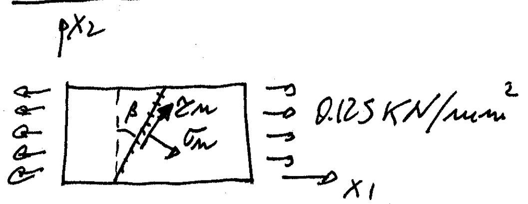
Problema 5

Viene svolto in classe → la relazione ricavata è $\boxed{G = \dfrac{E}{2(1+\nu)}}$

Problema 6

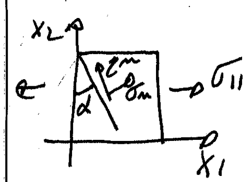
$\beta = 25^\circ$

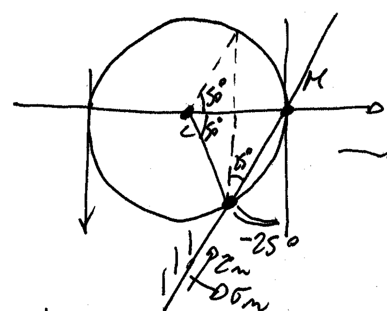


• Stato di sforzo uniassiale → $\underline{T} = \begin{bmatrix} 0.125 & 0 & 0 \\ 0 & 0 & 0 \\ 0 & 0 & 0 \end{bmatrix}$ in $x_1 - x_2 - x_3$

a/b)

• uso cerchio di Mohr per trovare σ_n e τ_n sulla saldatura





→ Cerco σ_n e τ_n su piano inclinato di -25° rispetto alla verticale

$$\begin{cases} \sigma_n = \dfrac{\sigma_{11}}{2} + \dfrac{\sigma_{11}}{2}\cos 50^\circ = \\ \quad = \dfrac{0.125}{2}(1 + 0.643) = 0.103 \ \mathrm{KN/mm^2} \\ \tau_n = \dfrac{\sigma_{11}}{2} \operatorname{sen} 50^\circ = 0.048 \ \mathrm{KN/mm^2} \end{cases}$$

c) $\varepsilon_n = \dfrac{\tau_n}{2G} = \dfrac{0.048 \cdot 1000}{2 \cdot 200000} = 1.2 \cdot 10^{-4}$

d) En. def. elastica $= \int_V \phi \, dV = \int_V \frac{1}{2} \sigma_{11} \varepsilon_{11} \, dV =$ dove $\varepsilon_{11} = \dfrac{\sigma_{11}}{E} = 6.25 \cdot 10^{-4}$

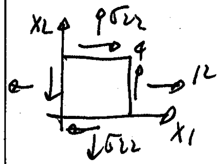
$= \frac{1}{2} 0.125 \cdot 1000 \cdot 6.25 \cdot 10^{-4} \cdot 10 \cdot 80 \cdot 160 = 5000 \ \mathrm{N \cdot mm}$

e) $\Delta l = \varepsilon_{11} l_0 = 0.1 \ \mathrm{mm}$ $\quad \Delta A = (\varepsilon_{11} + \varepsilon_{22}) \cdot A_0 =$ (160×80)

$\varepsilon_{22} = \dfrac{-\nu \sigma_{11}}{E} = -\dfrac{0.2 \cdot 0.125 \cdot 1000}{200000} = 1.25 \cdot 10^{-4}$ $\quad = (6.25 \cdot 10^{-4} + 1.25 \cdot 10^{-4}) \cdot 12800 = 9.6 \ \mathrm{mm^2}$

Problema 7

- è stato piano in $x_1 - x_2 \Rightarrow$ uso cerchio di Mohr



$$\tau_{MAX} = R = \sqrt{\frac{(12-\sigma_{22})^2}{4} + 16} \leq 15 \ \cancel{MPa}$$

$$\Rightarrow -16.913 \leq \sigma_{22} \leq 40.913 \ \cancel{MPa}$$

errata corrige

b) $\phi = \frac{1}{2}\sigma_{11}\varepsilon_{11} + \frac{1}{2}\sigma_{22}\varepsilon_{22} + \frac{1}{2}\sigma_{12}\gamma_{12}$ essendo $\sigma_{33} = \sigma_{13} = \sigma_{23} = 0$

calcolo $\varepsilon_{11} = \frac{1}{E}\left(\sigma_{11} - \nu\left(\sigma_{22} + \underbrace{\cancel{\sigma_{33}}}_{0}\right)\right) = \frac{1}{30000}\left[12 - 0.3(40.91)\right] =$

$$= 0.91 \cdot 10^{-5}$$

$$\varepsilon_{22} = \frac{1}{E}\left[\sigma_{22} - \nu(\sigma_{11})\right] = \frac{1}{30000}\left[40.91 - 0.3(12)\right] =$$

$$= 0.00124 = 1.24 \cdot 10^{-3}$$

$$\gamma_{12} = \frac{\sigma_{12}}{G} = \frac{\sigma_{12}\, 2(1+\nu)}{E} = \frac{4 \cdot 2\,(1+0.3)}{30000} = 0.00035 = 3.5 \cdot 10^{-4}$$

$\Rightarrow \phi = \frac{1}{2}\, 12 \cdot 0.91 \cdot 10^{-5} + \frac{1}{2}\, 40.91 \cdot 1.24 \cdot 10^{-3} + \frac{1}{2}\, 4 \cdot 3.5 \cdot 10^{-4} =$ sostituisci per il valore finale

Problema 8

$$\mathbb{E} = \begin{bmatrix} \frac{2c}{h^2}x_3x_1 & 0 & \frac{c}{2h^2}x_1^2 \\ 0 & \frac{2c}{h^2}x_3x_2 & \frac{c}{2h^2}x_2^2 \\ \frac{c}{2h^2}x_1^2 & \frac{c}{2h^2}x_2^2 & 0 \end{bmatrix}$$

Calcolo $\mathbb{T}$ usando la relazione $\mathbb{T} = \mathbb{C} \cdot \mathbb{E}$ o $\underline{\sigma} = \mathbb{C} \cdot \underline{\varepsilon}$

$$\begin{Bmatrix} \sigma_{11} \\ \sigma_{22} \\ \sigma_{33} \\ \sigma_{12} \\ \sigma_{23} \\ \sigma_{31} \end{Bmatrix} = \begin{bmatrix} \frac{(1-\nu)2G}{1-2\nu} & \frac{2G\nu}{1-2\nu} & \frac{2G\nu}{1-2\nu} & 0 & 0 & 0 \\ & \frac{(1-\nu)2G}{1-2\nu} & \frac{2G\nu}{1-2\nu} & 0 & 0 & 0 \\ S & & \frac{(1-\nu)2G}{1-2\nu} & 0 & 0 & 0 \\ & & & G & 0 & 0 \\ & S & & 0 & G & 0 \\ & & & 0 & 0 & G \end{bmatrix} \begin{Bmatrix} \varepsilon_{11} \\ \varepsilon_{22} \\ \varepsilon_{33} \\ 2\varepsilon_{12} \\ 2\varepsilon_{23} \\ 2\varepsilon_{31} \end{Bmatrix} \Rightarrow \ldots$$

$\mathbb{T}$ si ottiene risolvendo questo prodotto matrice x vettore