Fitting Maxwell Model to viscoelastic data

1. Decide on the number of modes you will have in the model, N.
2. Fix the range within which all relaxation times will lie $[\tau\_min, \tau\_max]$
   a. These are given by –

$$\tau_{\text{max}=}\frac{1}{\omega\_min} \quad \tau_{\text{min}=}\frac{1}{\omega\_max}$$

   b. All relaxation times can be approximated by (i varies from 1 to N):

$$\tau_i = \tau\_\min\left(\frac{\tau\_max}{\tau\_min}\right)^{\frac{i-1}{N-1}}$$

3. It is preferred to keep a tolerance of $e^{\pi/2}$ on either side of relaxation times range and follow the above uniform distribution for ease of procedure.
4. One can, however, prefer to use their own costum set of relaxation times for a better fit as long as they lie in the given range.
5. We have the Maxwell model –

$$G'(\omega)=\sum_{i=1}^{N} g_i \frac{\omega^2\tau_i^2}{1+\omega^2\tau_i^2}$$

$$G''(\omega)=\sum_{i=1}^{N} g_i \frac{\omega\tau_i}{1+\omega^2\tau_i^2}$$

6. The relaxation times are known, their strengths (g_i) are to be found
7. Prepare a regression model (the most popular being least squares regression) using inbuilt functions in MATLAB (eg: lsqcurvefit) or EXCEL (eg: solver function)
8. Apply model to either one of the moduli and verify results by fitting the result on the other.

Suggestions :

1. If you're getting negative values of g_i's you're probably overfitting, reduce N.
2. On increasing number of relaxation modes check the change in relative squared error, increasing N without much change in it is not useful.