

Problem Set #7 1.050 Solid Mechanics Fall 2004

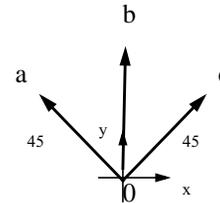
(Due Friday, 29 October)

Problem 7.1

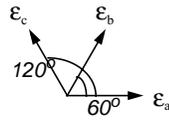
Three strain gages measure the extensional strain in the three directions θ_a , θ_b and θ_c at “the point 0”. Using the relationship we derived in class

$$\epsilon_{PQ} = \epsilon_x \cos^2 \phi + \gamma_{xy} \cos \phi \sin \phi + \epsilon_y \sin^2 \phi$$

find the three components of strain with respect to the xy axis in terms of ϵ_a , ϵ_b and ϵ_c



Problem 7.2



1.1 A strain gage rosette, fixed to a flat, thin plate, measures the following extensional strains

$$\epsilon_a = 1. \text{ E-}04$$

$$\epsilon_b = 1. \text{ E-}04$$

$$\epsilon_c = 2. \text{ E-}04$$

Determine the state of strain at the point, expressed in terms of components relative to the xy coordinate frame shown.

Using Mohr's circle, determine the strain components relative to an axis oriented at 45° rotation (ccw).

Problem 7.2

A two dimensional displacement field is defined by

$$u(x, y) = \frac{-\alpha}{2} \cdot y \quad \text{and} \quad v(x, y) = \frac{\alpha}{2} \cdot x$$

Sketch the position of the points originally lying along the x axis, the line $y = 0$, due to this displacement field. Assume α is very much less than 1.0.

Likewise, on the same sketch, show the position of the points originally lying along the y axis, the line $x = 0$, due to this displacement field.

Likewise, on the same sketch, show the position of the points originally lying along the line $y=x$, due to this displacement field.

Calculate the state of strain at the origin; at the point, x, y .

Respond again but now with $u(x, y) = \frac{\alpha}{2} \cdot y$ and $v(x, y) = \frac{\alpha}{2} \cdot x$

