Homework 4 2010

CM4650 Polymer Rheology

Due Wednesday 3 March 2010 in class

1. (10 points) Problem 5.1 (definitions)
2. (20 points) Problem 5.8 (SAOS for Newtonian)
3. (20 points) Plot $G'(\omega)$ and $G''(\omega)$ from equation 8.139 on a log-log plot for $\lambda=1$ s and $g=5 \times 10^4$ Pa. You may use the range of $\omega$ from $10^{-2}$ rad/s to $10^2$ rad/s. Choose your omegas to be evenly spaced on a log scale. Do not include symbols on your graphs, and be sure to choose enough values of omega to get a nice smooth line. Label your axes.
4. (20 points) If the shear rate as a function of time is given by the function below, calculate the strain $\gamma_{21}(0,t)$. Plot the shear-rate as a function of time and strain as a function of time on the same axes. The variable $t'$ is in units of seconds and the constant 0.8 has units of s$^{-2}$

$$\dot{\gamma}(t') = \begin{cases} 
0 & t' < 0 \\
0.8t' & 0 \leq t' \leq 1 \\
0 & t' > 1
\end{cases}$$

5. (20 points) For the shear rate as a function of time for the start-up of steady shear material function (see text equation 5.30 p139), calculate the strain function $\gamma_{21}(t, t')$, where $t$ and $t'$ are two times (they will appear in your answer). The time $t$ varies but is always positive, i.e. it goes between zero and $\infty$. The time $t'$ varies also and may be positive or negative, i.e. it ranges between $-\infty$ and $\infty$. 
