P3| La fuerza de 75 kg, genera: V, M

A) $\sigma_f = \frac{750(N)\cdot 0{,}25(m)\cdot r}{\frac{\pi}{4}\cdot r^4} = \frac{238{,}85}{r^3}$ ← esto queda en (Pa)

$\overline{\sigma}_V = 0$

B) $\sigma_f = 0$

$\overline{\sigma}_V = \frac{4\cdot 750(kg)}{3\pi r^2} = \frac{318{,}47}{r^2}$

La fuerza de 400kg genera: N, M

A) $\sigma_T = \frac{4000(N)}{\pi r^2} = \frac{1273{,}89}{r^2}$ $\quad \overline{\sigma}=0$

$\sigma_f = \frac{4000(N)\cdot 0{,}15(m)\cdot r}{\frac{\pi}{4} r^4} = \frac{764{,}33}{r^3}$

B) $\sigma_T = \frac{1273{,}89}{r^2}$ $\quad \sigma_f = 0$

$\Rightarrow \underset{\uparrow \sigma_x}{\Sigma \sigma_A} = \frac{238{,}85}{r^3} + \frac{764{,}33}{r^3} + \frac{1273{,}89}{r^2} = \frac{1003{,}18}{r^3} + \frac{1273{,}89}{r^2}$

como $\overline{\sigma}=0 \Rightarrow \sigma_x$ es esf principal

$\Rightarrow \sigma_{adm} = 450\times 10^6(Pa) = \frac{1003{,}18}{r^3} + \frac{1273{,}89}{r^2}$

$\Rightarrow (450\times 10^6) r^3 - 1273{,}89 r - 1003{,}18 = 0$

$\Rightarrow r = 0{,}013(m) \Rightarrow \boxed{r = 1{,}3(cm)}$

$\underset{\uparrow \sigma_x}{\Sigma \sigma_B} = \frac{1273{,}89}{r^2}$ $\quad \underset{\uparrow \overline{\sigma}_{xy}}{\Sigma \overline{\sigma}_B} = \frac{318{,}47}{r^2}$

$\Rightarrow \sigma_{1,2} = \frac{1273{,}89}{2r^2} \pm \sqrt{\left(\frac{1273{,}89}{2r^2}\right)^2 + \left(\frac{318{,}47}{r^2}\right)^2} \Rightarrow \sigma_1 = \frac{1349{,}07}{r^2}; \sigma_2 = -\frac{75{,}18}{r^2}$

luego $\sigma_{adm} = 450{,}10^6 = \frac{1349{,}07}{r^2} \Rightarrow \boxed{r = 0{,}0017(m)}$

Problema 7.4

Un panel está sujeto por un mástil horizontal, según el esquema de la figura. Teniendo en cuenta el peso propio del panel, el peso propio del mástil y la acción del viento, hallar las tensiones máximas en el empotramiento del mástil a la pared.

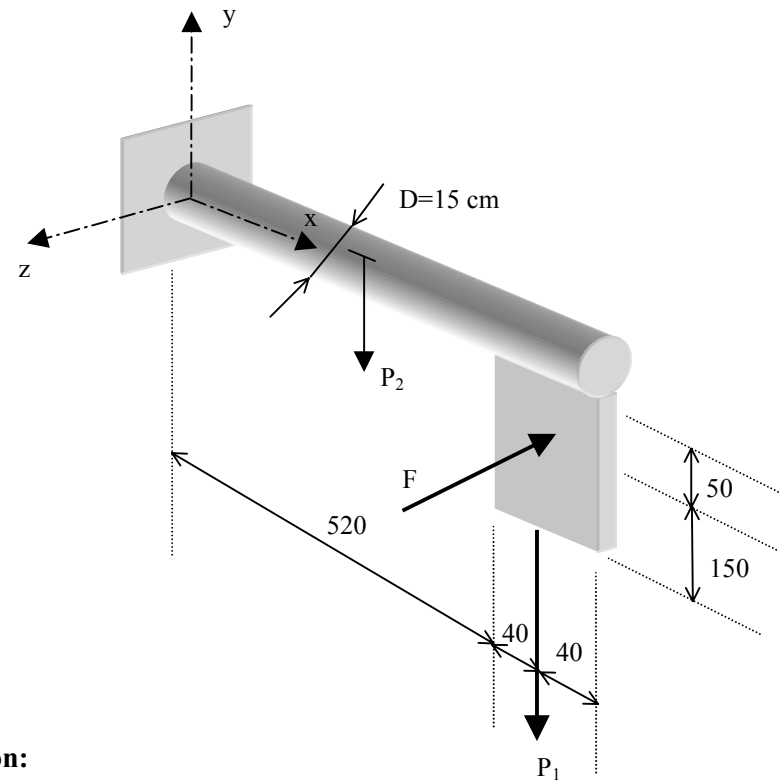
Datos: Peso propio del panel P_1= 90 kp

Dimensiones 80·200 cm

Diámetro del mástil D =15 cm

Empuje del viento f = 80 kg/m^2

(Peso propio del mástil de acero: $P_2 = 7850\ \text{kp/m}^3 \cdot 6\ \text{m} \cdot \dfrac{\pi \cdot 0{,}15^2}{4} = 832\ \text{kp}$ **)**

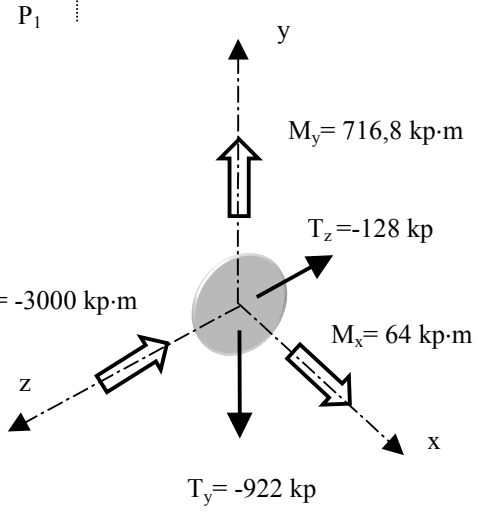


Resolución:

$$F = 80\frac{\text{kg}}{\text{m}^2} \cdot 0{,}8 \cdot 2 = 128\ \text{kp}$$

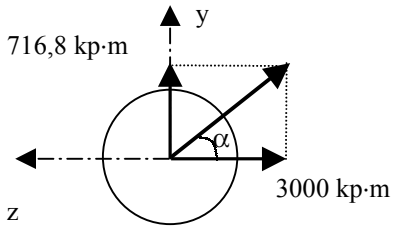
Sección en el empotramiento. Esfuerzos:

$$N_x = 0$$
$$T_y = -90 - 832 = -922\ \text{kp}$$
$$T_z = -128\ \text{kp}$$

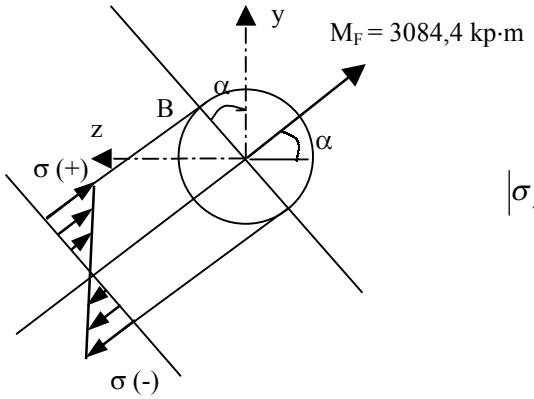


$$M_x = 128 \text{ kp} \cdot 0{,}5 \text{ m} = 64 \text{ kp} \cdot \text{m}$$
$$M_y = 128 \text{ kp} \cdot (0{,}4 + 5{,}2) \text{ m} = 716{,}8 \text{ kp} \cdot \text{m}$$
$$M_z = -90 \text{ kp} \cdot (5{,}2 + 0{,}4) \text{ m} - 832 \cdot 3 = -3000 \text{ kp} \cdot \text{m}$$

Tensiones normales debidas a los momentos flectores:

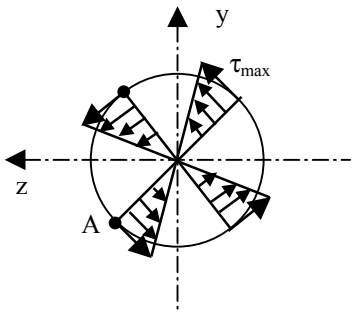


$$M_F = \sqrt{3000^2 + 716.8^2} = 3084{,}4 \text{ kp} \cdot \text{m}$$
$$\alpha = arctan\frac{716{,}8}{3000} = 13{,}4^\circ$$



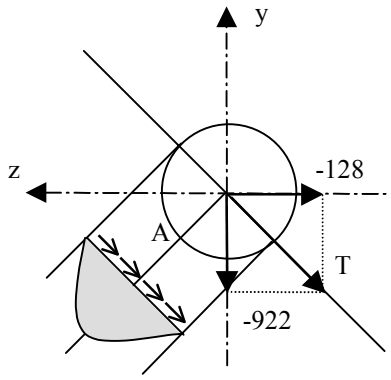
$$\left|\sigma_{x_{max}}\right| = \frac{M_F}{I_z}\frac{D}{2} = \frac{3084{,}4 \cdot 10^2}{\frac{\pi \cdot 15^4}{64}}\frac{15}{2} = 930{,}9 \text{ kp/cm}^2$$

Tensiones tangenciales debidas al momento torsor:



$$\tau_{max} = \frac{M_x \cdot r_{max}}{I_o} = \frac{6400 \cdot \frac{15}{2}}{\frac{\pi \cdot 15^4}{32}} = 9{,}66 \text{ kp/cm}^2$$

Tensiones tangenciales debidas a los esfuerzos cortantes:



$$T = \sqrt{T_z^2 + T_y^2} = \sqrt{128^2 + 922^2} = 930{,}8 \text{ kp}$$

$$\tau_{max} = \frac{4}{3}\frac{T}{A} = \frac{4}{3}\frac{930{,}8}{\frac{\pi \cdot 15^2}{4}} = 7{,}0 \text{ kp/cm}^2$$

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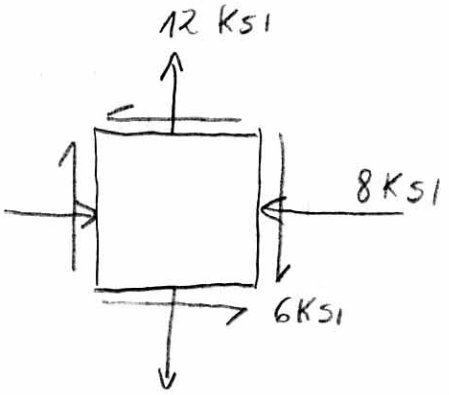
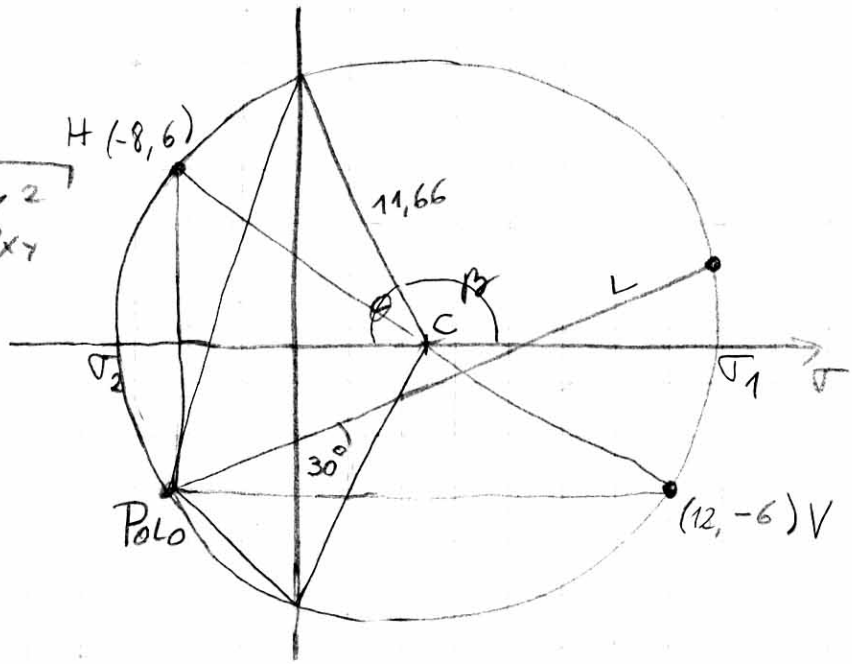
P2

a)



$$\sigma_{1,2} = \frac{\sigma_x + \sigma_y}{2} \pm \sqrt{\left(\frac{\sigma_x - \sigma_y}{2}\right)^2 + \tau_{xy}^2}$$

$$\sigma_{1,2} = \frac{-8+12}{2} \pm \sqrt{\left(\frac{-8-12}{2}\right)^2 + 6^2}$$



$$\sigma_{1,2} = 2 \pm 11,66$$

$$\sigma_1 = 13,66 \;//$$
$$\sigma_2 = 9,66 \;//$$

$$\tau_{max} = 11,66 \;//$$

b) Ec. círculo: $(\sigma_n - 2)^2 + \tau_n^2 = 11,66^2$ (1)

Ec. recta L: $\tau_n = tg(30)\,\sigma_n + b$

El polo pertenece a la recta $\Rightarrow$ $-6 = tg\,30^\circ(-8) + b$

$$b = -6 - tg\,30^\circ\,(-8) = -1,38$$

$$\Rightarrow \tau_n = 0,577\,\sigma_n - 1,38 \quad (2)$$

(2)

(2) en (1) $\Rightarrow$ $\sigma_n^2 - 4\sigma_n + 4 + (0{,}577\sigma_n - 1{,}38)^2 = 136$

$\sigma_n^2 - 4\sigma_n + 4 + 0{,}577^2\sigma_n^2 - 2\cdot 0{,}577\sigma_n \cdot 1{,}38 + 1{,}38^2 = 136$

$\sigma_n^2 - 4\sigma_n + 4 + 0{,}33\sigma_n^2 - 1{,}59\sigma_n + 1{,}9 = 136$

$1{,}33\sigma_n^2 - 5{,}59\sigma_n - 130{,}1 = 0$

$\sigma_n = 12{,}21$ // en (2) $\Rightarrow$ $\tau_n = 5{,}66$ //

Falta el otro eje.

c) Ec. círculo: $(\sigma_n - 2)^2 + \tau_n^2 = 136$ $\quad \sigma_n = 0$

$\Rightarrow 4 + \tau_n^2 = 136$

$\tau_n = \sqrt{132} = 11{,}49$ //

$11{,}66 \cos\theta = 2 \Rightarrow \theta = \arccos\left(\frac{2}{11{,}66}\right) = 80{,}12°$

$\Rightarrow \beta = 180 - 80{,}12 = 99{,}88°$ //

Falta el segundo plano.