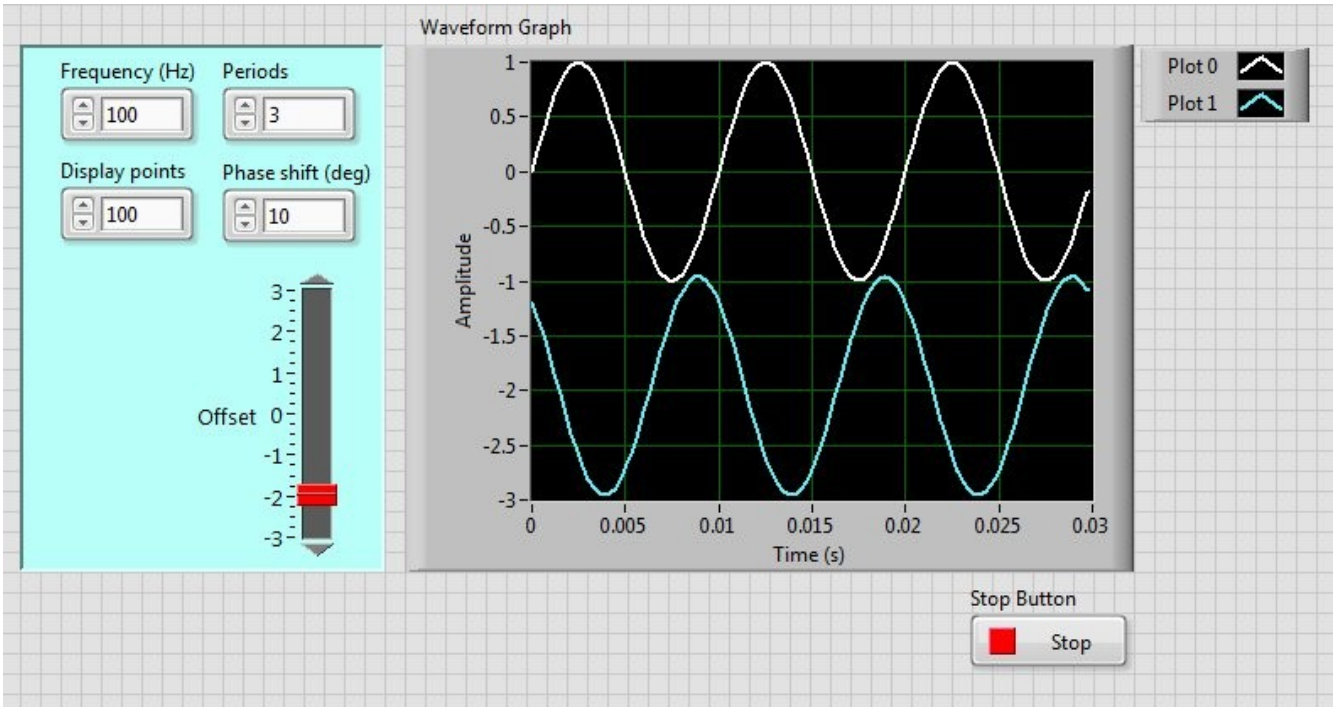
PHYC 500: Introduction to LabView

M.P. Hasselbeck, University of New Mexico

Exercise 7 (v 1.1) Generating and displaying waveforms

Open a blank VI and go to the Block Diagram. Create a While Loop and place a stop button control on the conditional terminal. Add a Wait function to make the loop run at 10 Hz, i.e. 100 ms. Place a For Loop inside the While Loop. Now put a Sine function inside the For Loop. One could search through the palettes to find this function, but an easier way is to make use of LabView's Quick Drop utility. Hold down the CTRL key and press the space-bar to activate it. Type in the word “Sine” and you will be presented with a list of available functions. Select the first result (Sine) and press Enter. A second Sine function is also needed inside the For Loop. Instead of copy-paste, hover the select tool above the Sine function, press the CTRL key, and drag (left-click and hold) a duplicate Sine function to a new spot inside the For Loop.

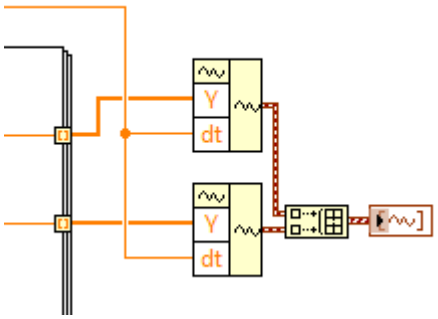
Go to the Front Panel. A variety of controls and indicators are needed as shown in the figure below. Place four numerical controls for frequency (Hz), periods, phase shift (degrees), and display points. Add a vertical fill slide for the offset. Also place a waveform graph that can be found in the palette Graph: Waveform Graph.



Go to the Block Diagram. The representation of each control must be correct. Display points and periods should be I32. Frequency, phase-shift, and offset are in DBL. Right-click on each icon to access the representation and change as needed.

Connect the Display Points icon to the count terminal of the For Loop. Write code to implement the first function as $\sin(2\pi f\,\Delta t\,i)$, where f is frequency (Hz) and i is the For Loop iteration count. The time step $\Delta t = P/Nf$, where P is the specified number of periods and N is the display points. The second function in the For Loop is $\sin(2\pi f\,\Delta t\,i + j\Delta\phi)$ + Offset, where $\Delta\phi$ is the specified phase-shift (you will have to convert from degrees to radians) and j corresponds to the loop index of the outer While Loop. The conversion is already available as an Expression Node in the library; use Quick Drop to find "Degrees to Radians". Another shortcut is to use the built-in constant for 2π, that can be located with Quick Drop as "Pi multiplied by 2".

This VI will generate two sinusoidal waveforms during each iteration of the While Loop. To display them, the Waveform Graph is placed outside the For Loop but still inside the While Loop. A waveform is produced with the Build Waveform function. Locate it with Quick Drop or directly in the Waveform palette. The default rendering has a terminal for the 1-D array for the waveform y-axis data. Drag the bottom of the icon to open a second terminal that shows `attributes'. Right-click on the attributes terminal, Select Item: dt. Duplicate the Build Waveform that was just created. Wire Δt to the corresponding dt terminals. The 1-D arrays for each sine wave are connected to the Y terminals as shown in the figure below:



Indexing is enabled by default on the For Loop, so an array is present at both output tunnels. This is confirmed by the thicker orange line, which indicates the wire contains a 1-D array. The waveforms are to be displayed on the same graph, which is accomplished with the Build Array function shown in the Block Diagram above. The 2-D waveform array is then connected to the Waveform Graph icon. Notice the brown/white hatched wire indicating a single waveform at the output of each Build Waveform operation. A slightly thicker wire with the same brown/white pattern represents the waveform array (two waveforms) that are displayed on the graph.

On the Front Panel, the two plots can be customized. If a Plot Legend is not shown, right-click on the Waveform Graph, select Visible Items: Plot Legend. Drag the lower edge of the Plot Legend to reveal Plot 0 and Plot 1. Right-click on either icon to customize the individual plots. In the Front Panel shown above, the line thickness and color has been changed from the default values.

Choose a frequency, display points, periods (both integer values) and run the VI. While the VI is running, enter a ± phase-shift as well as an offset to make the waveforms separate. This simulates the behavior of an oscilloscope.