Consider the hydrogel that has the smallest molecular weight (review the Module 11 Lecture). Use its material parameters from Lecture 11 and draw the graphs of $G'(\omega)$ and $G''(\omega)$ for $0 < \omega < 1\text{kHz}$.

From lecture 11, slide 5, the parameters obtained by fitting the Maxwell-Weichert Model to the results of the stress relaxation experiment for the four Alginate Hydrogels are the following:

Alginate Type:	280 kDa	70 kDa	35 kDa	35 kDa – 5k PEG
$\tau 1$ (s)	510	125	81	39
E1 (norm.)	0.25	0.46	0.5	0.58
$\tau 2$	11111	1734	900	637
E2	0.75	0.54	0.5	0.42

The 35 kDa hydrogel is the smaller molecular weight hydrogel and the model parameters are:

- Tau1 = 81
- E1 = 0.5
- Tau2: 900
- E2 = 0.5

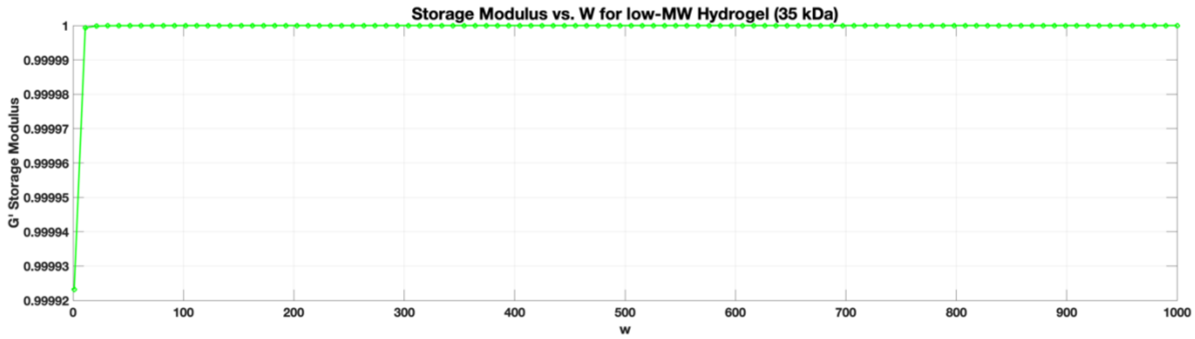
Slide 4, lecture 11, gives the equations of the components of the harmonic modulus G:

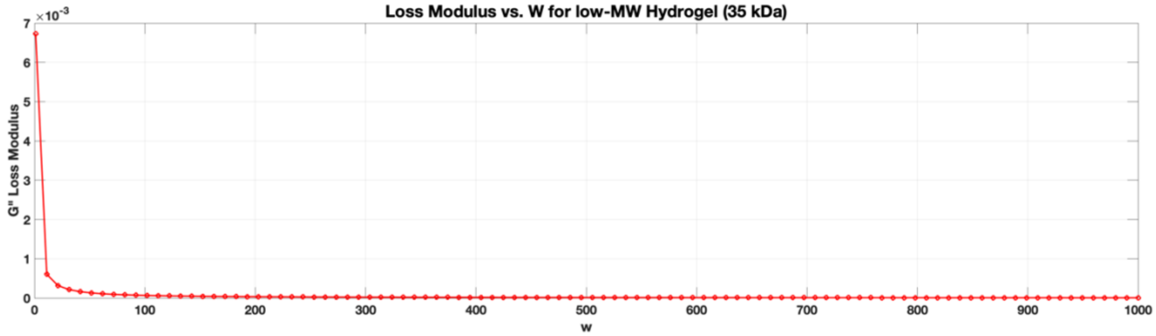
G = G' + i G''

Where

- G' = E1 * (Tau1^2 w^2 / (1+ Tau1^2 w^2)) + E2 * (Tau2^2 w^2 / (1+ Tau2^2 w^2))
- G'' = E1 * (Tau1 w / (1+ Tau1^2 w^2)) + E2 * (Tau2 w / (1+ Tau2^2 w^2))

Using these equations for 0 < w < 1kHz, we obtain the following plot:





- G’, storage modulus, increases slowly to reach a plateau at 1, indicating that the hydrogel preserves energy well and the elastic component is constant across the low-frequency range.
- G’’, loss modulus, decreases rapidly, from 0.07 to almost 0, indicating the viscous component dissipates quickly as frequency increases.

As low-frequency G’ and G’’ are close, the hydrogel shows more viscous behavior and as frequency increases, G’ dominates thus the hydrogel behaves more elastically (stress relaxation is slower).