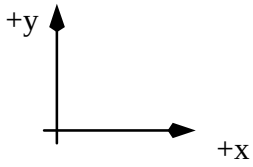
ME 556 - HOMEWORK ASSIGNMENT #1

Autumn Quarter 2011 Due Thursday, October 6

In problems 1 and 2 the x-axis is defined as the "horizontal" direction, positive to the right, and the y-axis is defined as the "vertical" direction, positive upwards.



1. The stress state at a point of interest on a structure is known to be:

σ_{xx} = -25000 psi
σ_{yy} = 25000 psi
τ_{xy} = -25000 psi

For each of the following coordinate systems (i) determine the three in-plane stress components, and (ii) draw a "rough sketch" of the stress components on a *properly oriented* element. Make sure your sketch is neat and easily interpreted.

(a) The x-y coordinate system.
(b) The x'-y' coordinate system, 50° CCW from the x-y coordinate system.
(c) The x"-y" coordinate system, 40° CW from the x-y coordinate system.
(d) The principal stress coordinate system.
(e) The maximum shear stress coordinate system.

2. The strain state at a point of interest on a structure is measured to be:

ε_{xx} = 3000 $\mu m/m$
ε_{yy} = -3000 $\mu m/m$
γ_{xy} = -3000 μrad

For each of the following coordinate systems (i) determine the three in-plane strain components, and (ii) draw a "rough sketch" of both the initial square element and the deformed element, *properly oriented*. Make sure your sketch is neat and easily interpreted.

(a) The x-y coordinate system.
(b) The x'-y' coordinate system, 40° CCW from the x-y coordinate system.
(c) The x"-y" coordinate system, 50° CW from the x-y coordinate system.
(d) The principal strain coordinate system.
(e) The maximum shear strain coordinate system.

3. An isotropic material is known to have the following elastic properties:

$E = 205GPa$ $\nu = 0.285$ $G = 79.8GPa$

What stress tensor must be applied to this material in order to induce a uniaxial strain $\varepsilon_{yy} = 2000\mu m/m$?