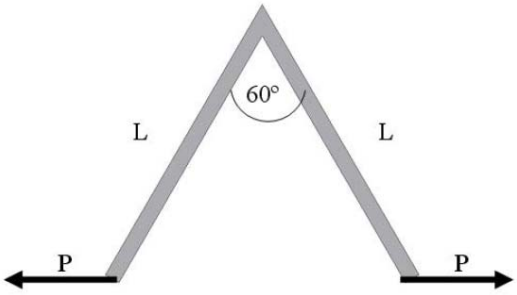
Universidad de Chile
Facultad de Ciencias Físicas y Matemáticas
Departamento de Ingeniería Mecánica

ME46A-02 Resistencia de Materiales
Profesor Cátedra: Francisco Escandón Artiz
Profesor Auxiliar : Felipe Donoso Ojeda

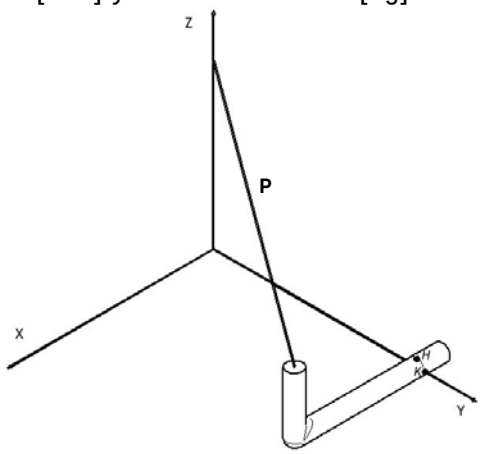
Semestre Otoño 2007
(20 de Abril)

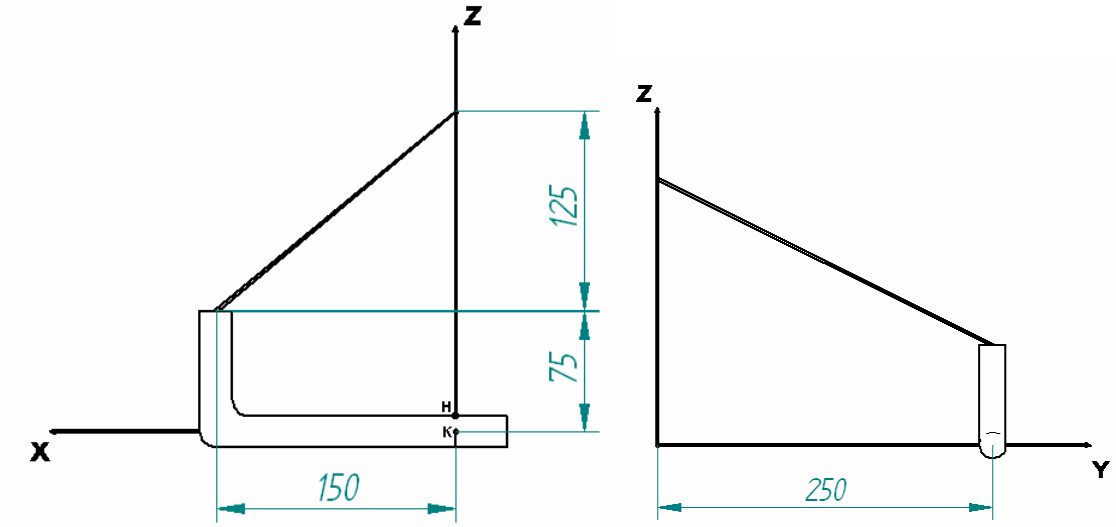
Clase Auxiliar Nº4

P1.-Para el sistema de la figura se pide determinar los diagramas V(x), N(x) y M(x).



P2.-Para el sistema de la figura se pide determinar los esfuerzos de compresión y tracción en los puntos H y K. El diámetro D = 20 [mm] y la fuerza P = 500 [Kg]

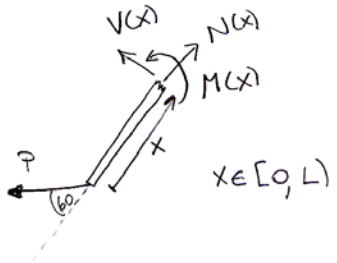




Pauta Ejercicio 2
ME46A - 02

Semestre 2006-1

P1)

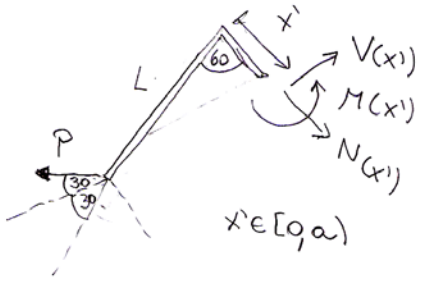


$x \in [0, L)$

$\sum F_x = 0 \Rightarrow N(x) = P \cdot \cos 60°$

$\sum F_y = 0 \Rightarrow V(x) = -P \cdot \operatorname{sen} 60°$

$\sum M_z = 0 \Rightarrow M(x) = x \cdot P \operatorname{sen} 60°$

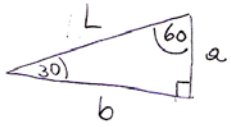


$x' \in [0, a)$

$\sum F_{x'} = 0 \Rightarrow N(x') = P \cdot \operatorname{sen} 30°$

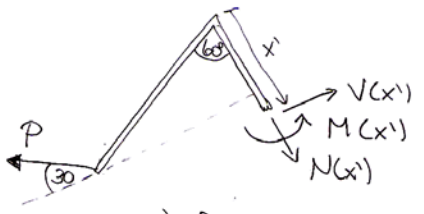
$\sum F_{y'} = 0 \Rightarrow V(x') = P \cdot \cos 30°$

$\sum M_z = 0 \Rightarrow M(x') = b \cdot P \operatorname{sen} 30° + (a - x') P \cdot \cos 30°$



$a = L \cdot \operatorname{sen} 30$

$b = L \cdot \cos 30$



$x' \in [a, L)$

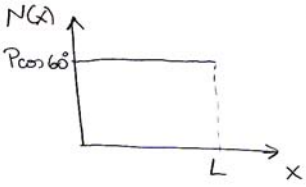
$\sum F_{x'} = 0 \Rightarrow N(x') = P \cdot \operatorname{sen} 30°$

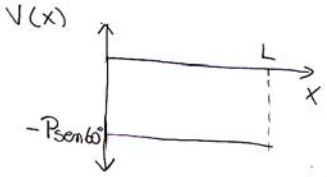
$\sum F_{y'} = 0 \Rightarrow V(x') = P \cdot \cos 30°$

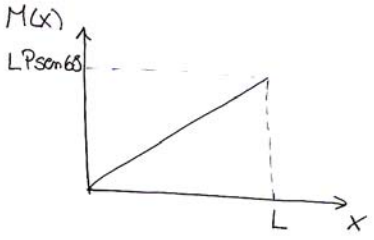
$\sum M_z = 0 \Rightarrow M(x') = b \cdot P \operatorname{sen} 30 - (x' - a) P \cos 30°$

$M(x') = b \cdot P \operatorname{sen} 30 + (a - x') P \cos 30°$

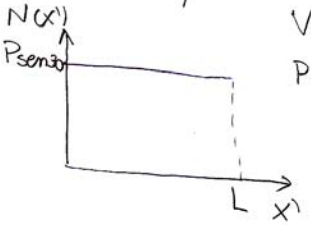
$x \in [0, L)$

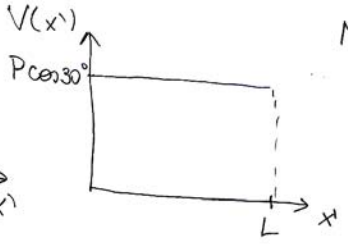


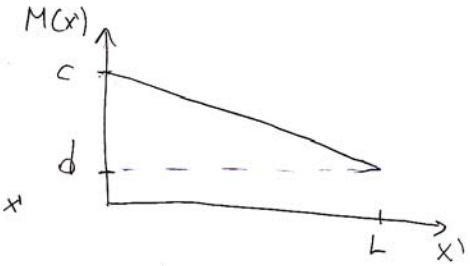




$x' \in [0, L)$



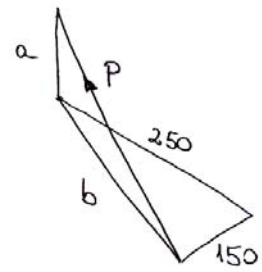


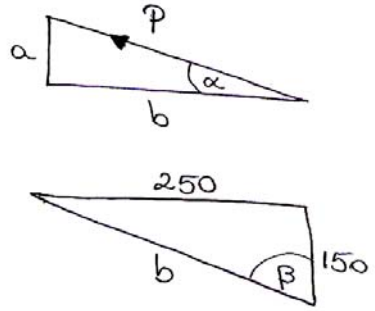


$c = b\,P\,\mathrm{sen}\,30 + a\,P\cos 30$

$d = c - L\,P\cos 30$

P2)





$b = \sqrt{150^2+250^2} \Rightarrow b = 291,5 \text{ mm}$

$a = 125 \text{ mm}$

$\alpha = \text{arctg}\left(\frac{a}{b}\right) \Rightarrow \alpha = 23,21°$

$\beta = \text{arctg}\left(\frac{250}{150}\right) \Rightarrow \beta = 59,04°$

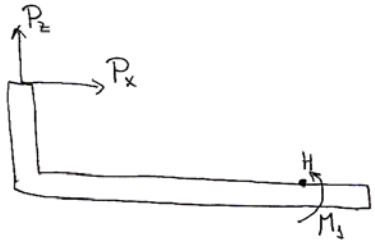
Componentes de P:

$P_x = -P \cdot \cos\alpha \cdot \cos\beta \, \hat{x} \Rightarrow P_x = -236,4 \, \hat{x} \, [Kg]$

$P_y = -P \cdot \cos\alpha \cdot \text{sen}\beta \, \hat{y} \Rightarrow P_y = -394,1 \, \hat{y} \, [Kg]$

$P_z = P \cdot \text{sen}\alpha \, \hat{z} \Rightarrow P_z = 197,0 \, \hat{z} \, [Kg]$

Plano X - Z



$\Sigma M_y = 0 \Rightarrow \quad M_1 = 75\,P_x + 150\,P_z$

$M_1 = 47286{,}6\ [Kg \cdot mm]$

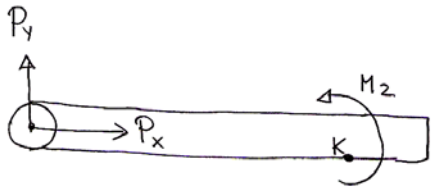
$\sigma_{fH} = -\dfrac{M_1 \cdot R}{\frac{\pi \cdot R^4}{4}} \Rightarrow \quad \sigma_{fH} = -60{,}21\ [Kg/mm^2]$ Esfuerzo flexión en H (compresión)

$\sigma_{AH} = -\dfrac{P_x}{\pi R^2} \Rightarrow \quad \sigma_{AH} = -0{,}753\ [Kg/mm^2]$ Esfuerzo axial en H (compresión)

$\sigma_H = \sigma_{fH} + \sigma_{AH} = -60{,}21 - 0{,}753$

$\Rightarrow \boxed{\sigma_H = -60{,}96\ [Kg/mm^2]}$ Esfuerzo de compresión en H

Plano x-y



$\Sigma M_z = 0 \Rightarrow M_z = 150 \cdot P_y$

$M_z = 59108{,}3\ [Kg \cdot mm]$

$\sigma_{fK} = -\frac{M_z \cdot (-R)}{\frac{\pi \cdot R^4}{4}} \Rightarrow \sigma_{fK} = 75{,}26\ [Kg/mm^2]$ Esfuerzo flexión en K (tracción)

$\sigma_{AK} = -\frac{P_x}{\pi \cdot R^2} \Rightarrow \sigma_{AK} = -0{,}753\ [Kg/mm^2]$ Esfuerzo axial en K (compresión)

$\sigma_K = \sigma_{fK} + \sigma_{AK} = 75{,}26 - 0{,}753$

$\Rightarrow \boxed{\sigma_K = 74{,}51\ [Kg/mm^2]}$ Esfuerzo de tracción en K.

Atentamente,

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