

Signals and Systems

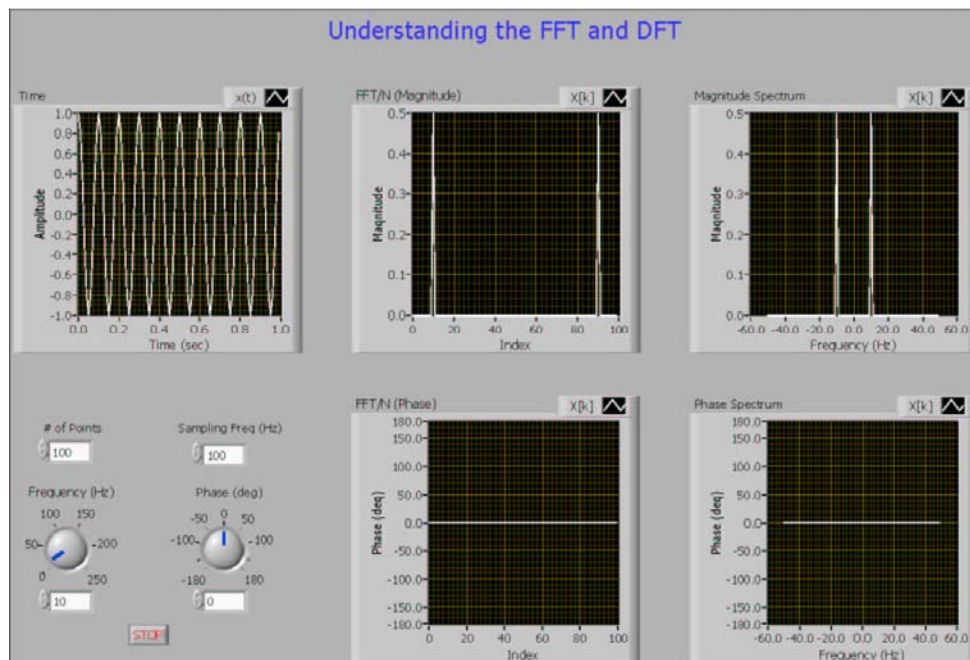
Laboratory Exercise 3A

Objective

This lab is designed to help you review and understand the use of the FFT to approximate Fourier coefficients and compute the spectrum of a signal. You will be using an application created in LabView but, unlike previous (and future) labs, you will not be required to write any code.

LabView Application

Copy the Lab3A_mac or Lab3A_pc folder to your Mac or PC respectively. Before you can run the application you must install the LabView runtime engine. If you are using a Mac copy the LabVIEW_7.1.1_Runtime.dmg file to your computer where it will be a disk image. Double click and then double click the installer. Copy the TestDFT.app directory to your Mac (it appears as an application on the Mac) and double click to run. If you are using a PC double click the LVRunTimeEng.exe file to install the runtime engine and double click the TestDFTpc.exe file to execute the application.



When launched, the application will be in run mode. You can stop the application using the STOP button. Since the displays change dynamically, there is no need to stop the application when making changes to the input controls. You will notice that an initialization file is created in the same directory from which the application was launched. If you delete it the application will create the file again the next time you run it.

Familiarize yourself with the application and the input controls. Watch the graph panels as you vary the input parameters. You can use the mouse to rotate the knobs and/or type in values in the numeric input boxes. Note that you can always return to the starting (default) values by clicking **Operate >> Reinitialize All to Default**.

Questions

Hand in **brief** answers to the following questions. Include a sketch or simple diagram if helpful but **do not** print out pictures of the panel. Your answers should be appropriate for a Frequently Asked Questions (FAQ) document. Make the parameter changes in the order indicated by the questions.

1. With the inputs set at the default values, for what values of the index k are the values of $X[k]$ non-zero? What are the values? Is this consistent with the FFT/N plots?
2. To what frequencies do the non-zero values of $X[k]$ in part one correspond? Is this consistent with the spectrum plots? Explain.
3. Change the phase to -90 degrees and repeat questions 1 and 2.
4. Starting with the settings of question 3, change the frequency to 50 Hz. What happens to the graphs of $x(t)$ and the magnitude spectrum? Why?
5. Change the phase to 0 degrees and repeat question 4.
6. Reset the phase to -90 degrees. Compare the time and phase plots with the frequency set to 49 Hz with the phase plot when the frequency is set to 51 Hz. What happens? Why?
7. Compare the time plots with the frequencies of 99 Hz and 101 Hz. What happens? Why?
8. Repeat question 7 with frequencies of 199 Hz and 201 Hz with the number of points set to 200 and the sampling frequency set to 200 Hz.
9. Reset the inputs to the default values. Change the phase to -90 degrees. Compare the plots with the number of points set to 50 with those when the number of points is set to 100 and then to 200. What happens? Why?
10. Reset the inputs to the default values and change the phase to -90 degrees. Change the number of points to 125. What happens? Why?
11. Select an interesting set of parameter values. What are the results? Explain?