고체역학 I 과제물(HW:20점) May 21, 2018

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1. (10점)

An element in plane stress is subjected to stresses $\sigma_x, \sigma_y, \tau_{xy}$ as shown in the boxes.
Find the principal stresses and the absolute maximum shear stress.

$\sigma = \begin{bmatrix} 3 & 3 \\ 3 & -5 \end{bmatrix}$	$\sigma = \begin{bmatrix} -5 & -3 \\ -3 & 3 \end{bmatrix}$	$\sigma = \begin{bmatrix} 3 & 4 \\ 4 & -3 \end{bmatrix}$	$\sigma = \begin{bmatrix} 3 & -4 \\ -4 & -3 \end{bmatrix}$	$\sigma = \begin{bmatrix} 5 & -3 \\ -3 & -3 \end{bmatrix}$
$\begin{cases} \sigma_I = 4 \\ \sigma_{II} = (\quad) \\ \tau_{\max} = (\quad) \end{cases}$	$\begin{cases} \sigma_I = (\quad) \\ \sigma_{II} = -6 \\ \tau_{\max} = (\quad) \end{cases}$	$\begin{cases} \sigma_I = (\quad) \\ \sigma_{II} = -5 \\ \tau_{\max} = (\quad) \end{cases}$	$\begin{cases} \sigma_I = (\quad) \\ \sigma_{II} = -5 \\ \tau_{\max} = (\quad) \end{cases}$	$\begin{cases} \sigma_I = (\quad) \\ \sigma_{II} = -4 \\ \tau_{\max} = (\quad) \end{cases}$

2. (4점)

When 45^o strain rosette gage measures the normal strains $\epsilon_{\theta=0^o} = 2\mu\epsilon$, $\epsilon_{\theta=45^o} = 4\mu\epsilon$, $\epsilon_{\theta=90^o} = 4\mu\epsilon$ respectively.
(Let $\sqrt{2} = 1.4$, $\sqrt{3} = 1.7$.)

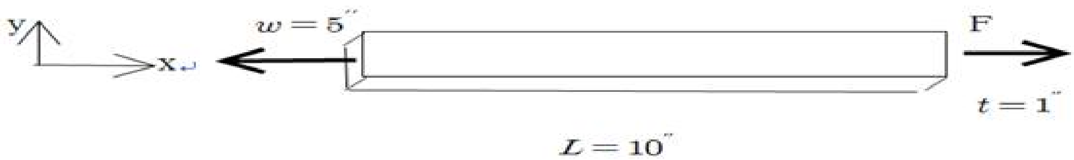
Obtain $\epsilon_x, \epsilon_y, \gamma_{xy}$, and the principal strains $\epsilon_I, \epsilon_{II}$ and the absolute maximum shear strain $\gamma_{\max}$.

$\epsilon_x = (\quad)\mu\epsilon$, $\epsilon_y = 4\mu\epsilon$, $\gamma_{xy} = (\quad)\mu\epsilon$,

$\epsilon_I = 4.4\mu\epsilon$, $\epsilon_{II} = (\quad)\mu\epsilon$, $\gamma_{\max} = (\quad)\mu\epsilon$.

3. (6점)

다음 그림은, 양단에 주어진 하중 F=10 lbf 이 작용하는 것을 나타내고 있고,
변형전의 물체의 형상은, 길이 L=10인치, 폭 w=5인치, 두께 t=1인치 이다.
변형후에, 늘어난 길이는 0.02인치, 줄어든 폭은 0.005인치 일 때,
x축방향의 변형률 $\epsilon_x = \epsilon_L$, y축방향의 변형률 $\epsilon_y = \epsilon_w$, 프와송비(Poisson's ratio) ν,
x축방향의 수직응력(normal stress) $\sigma_x = \sigma_L$, 탄성계수(elastic modulus) E,
전단탄성계수(shear modulus) G , 체적변형률(volumetric strain) ϵ_v 를 구하시오.



Answer:

$\epsilon_x = \epsilon_L =$ (____________) , $\epsilon_y = \epsilon_w =$ (____________) , $\nu =$ (_____) ,

$\sigma_x = \sigma_L =$ (_____) psi , E = (_____) ksi , G = (_____) ksi , ϵ_v = 0