Last Updated: January 13, 2022 at 3:36pm

Name:

Homework 2
Due 18 Feb 2022

1. Plot stiffness predictions for a perfectly aligned short-fiber composite with $E_f = 200$ GPa, $\nu_f = 0.2$ and $E_m = 10$ GPa, $\nu_m = 0.4$. Assume fibers and matrix are both individually isotropic, and that the fiber aspect ratio is 50. Plot E_1 (stiffness in fiber direction), E_2 (stiffness transverse to fibers) and G_{12} (shear modulus in fiber direction) vs. volume fraction (between 0 and 50%) for the following methods

    (a) Eshelby

    (b) Mori-Tanaka

    (c) Halpin-Tsai

2. For the Eshelby and Mori-Tanaka methods, compare the stiffness at 50% volume fraction for perfectly aligned fibers with a similar material with random fibers such that

$$a_{ij} = \begin{bmatrix} 0.33 & 0 & 0 \\ 0 & 0.33 & 0 \\ 0 & 0 & 0.33 \end{bmatrix} \tag{1}$$

Note: You will need to use a closure approximation to use orientation averaging. You may choose whether to use a linear or quadratic closure.