HW#7 ME 4210 Due Date: Friday, October 30, 2015

1. As everybody has a failure theory, I thought I would make up one for myself. I call it Tsai-Sanei. Determine the coefficients of this cubic failure theory based on lamina strength. (It is not a real failure theory, don't use if you get recruited for the design of next composite airplane)

$$A\sigma_1^2 + B\sigma_2^2 + C\sigma_3^2 + D\sigma_4^2 + E\sigma_5^2 + F\sigma_6^2 + G\sigma_1^3 + H\sigma_2^3 + I\sigma_3^3 = 1$$

- Note that stresses are shown in contracted notation.

2. Determine whether the following stress state causes failure based on
   a. Tsai-Hill
   b. Tsai-Wu (Plane stress)
   c. Hashin (Plane stress)
   d. Which of the theory is the most and least conservative for the given stress state, is that true for all stress states? Explain your answer.

$$\begin{Bmatrix}\sigma_x\\ \sigma_y\\ \tau_{xy}\end{Bmatrix} = \begin{Bmatrix}75\\ -150\\ -10\end{Bmatrix}\text{MPa} \qquad \theta = 10^0$$

$S_L^+ = 1000$ MPa $\quad S_L^{(-)} = 500$ MPa $\quad S_T^{(+)} = 45$ MPa $\quad S_T^{(-)} = 145$ MPa $\quad S_{LT} = 57.2$ MPa

$S_{TT}, = 32.4$ MPa

3. In the previous homework, you developed a MATLAB function for Maximum Stress and Maximum Strain Criteria. Add the following criteria to your function
   a. Tsai-Hill
   b. Tsai-Wu (Plane stress)
   c. Hashin (Plane stress)

   - Test the accuracy of your code using the given stress state and mechanical properties of previous question.