MECÂNICA DOS SÓLIDOS 3
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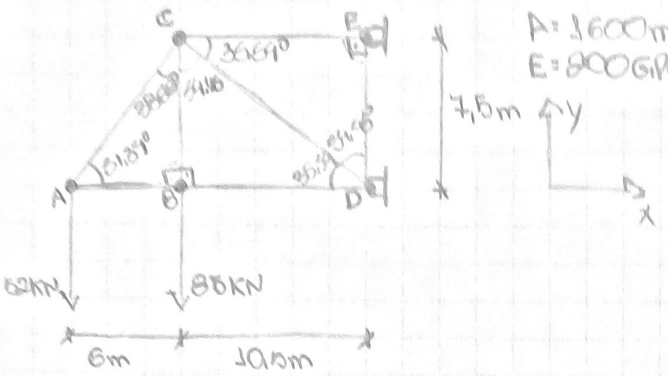


$A = 1600mm^2$
$E = 200GPa$

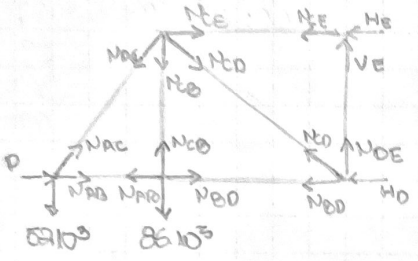
• Adicionando uma carga P qualquer em A, temos:

$\sum Fx = P - Ex + Dx = 0$
$\sum Fy = Ey - 52 - 85 = 0$
$\sum M_E = 52.16,5 + 85.10,5 + Dx.7,5 + 7,5P = 0$

$Ey = 137kN$
$Dx = P - 233,41kN$
$Ex = 233,41kN$

• Método dos nós

$AC = 9,6m$; $CD = 12,9m$



$\sum FH_D = -H_D - N_{BD} - N_{CD}\cos(35,54) = 0$
$\sum FV_D = N_{DE} + N_{CD}\cos(54,46) = 0$
$\sum FH_B = N_{BD} - N_{AB} = 0$
$\sum FV_B = N_{CB} - 85.10^3 = 0$
$\sum FH_A = N_{AB} + N_{AC}.\cos(53,24) + P = 0$
$\sum FV_A = N_{AC} - \sin(53,24) - 52.10^3 = 0$
$\sum FH_C = N_{CE} - N_{AC}\sin(36,66) + N_{CD}\cos(35,24) = 0$
$\sum FV_C = -N_{AC}.\cos(36,66) - N_{CB} - N_{CD}\cos(54,76) = 0$
$\sum FH_E = -H_E - N_{CE} = 0$
$\sum FV_E = V_E - N_{DE} = 0$

$N_{DE} = 137,00kN$
$N_{BD} = -41623,75 - Pkn$
$N_{CB} = 85kN$
$N_{AB} = -41623,75 - P\,kN$
$N_{AC} = 66,598kN$
$N_{CE} = 233,395kN$
$N_{CD} = -235,7kN$
$H_E = -233,395kN$

• Para barras:

$$\Delta = \sum_{i=1}^{m} \int_0^{L_i} \frac{N_i}{E_i A_i} \cdot \frac{\partial N_i}{\partial P} dx$$

$$*\Delta_{AB} = \int_0^{6} \frac{(-41623,75 - P)\cdot(-1)}{EA} dx$$

$\Delta_{AB} = 0,00089m$

$$*\Delta_{AC} = \int_0^{9,6} \frac{66,598 \cdot 0}{EA} dx$$

$\Delta_{AC} = 0$

$$*\Delta_{BC} = \int_0^{7,5} \frac{85 \cdot 0}{EA} dx$$

$\Delta_{BC} = 0$

$$*\Delta_{BD} = \int_0^{10,5} \frac{(-41623,75 - P)(-1)}{EA} dx$$

$\Delta_{BD} = 0,00144m$

$$*\Delta_{CD} = \int_0^{12,9} \frac{-235,7 \cdot 0}{EA} dx$$

$\Delta_{CD} = 0$

$$*\Delta_{CE} = \int_0^{10,5} \frac{233,395 \cdot 0}{EA} dx$$

$\Delta_{CE} = 0$

$$*\Delta_{DE} = \int_0^{7,5} \frac{137005 \cdot 0}{EA} dx$$

$\Delta_{DE} = 0$

$\Delta_A = \Delta_{AB} + \Delta_{AC} + \Delta_{BC} + \Delta_{BD} + \Delta_{CD} + \Delta_{CE} + \Delta_{DE}$

$\Delta_A = 0,00232m$

Logo o deslocamento em B será de 2,32mm para a direita

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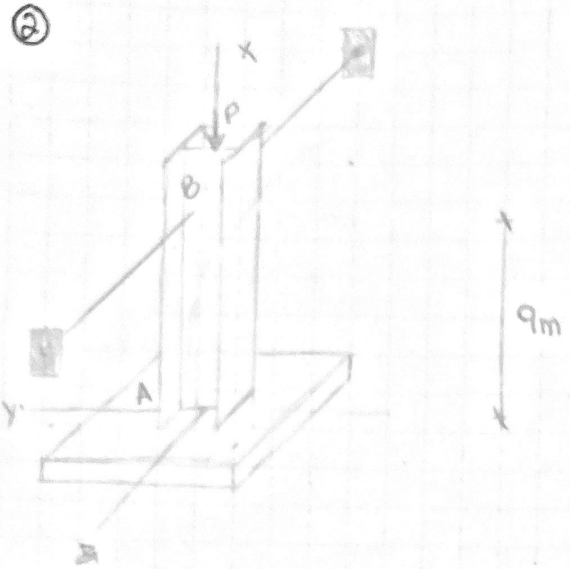

$\sigma_{adm} = 250\,MPa$
$E = 200\,GPa$
$I_{xx} = 128 \cdot 10^6\,mm^4$
$I_y = 18{,}4 \cdot 10^6\,mm^4$
$k_x = 130\,mm$
Coef de segurança de flambagem 2

- Considerando a flambagem em torno do eixo x:

$$P_{cr} = \frac{\pi^2 E I_{xx}}{(KL)_x^2} = \frac{\pi^2 (200\,N/mm^2)(128 \cdot 10^6\,mm^4)}{[2 \cdot 9m \cdot 1000\,mm/m]^2} = 779{,}82\,kN$$

- Em torno do eixo y:

$$P_{cr} = \frac{\pi^2 E I_y}{(KL)_y^2} = \frac{\pi^2 (200\,N/mm^2)(18{,}4 \cdot 10^6\,mm^4)}{(0{,}7 \cdot 9m \cdot 1000\,mm/m)^2} = 956{,}1\,kN$$

Logo, o P_{cr} adotado será 779,82 kN

- Para a tensão crítica:

$$\sigma_{cr} = \frac{\pi^2 E}{(KL/r)^2} = \frac{\pi^2 \cdot (200\,N/mm^2)}{(2 \cdot 9m \cdot 1000\,mm/m / 130\,mm)^2} = 102{,}9\,MPa$$

Como $\sigma_{cr} < \sigma_{adm}$, confirmamos a validade do P_{cr} adotado

- Pelo critério de estabilidade:

$$\sigma \leq \frac{\sigma_{cr}}{n_p} \;;\; \frac{P}{A} \leq \frac{P_{cr}}{A \cdot n_p} \;;\; P \leq \frac{779{,}82}{2} \;;\; P \leq 389{,}91\,kN$$

Carga admissível: 389,91 kN