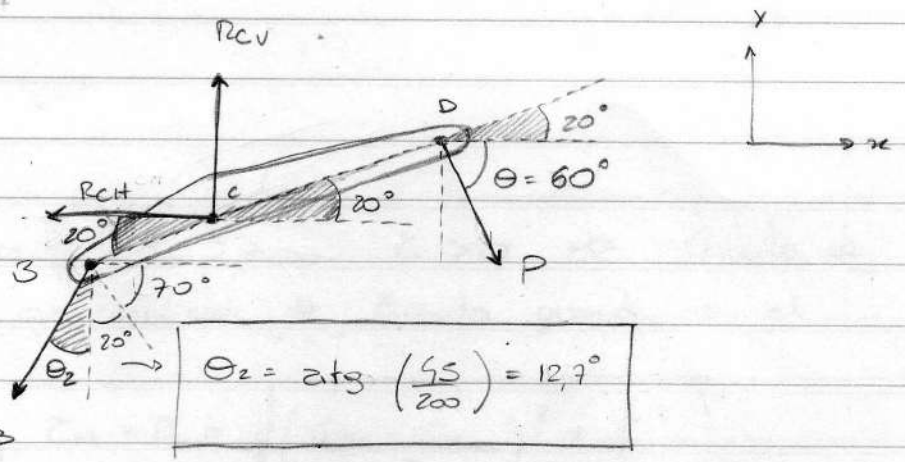
1°P 2023 | Solución

Ejercicio 1

DE y AB son elementos a 2 fuerzas ⇒

• DCL BCD:



$\theta_2 = \text{atg}\left(\frac{55}{200}\right) = 12,7°$

• $\sum F_y = 0 \Leftrightarrow R_{CV} = P \cdot \text{sen}(60°) + F_{AB} \cdot \cos(\theta_2)$

$\Rightarrow \boxed{R_{CV} = 0,86\,P + 0,98\,F_{AB}}$ (1)

• $\sum F_x = 0 \Leftrightarrow R_{CH} + F_{AB} \sin(\theta_2) = P \cos(60)$

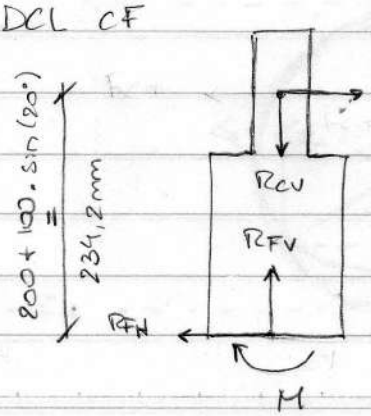
$\Rightarrow \boxed{R_{CH} + 0,22\,F_{AB} = 0,50\,P}$ (2)

• $\sum M_{C(k)} = 0 \Leftrightarrow P \cos(10°) \cdot 175\,mm = F_{AB} \cos(\theta_2 + 20°) \cdot 100\,mm$

$\Rightarrow \boxed{2,05\,P = F_{AB}}$ (3)

$\Rightarrow$ 3 ecs. 3 inc. $\Rightarrow$ $\boxed{F_{AB} = 4100\,N}$ $\boxed{R_{CH} = 98\,N}$ $\boxed{R_{CV} = 5978\,N}$

• DCL CF

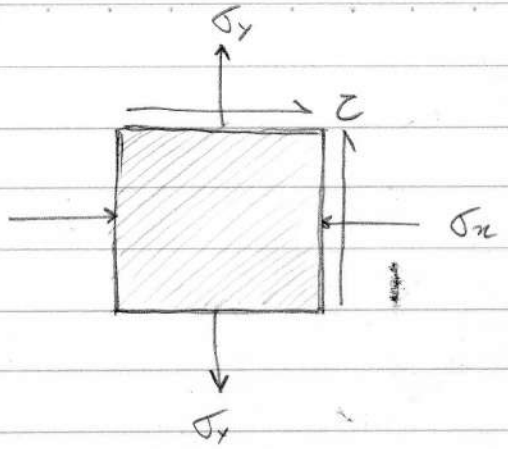


$\boxed{R_{FV} = R_{CV}}$ $\boxed{R_{FH} = R_{CH}}$

$M = R_{CH} \cdot 0,2342\,m$

$\boxed{M = 22,95\,Nm}$ ✓

Ejercicio 2



Datos: $\sigma_y = 50\ MPa$

$\tau = 75\ MPa$

$\tau_H \leq 125\ MPa$

a) Como $\sigma_x < 0$, $\sigma_y > 0$, $\tau > 0$ ⇒ Círculo de Mohr corta eje vertical ⇒ Círculo grande es el principal ⇒

$$\tau_H = R = \sqrt{\left(\frac{\sigma_x - \sigma_x}{2}\right)^2 + \tau^2}$$

b) i) ii) iii)

$C = -50\ MPa$

$R = \tau_H = 125\ MPa$

$\sigma_1 = C + R = 75\ MPa$

$\sigma_2 = C - R = -175\ MPa$

$\sigma_3 = 0$

$$\tau_H^2 = \left(\frac{\sigma_x - \sigma_x}{2}\right)^2 + \tau^2$$

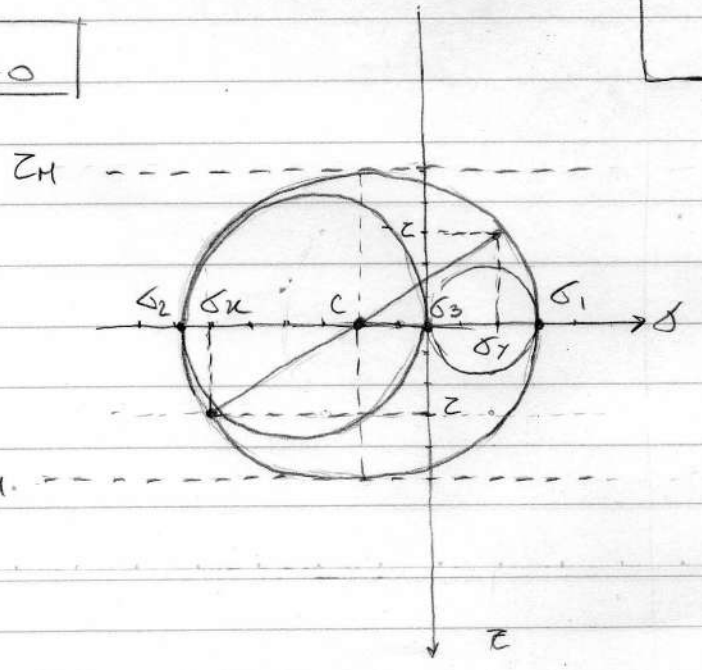
$$15.625 = \frac{\sigma_x^2 + \sigma_y^2 - 2\sigma_x\sigma_x}{4} + \tau^2$$

$$40.000 = \sigma_x^2 + \sigma_y^2 - 2\sigma_x\sigma_x$$

$$\sigma_x^2 - 100\sigma_x - 37.500 = 0$$

$\sigma_x = 250$ ×

$\sigma_x = -150$ ✓



$$\cos(2\theta) = \frac{\sigma_y - C}{R}$$

$$\cos(2\theta) = \frac{50 - (-50)}{125}$$

$\theta = 18{,}43°$

Ejercicio 3

BC y DE Acero $\Rightarrow$ $E = 210\,GPa$

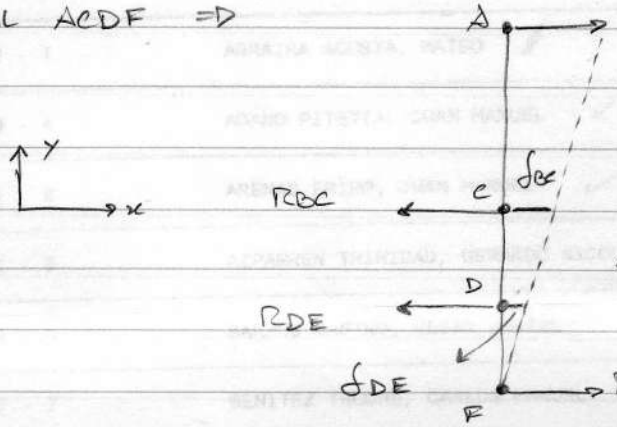
$\Delta T = 40\,^\circ C$

$\alpha = 11{,}7 \times 10^{-6}\,^\circ C^{-1}$

$A = 1\,cm^2 = 1 \times 10^{-4}\,m^2$

a) BC y DE son elementos a 2 fuerzas $\Rightarrow$ fuerza en sentido axial de BC y DE únicamente.

• DCL ACDF $\Rightarrow$



$\sum F_x = 0 \Leftrightarrow \boxed{P + R_F = R_{BC} + R_{DE}}$ (1)

$\sum M_F = 0 \Leftrightarrow \boxed{P \cdot 200 = R_{BC} \cdot 100 + R_{DE} \cdot 50}$ (2)

$\Rightarrow$ 2 ec. 3 inc. $\Rightarrow$ HE.

Necesito CD $\Rightarrow$

• CD $\Rightarrow$ $\dfrac{\delta_{BC}}{\delta_{DE}} = \dfrac{100}{50} \Rightarrow \boxed{\delta_{BC} = 2\,\delta_{DE}}$ (3)

$$\boxed{\delta_{BC} = \frac{R_{BC} \cdot 0{,}1\,m}{E \cdot A} + \alpha \Delta T \cdot 0{,}1\,m}$$

$$\boxed{\delta_{DE} = \alpha \Delta T \cdot 0{,}125\,m - \frac{R_{DE} \cdot 0{,}125\,m}{E \cdot A}}$$

$\Rightarrow$ $\boxed{R_{BC} = 2547\,N}$ $\boxed{R_{DE} = 4905\,N}$ $\boxed{R_F = 4953\,N}$

$\boxed{\sigma_{BC} = 25{,}47\,MPa\ (\text{Tracción})}$ $\boxed{\sigma_{DE} = 49{,}05\,MPa\ (\text{Comp.})}$

b) $\dfrac{\delta_A}{\delta_{BC}} = \dfrac{200}{100} \Rightarrow \delta_A = 2\,\delta_{BC}$ con $\boxed{\delta_{BC} = 5{,}89 \times 10^{-5}\,m}$

$\Rightarrow \boxed{\delta_A = 1{,}18 \times 10^{-4}\,m}$