Rotating Lab 5
Wave Interference

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PHYS 1320
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1 Introduction

1.1 Free-Form Lab Investigation

The Last five labs of the semester are "free-form" rather that "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, ant 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 lag segment.

- **This lab makes use of a Fourier Transform board, oscilloscope, and home-made laser Lissajous device, all of which are expensive and delicate. If you have questions, please ask.**
- **The third part of this lab is optional and uses a laser. Please use this with caution: do not look at the laser beam, and do not point the laser beam at any person—this can result in permanent eye damage.**

1.3 Required Reading

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

- Waves p.35-42
- Properties of waves p.45-49

2 Experiment

This lab is divided into three parts:

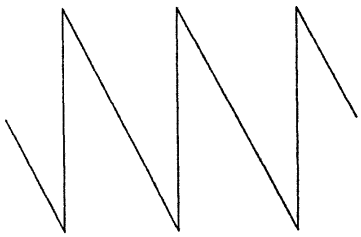
- Fourier Transforms (Frequency Domain Plots)

- Lissajous Figures (superposition of two different frequencies)
- Optional: Laser Lissajous figures

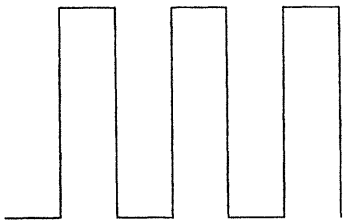
2.1 Fourier Transforms (Frequency Domain Plots)

Using the Fourier Transform box and an oscilloscope, generate a

- Saw-tooth wave



- Step-wave



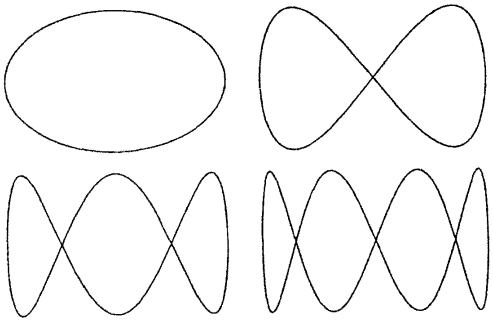
- Another wave of your choice.

Slowly vary the phase of the different partials.

- Does the phase affect the waveform you see on the oscilloscope?
- Does the phase affect what you here?

2.2 Lissajous Figures (superposition of two different frequencies)

Using the oscilloscope in "xy" mode, we will input one frequency on the x-axis, and vary the frequency on the y-axis to produce Lissajous figures. The figure below shows Lissajous figures for frequency ratios of 1:1, 1:2, 1:3, and 1:4. Identify each figure with the corresponding ratio. Now you try it with some different frequency ratios. Also, try adjusting the phase. Sketch your results for three cases.



2.3 Optional: Laser Lissajous Figures

This part is optional as the equipment is home-made, and may not work. We will repeat the above exercise, but use two mirrors instead of an oscilloscope to generate the Lissajous figures. I suggest that you set up the laser so that it shines on the ceiling (away from anyone's eyes), and I recommend you start with frequencies around 100Hz.