Instructions for Data Analysis for Lab 3.

This details only the analysis of the small harmonic oscillations. The remaining part of the analysis should be straightforward.

The Matlab program ‘split.m’ was written to reduce the tedious process of manually finding intervals for each oscillation and reduced relaxation curve. The inputs into the harmonic oscillation VI are required as inputs into this program. Note that the algorithm used to split the data assumes the data is being consistently recorded, otherwise some deviation in the accuracy of the data may be present. Possible deviation is easily viewed by looking at the output graphs. The TA will look at all group files to ensure this program works.

General comments:
- Matlab inputs need to be edited specifically for each group.
- Matlab output is currently in force and displacement.
- Matlab output can be imported directly into Sigmaplot, or opened with excel using space delimiters, and then pasted into Sigmaplot.

Curve fitting in sigmaplot
- Paste your data (or import) into Sigmaplot – you should have a stress and time column.
- Now go into ‘Statistics’ -> ‘Regression Wizard’.
- In the drop down menu called ‘Equation Category’ –-> select ‘Waveform’ –-> ‘Sine, 4 Parameter’ -> Next
  - First fit the strain data to get the relevant constants as explained during the lab session. These include amplitude, frequency, and phase information.
  - *Time will be your x− column data and the data you want to curve fit will be your y− column.* Click the top of the column when the ↓ appears to select the entire column (x: Column 1, y: Column 2) -> Next
- Make sure the following boxes are checked: Parameters, Predicted, Residual, Report -> Next
- Make sure the following boxes are checked: Create new graph, Extend to fit axes -> Next
- Finish
- You will now have a Report and Graph subfile that appear below your Data spreadsheet.
- Note the following values in the Report:
  - a = used for calculating dynamic stiffness
  - b = inverse of the frequency (this is a good check of the curve fit as it is calculated from the data)
  - c = used for calculating the phase shift
  - yo = offset from zero (should be minimal)
- Also check the Graph to be sure the data fit looks relatively good for the amount of data available
- Note the value of ‘b’ from the strain/stress data curve fit. This should match the input frequency of the sine wave. (1/b = Frequency in Hz).
- Repeat similar steps for the stress data as well and do the curve fit.
- You will have 12 such pairs of constants at the end of the analysis (3 strain levels, 4 frequencies). Now compare the fit constants for the various profiles to calculate the dynamic stiffness, phase shift, etc
- Attach any relevant plots required by the protocol of lab report guide