

Musical Synthesizer Lab

Directions:

Collecting the Sound Sample

1. Plug the microphone into the CH1 port on the side of the LabPro.
2. Open the Logger Pro application.
3. From the **File** menu, select **Open ...** . Open the file Timbre.cmbl.
4. Collect a sample of sound from your musical instrument or device. To do so, play a single note. While the note is sustained, press the Green Collect button in Logger Pro.

You may need to experiment with timing, volume of the note being played, distance from the instrument to the microphone, etc.

IMPORTANT: the recorded sample should include some harmonics but not be "noisy".

Analyzing the Sound Sample

5. Once a good sound sample is acquired, print a copy of the graph - one copy for each member of the group.
6. Select **Examine** from the **Analyze** menu. Hover over a distinct peak in the FFT spectrum window. Record the frequency value and the relative amplitude on the print-out. Perform this procedure for every obvious peak in the spectrum. Record all values in an organized manner on the print-out; label values as $f_1 = \dots$, $A_1 = \dots$.
7. Scale amplitude values in such a manner that the highest amplitude is 1.00.

Modeling the Sound Sample with Desmos - a Group of Two Exercise

1. Open Desmos. Launch Calculator.
2. Type in several wave functions in several expression windows - 1 expression for each significant harmonic seen on the spectrum. Each wave function will have the form $A\sin(fx)$. Use different *variables* for different harmonics. So there will be $B\sin(gx)$, $C\sin(hx)$, etc. Add sliders for all variables. Expression windows can be added using the the + menu.
3. Set your amplitude values to match the relative amplitudes.
4. Set your frequency values to the values for each of the harmonics.
5. At this point, all you will see in your graph window will be some very compressed together waves that will not look like waves. You will need to change the scale so that what you see are a series of wave cycles for the waves that Desmos is drawing. You have several options for doing this. Zooming in will help. Clicking on the Gear button to edit the range of the variables might also help. (You may wish to do this anyways just to control colors.) And finally, the wrench icon can be clicked and you can set the y scale and the x scale (see diagram at right).
6. Now create a sum of all the wave functions for the individual waves in a new expression window. Your goal is to now tweak the variables to match the Desmos wave form to the Logger Pro printout of the wave form. You may need to add a P or Q to one of more of the wave functions: $B\sin(gx + P)$, $C\sin(hx + Q)$. Make P and Q variables and set the range between 0 and $6.28 (2\pi)$.
7. Print your best match. It must be included with your report.

