

**EML3035
Programming Concepts for Mechanical Engineers**

Homework: Principal Stresses

Follow the same format as given at
http://www.eng.usf.edu/~kaw/class/EML3035/homework/sample_homework.htm
 where you need to look under
Sample HW for assignments **HW#5 and beyond**

What to Submit

The sequence of items attached needs to be as follows

1. Affidavit Sheet
http://www.eng.usf.edu/~kaw/class/EML3035/Independent_affidavit_sheet.pdf
2. Pseudo-code for the function
3. Flow Chart (**Skip this part for this HW**)
4. mfile for the function
5. Published mfile to test the function

Background

The three principal stresses $\sigma_1, \sigma_2, \sigma_3$ for the stress state

$$\text{Stress State} = [\sigma_x, \sigma_y, \sigma_z, \tau_{xy}, \tau_{yz}, \tau_{zx}] \quad (1)$$

at a point are given by the solution of the nonlinear equation

$$\sigma^3 - J_3\sigma^2 - J_2\sigma - J_1 = 0 \quad (2)$$

where

$$J_1 = \sigma_x\sigma_y\sigma_z + 2\tau_{xy}\tau_{yz}\tau_{zx} - \sigma_x\tau_{yz}^2 - \sigma_y\tau_{zx}^2 - \sigma_z\tau_{xy}^2$$

$$J_2 = \tau_{xy}^2 + \tau_{yz}^2 + \tau_{zx}^2 - \sigma_x\sigma_y - \sigma_y\sigma_z - \sigma_z\sigma_x$$

$$J_3 = \sigma_x + \sigma_y + \sigma_z$$

Specifications

Write a pseudo code and MATLAB function to find the principal stresses (output), if the stress state (input) is given as a vector of elements.

The input to the function would be a single vector of stress state with 6 elements as given . The output would be a single vector with 3 elements of the principal stresses $[\sigma_1, \sigma_2, \sigma_3]$. You can use any MATLAB function to solve the cubic equation given by equation (2).

For submission purposes, use $[120, 60, 70, -45, 49, 53]$ for the test mfile.