

Travaux Dirigés (Série n°4)

Exercice N° 01 :

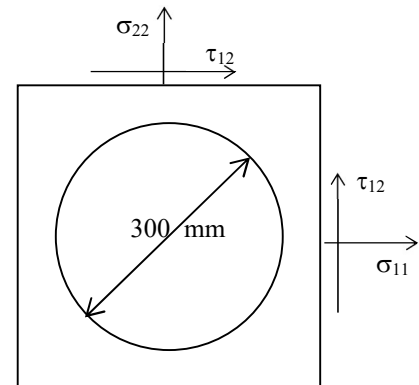
A circle 300 mm in diameter is engraved on a mild steel plate; this plate is then subjected to forces such that the stresses in the plate are respectively given by:

$$\sigma_{11} = 160 \text{ N/mm}^2 ; \quad \sigma_{22} = 20 \text{ N/mm}^2$$

$$\tau_{12} = -100 \text{ N/mm}^2.$$

The steel operates in the linear elastic zone and its mechanical properties are: $E = 210000 \text{ N/mm}^2$; $\nu = 0.28$.

After being subjected to stress, the circle deforms into an ellipse; calculate the lengths of the major and minor axes of this ellipse and mark their directions on the figure.



Exercice N° 02 :

The stress state at point P of a material is given by the tensor defined in the basis (e_1, e_2, e_3) . Its representative matrix is :

$$\Sigma = \begin{pmatrix} 8 & 0 & 12 \\ 0 & -5 & 0 \\ 12 & 0 & 8 \end{pmatrix} \text{ daN/mm}^2$$

1°) Determine the principal stress and principal directions of Σ in P

2°) Determine the matrix associated with the strain tensor in the initial basis and in the principal basis.

3°) Consider a steel sphere with a diameter of one meter (1m) subjected to the stress field defined previously.

- a) What happens to this sphere after deformation?
- b) Determine its characteristic lengths
- c) calculate the final volume of this sphere.

Material Characteristics:

$$E = 22000 \text{ daN/mm}^2$$

$$\nu = 0.3$$