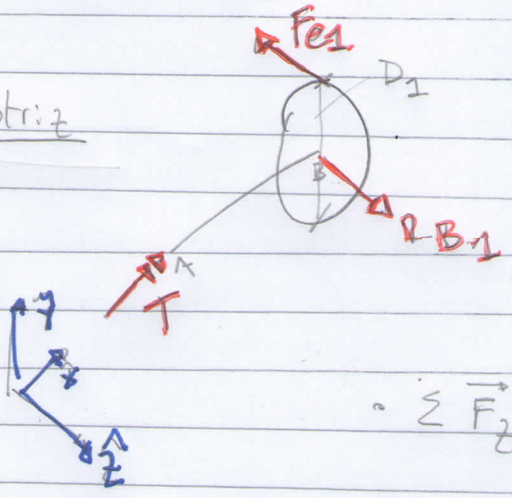
(Diam. eng. Gancho) $D_2 = 2{,}5 \cdot 30 = 75$ cm

(Diam. eng. motor) $D_1 = 75/25 = 3$ cm

Ejercicio 1 (50 p)

A) * eje motriz



$P = 15000$ W

$\omega = 375$ rpm $= 39{,}27$ rad/s

$P = T \cdot \omega$

↳ $T = 381{,}97$ Nm.

• $\sum \vec{F}_{\hat{z}} = \vec{0} \Rightarrow Fe_1 = R_{B1}$

↳ el eje AB esta sometido a torsión

$\sum M_{\hat{x}}^{A} = \vec{0} \Rightarrow T = Fe_1 \cdot \frac{D_1}{2} =$

↳ $Fe_1 = 25{,}46$ kN

⇒ estado tensional del pto mas comprometido

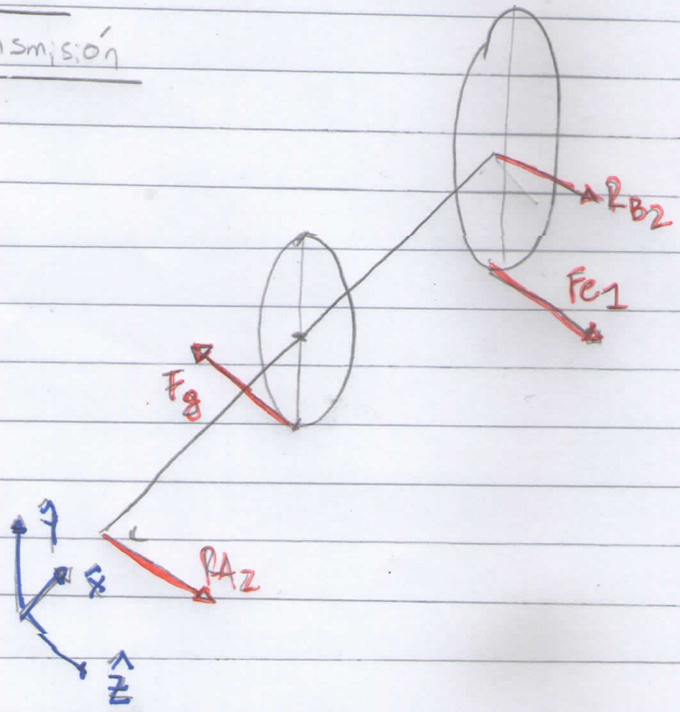
τ ⇒ tresca : $\tau_{max} \leq \frac{S_y}{2N}$

$\tau_{max} = \frac{Tr}{J} = \frac{381{,}97 \cdot r}{\frac{\pi r^4}{2}} = \frac{243{,}17}{r^3}$ ⇒ $r = 0{,}0185$ m

$N = 2{,}5$

$S_y = 200$ MPa

* eje de transmisión



• $\sum M_{\hat{x}}^{c} = \vec{0}$

↳ $Fg \cdot \frac{30}{2} = Fe_1 \cdot \frac{75}{2}$

$Fg = 63{,}65$ kN

• $\sum M_{\hat{y}} = \vec{0}$

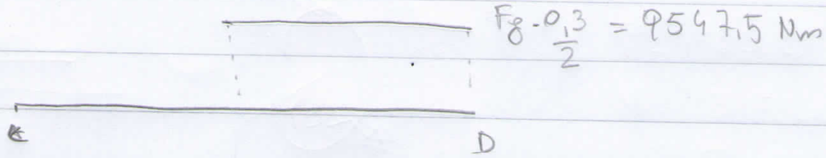
$Fg \cdot \frac{0{,}5}{2} = (Fe_1^* + R_{B_2}) \, 0{,}5$

$R_{B_2} = 6{,}365$ kN

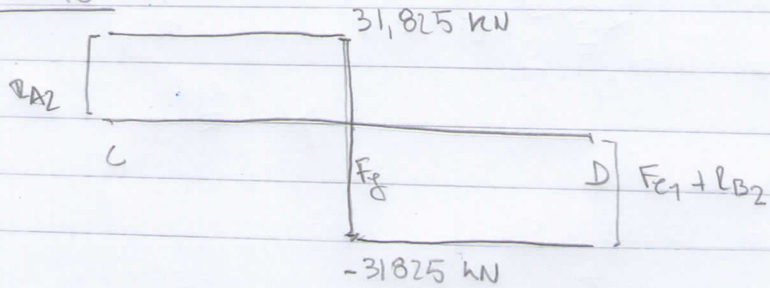
• $\sum \vec{F}_z = \vec{0} \rightarrow R_{A_2} = 31{,}825$ kN

⇒ Diagramas eje transmisión

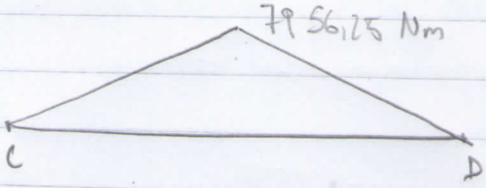
torsor



Cortante

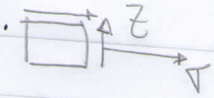


Flector



⇒ Punto más comprometido = sección media de la barra

⇒ est. tensional en ese punto =



tresca $= \tau_{max} \leq \frac{S_y}{2N} \Rightarrow \sqrt{\sigma^2 + 4\tau^2} \leq \frac{S_y}{N}$

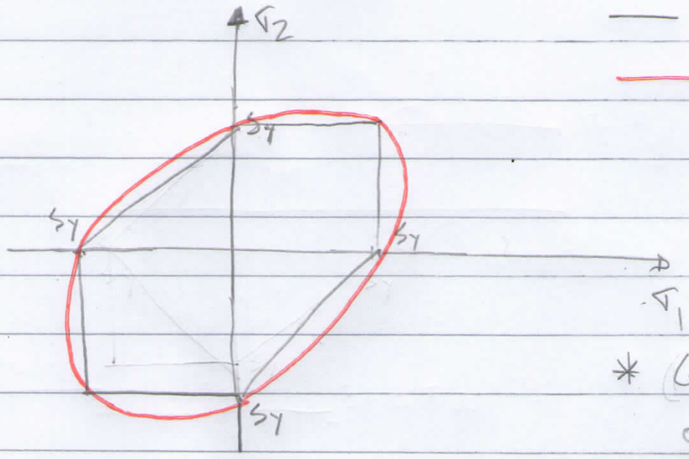
$$\sigma = \frac{Mr}{I} = \frac{7956,25 \cdot r}{\frac{\pi r^4}{4}} = \frac{10130}{r^3}$$

$$\tau = \frac{Tr}{J} = \frac{9547,5 \cdot r}{\frac{\pi r^4}{2}} = \frac{6078}{r^3}$$

$r = 0,0585$ m

- $N = 2,5$
- $S_y = 700$ MPa

B)



— tresca
— Von Misses

* Graficamente se observa que el FS por VM debe ser mayor que por tresca

*eje motriz

De la teoría: $\frac{S_y}{N} \geq \sqrt{\sigma^2 + 3\tau^2} \rightarrow N = 4,3$
(en caso de Flexo-torsión)

↳ $\sigma = 0$

$S_y = 200$ MPa

* eje transmisión $\frac{S_y}{N} \geq \sqrt{\sigma^2 + 3\tau^2} \rightarrow N = 2,7$

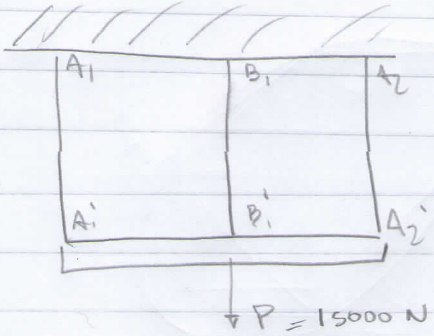
⇒ Ambos ejes cumplen lo que se observa en la Figura

c) $\theta = \frac{T L}{G J}$

eje 1 ⇒ $\theta_1 = 0,24°$
↳ $L = 0,15$ m, $G = 80$ GPa,
$J = 1,74 \times 10^{-7}$ m^4

eje 2 ⇒ $\theta_2 = 0,09°$
↳ $L = 0,5/2$ m
$J = 1,01 \times 10^{-5}$ m^4

ejercicio 2 (25 p)



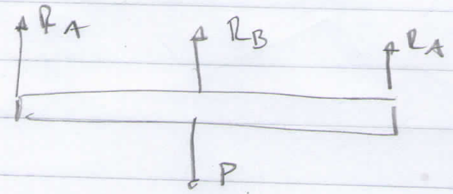
* Cables $A_1 - A_1'$ y $A_2 - A_2'$ (acero)

- Area A
- Modulo de Young $= E$
- Coef. de Dil. termica α
- largo $= L$

* Cable $B_1 - B_1'$ (cobre)

- Area $A/4$
- Modulo de Young $E/2$
- Coef. de dil. termica 2α
- largo L

* DCL de barra rigida



$2R_A + R_B = P \qquad R_A = \dfrac{P - R_B}{2}$

* Cond. de deformación

$\Delta l_{Acero} = \Delta l_{Bronce}$

* $\Delta l_{Acero} = \dfrac{R_A L}{AE} + \alpha \Delta T L \quad (1)$

* $\Delta l_{Bronce} = \dfrac{R_B L}{A/4 \; E/2} - 2\alpha \Delta T L \quad (2)$

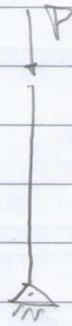
(1) y (2)

$\Rightarrow \dfrac{(P - R_B)}{2AE} - \alpha \Delta T L = \dfrac{8 R_B}{AE} - 2\alpha \Delta T L \Rightarrow P/2 + \alpha \Delta T A E = \dfrac{17}{2} R_B$

$R_B = \dfrac{2}{17}\left[\dfrac{P}{2} + \alpha \Delta T A E\right]$ → $R_B = 1308$ N, → $R_A = 6696$ N (sustituyendo con valores de letra)

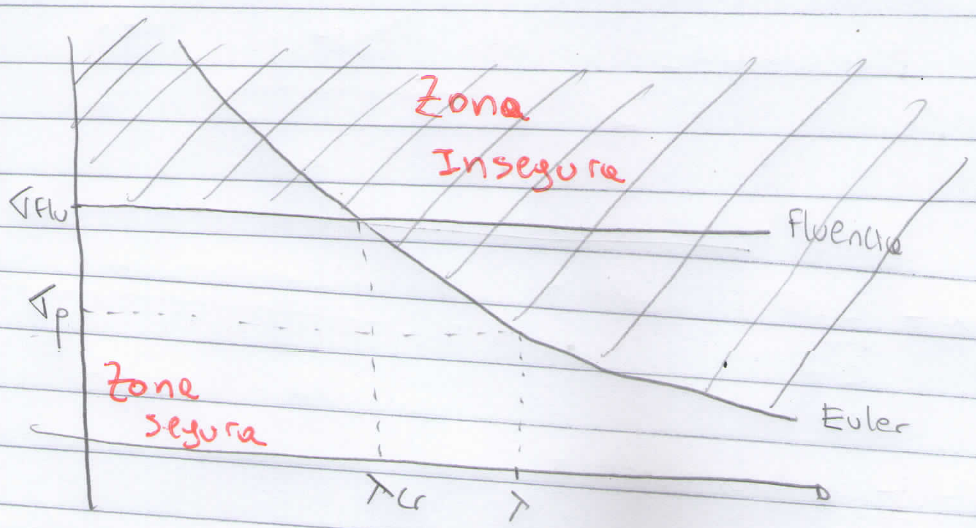
Δl_{Bronce} ⇒ operando con ec. (1) ó (2) $\Delta l_B = 0{,}186$ mm

Ejercicio 3 (25p)



- $I = \dfrac{0{,}1^4 - 0{,}092^4}{12} = 2{,}36 \times 10^{-6}\ m^4$
- $A = 0{,}1^2 - 0{,}092^2 = 0{,}0015\ m^2$
- $\rho = \sqrt{I/A} = 0{,}03922$
- $\lambda = L/\rho = 127{,}5$
- $\lambda_{cr} = \pi \sqrt{\dfrac{E}{\sigma_{Flu}}} = 106{,}9$

Debe estudiarse Pandeo



$\sigma_{pandeo} = \dfrac{\pi^2 E}{\lambda^2} \rightarrow \sigma_p = 134\ MPa \rightarrow P_p = \sigma_p \cdot A \rightarrow P_p = 205\ kN$