HW#5 ME 4210 Due Date: Friday, October 16, 2015

1. Derive the following equations

a. $\frac{1}{E_2} = \frac{1}{v_f + \eta_2 v_m}\left[\frac{v_f}{E_{f_2}} + \eta_2 \frac{v_m}{E_m}\right]$

b. $v_{12} = v_{f_{12}} \mathrm{v}_f + v_m \mathrm{v}_m$

c. $\frac{1}{G_{12}} = \frac{v_f}{G_{f_{12}}} + \frac{v_m}{G_m}$

2. Write a MATLAB function that takes the fiber and matrix properties as inputs and plots the composite properties as function of fiber volume fraction. Write few lines about each plot.

$E_{f_1} = 224$ GPa $E_{f_2} = 19.30$ GPa $E_m = 3.43$ GPa $G_{f_{12}} = 17.45$ GPA $G_m = 1.21$ GPA

a. Plot E1
b. Plot E2 (use simplified rule of mixture)
c. Plot G12

3. Determine the longitudinal elastic modulus of interphase, E_i assuming the interphase thickness is 500 nm.

- Use your findings of previous homework for fiber volume fraction and fiber dimeter.
- $E_1 = 135.77$ GPA $E_{f_1} = 224$ GPa $E_m = 3.43\ GPa$