match each plot to the comments in your lab book.