Activity 9: Constructive and Destructive Interference

Background

When two sound waves with identical frequencies and amplitudes combine, they may interfere constructively or destructively. When constructive interference occurs, the resulting tone is louder than either of the individual tones. When interference is destructive, the combined tone is less loud than the individual tones. For two waves of equal frequency, the type of interference depends on the phase relationship between the waves.

In this activity, you will use the GLX to generate two tones at 440 Hz while varying the phase of one.

Before You Begin

Start a new experiment on the GLX.

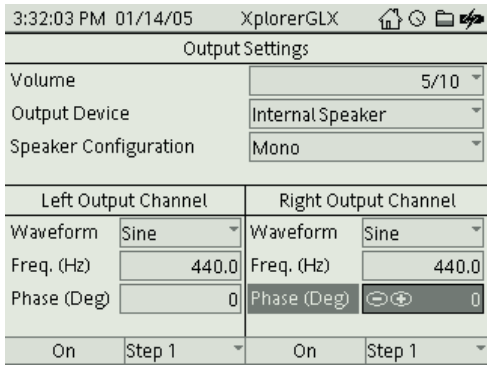
1. Press ⌂ to go to the Home Screen.
2. Use the arrow keys to highlight the Data Files icon and press ✓ to open the Data Files screen.
3. Press F4 to open the Files menu and press 1 pqrs to select New File.
4. When the GLX asks if you would like to save the previous file, press F1 to save or F2 not to save.

Procedure

1. Press ⌂ to return to the Home Screen.
2. Use the arrow keys to highlight the Output icon and press ✓.

3. If the Speaker Configuration is not already set to Mono, use the arrow keys to highlight Speaker Configuration and press ✓ to set it to Mono.

4. Use the arrow keys to highlight the Phase of the Right Output Channel (as pictured to the right).



5. Press (F3) to turn on the Right Output Channel.

6. Press (+) and (−) to vary the phase of the Right Output wave. As you vary the phase of the wave between -360° and +360°, how does the sound change?

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7. Set the phase of the Right Output wave back to 0°.

8. Press (F1) to turn on the Left Output Channel. How does the addition of the Left Output wave affect the sound that you hear?

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9. Press (+) and (−) to vary the phase of the Right Output wave again. As you vary the phase of the Right Output wave between -360° and +360°, how does the sound of the combined waves change?

10. Listen to the sound. At what values of phase does maximum *destructive* interference occur?

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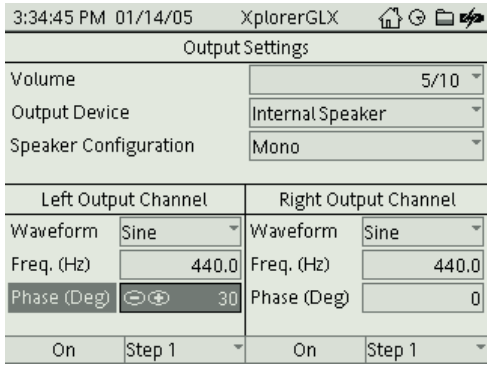
11. Press the left arrow key to highlight the Phase of the Left Output Channel. Press (+) to set the phase to 30°.



12. Press the right arrow key to highlight the Phase of the Right Output Channel again. While listening to the combined tone, vary the phase of the Right Output wave between -360° and +360°.

13. With the Left Channel phase set at 30°, at what values of phase (for the Right Channel) does maximum *destructive* interference occur?

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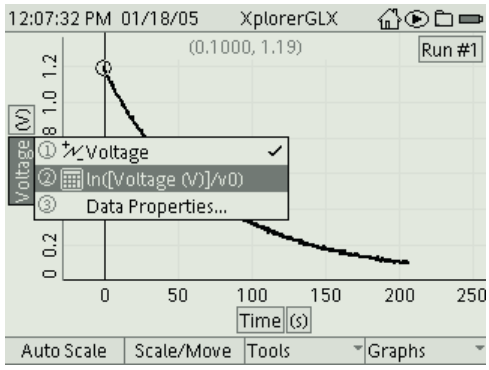
3. Make a graph of $\ln(V/V_0)$ versus t.

a) Press ⌂ to return to the Home Screen; press F1 to open the Graph display.

b) Press F4 to open the Graphs menu; press 6mno to select New Graph Page.

c) Press ✓ *twice* to highlight the data source menu. Select ln(v/v0) from the menu



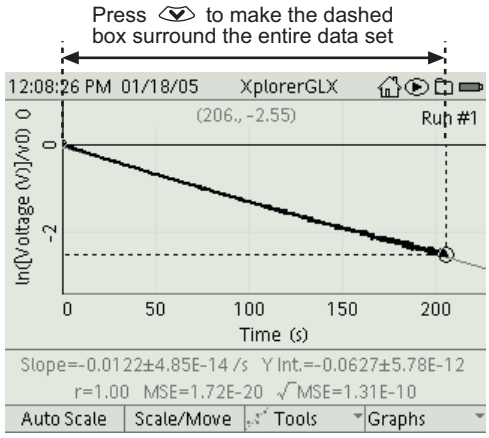
4. Apply a linear fit and find the value of τ.

a) Press F3 to open the Tools menu; press 5jkl to select Linear Fit.

b) Press the down arrow key to make the dashed box surround the entire data set.

c) The slope of the best-fit line equals τ.

τ = _____ (include units)



5. (Optional) Repeat the experiment with different resistors. Make a graph of R versus τ. What is the relationship between time constant and resistance?

6. (Optional) Repeat the experiment with different capacitors. Make a graph of C versus τ. What is the relationship between time constant and capacitance?