Starting with the stress tensor given in Problem 2.16 from Budynas, 2nd ed. The problem states the state of stress is plane stress (no stress in the z direction). The plane stress condition results from a structure being very thin.



This principal stress cube was then rotated 15° about the z-axis and resulted in the following state of stress.



The problem also asked to determine the state of stress where the shear was maximum in the x-y plane. This resulted in the following state of stress.



Given the material is steel (E=75GPa, υ=0.3), determine the initial engineering strain tensor and the engineering strain tensor after transformation.

SOLUTION:

>> Sig=[40 10 0]'\*1e6  
Sig =  
 40000000  
 10000000  
 0

>> Sig\_xyz=[38 12 7.5]'\*1e6  
Sig\_xyz =  
 38000000  
 12000000  
 7500000

>> Sig\_maxShear=[25 25 15]'\*1e6  
Sig\_maxShear =  
 25000000  
 25000000  
 15000000

>> Scomp=[1/75e9 .3/75e9 0; .3/75e9 1/75e9 0; 0 0 2\*(1+.3)/75e9]  
Scomp = 1.0e-010 \*  
 0.1333 -0.0400 0  
 -0.0400 0.1333 0  
 0 0 0.3467

e = 1.0e-003 \*  
 0.4933  
 -0.0267  
 0



>> e\_xyz=Scomp\*Sig\_xyz  
e\_xyz = 1.0e-003 \*  
 0.4587  
 0.0080  
 0.2600



>> e\_maxShear=Scomp\*Sig\_maxShear  
e\_maxShear = 1.0e-003 \*  
 0.2333  
 0.2333  
 0.5200

