ChE 613A- The Structure and Rheology of Complex fluids

Assignment No. - 5

Due date: 27-09-21

Instructions:

1) The answer script has to be uploaded in the mookit platform in a single file named "roll number_assignment 5". Please note mookit allows a single file upload, so prepare your answer script accordingly.
2) The answer script must contain the following:

    a) The data extracted from the plot.
    b) The relevant information regarding the steps you have followed (model, fitting parameter, software used, tolerance limit used etc.). We encourage you to share the algorithm you have followed in the software.
    c) A good quality image of the fitting line along with the experimental data provided to you.
    d) A rational for the number of modes you are using (i.e. the value of N) and what happens when you increase or decrease the number of modes.
3) In case you have any query regarding the paper, please post it in the discussion forum. Any type of image or file sharing in the forum is strictly prohibited in this matter.

Question:

Fit a multimode Maxwell model with modulus and relaxation time scales G_i and τ_i ($i = 1$ to N) to the given experimental plot of G' and G'' versus ω. Obtain an expression for relaxation modulus $G(t)$ and plot it with respect to time. Also calculate the shear viscosity η.

The instructions to obtain the fit is given below. You may just consider this procedure as a starting point.

Procedure for the problem:

1. Extract the data from the image. You can use any software for data extraction. If you do not know any data extraction software, you can use:

http://arohatgi.info/WebPlotDigitizer/app/?

It also has tutorials here:

http://arohatgi.info/WebPlotDigitizer/tutorial.html

2. Find the attached file for fitting algorithm and obtain a fit for your data.

3. Obtain an expression for relaxation modulus and shear viscosity in terms of the modulus and relaxation time of multimode Maxwell model obtained from fitting.