Project Two: **Find the phase retardance of a liquid crystal cell (LC)**

In this project, you are required to write a LabVIEW code to make the plot curve of a liquid crystal (LC) cell that is the key component for the construction of a polarimeter to measure the polarimetry Stokes parameters (*I, Q, U, V*) (https://en.wikipedia.org/wiki/Stokes_parameters) to inverse the solar magnetic fields, which is part of the research for our two projects being supported by the National Science Foundation (NSF). The Eq. (2) discussed in the LC introduction PDF file will be used to make the LC ***phase retardance (in degree) vs. the voltage (in volt) plot***, based on the 55 laboratory measured images provided.

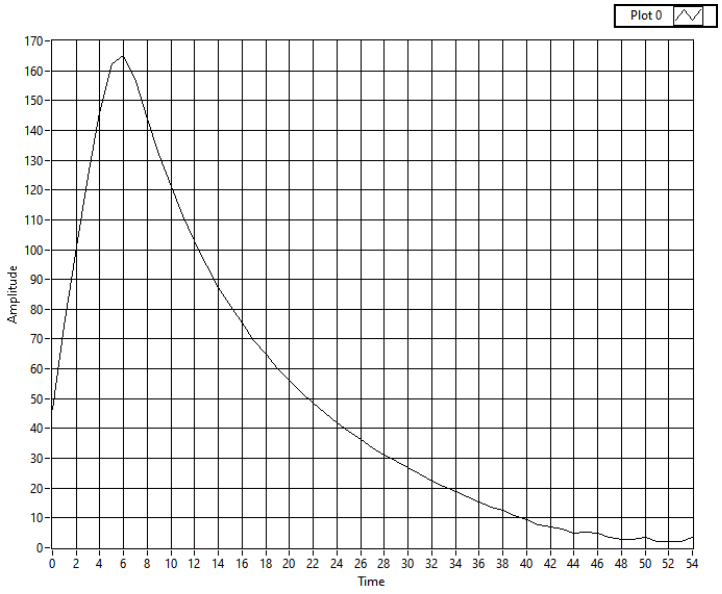
Each image's name includes the voltage information. For example, the first image V016.tif and the last image V124.tif mean the voltages for these two images are 1.6V and 12.4V, respectively (one decimal shift). Therefore, the voltage is in the range from 1.6 to 12.4V, with an increment of 0.2V, for each step in our measurement.

Two outputs are required:

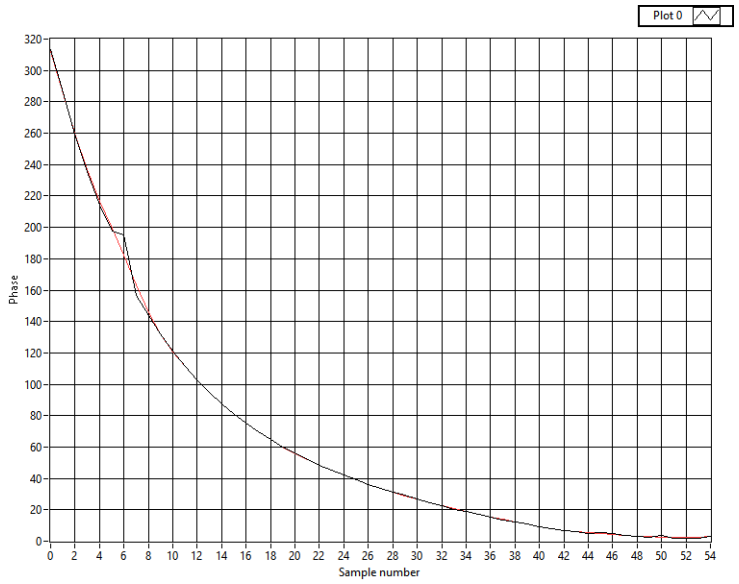
1). The LC phase retardance (in unit of degree) vs. the voltage (in unit of volt) plot, based on the measured data directly calculated with Eq. (2), by using the maximum values of the two target images that are defined by 2 small windows. Show this plot curve with a "Waveform graphs" widow.
2). Using the LabVIEW function "Cubic Spline Fit" to Fit the above plot or data to further improve the measurement accuracy, such as to remove some measured odd points. This would generate a smooth plot curve. Show this plot curve with a "XY Graphs" widow.
3).Find the voltage (in V) corresponds to the phase of 90°, with a phase retardance accuracy of 0.1°. To find this value, you will need to use the LabVIEW function "Interpolate 1D" to fit the above plot, for the required accuracy.

Hints: (The following plots should be included in your LabVIEW code)

1).The plot directly based on Eq. (2) without phase compensation should looks like this one (degree vs. image number):



2). The plot directly based on Eq. (2) with phase compensation should looks like this one (black curve). Also includes the fitting curve (red curve), by using the "Cubic Spline Fit" Function.



3). The fitting curve with image number based on its name is converted to the voltage (in V), which is out final plot. Also by using the "Interpolate 1D" to fit this plot to find the voltage (in V) corresponds to the phase of 90°, with a phase retardance accuracy of 0.1°. Save this array data in you code by using "Data Operation"➔ "Make Current Data Default"➔then save you code