MEC 3 - Prova 4

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1)

↳ Para o plano XY, $n_1 = 2$ → fixo - livre

$$P_{cr} = \frac{\pi^2 E I_z}{(K \cdot L)_z^2} = \frac{\pi^2 (200.000\,N/mm^2)(128 \times 10^6\,mm^4)}{[2 \cdot 9000\,mm]^2}$$

↳ $P_{cr} = 779,8 \cdot KN$

• Índice de esbeltez:

$$\lambda = \frac{L_e}{r} = \frac{K \cdot L}{r_z} = \frac{2 \cdot 9000\,mm}{130\,mm} = 138,5$$

↳ Para o plano XZ, $n_1 = 0,7$ → fixo - articulado

↳ $$P_{cr} = \frac{\pi^2 E I}{(KL)_y^2} = \frac{\pi^2 (200.000\,N.mm^2) \cdot (18,4 \times 10^6\,mm^4)}{[0,7 \cdot 9000 \cdot mm]^2}$$

↳ $P_{cr} = 915,09 \cong 915,1\,KN$.

Logo, o menor P_{cr} é $779,8\,KN$.

↳ Tensão crítica:

→

- Tensão crítica:

$$\sigma_{cr} = \frac{\pi^2 \cdot E}{[\lambda]^2} = \frac{\pi^2 \cdot 200.000}{[138,5]^2} = 102,9\ MPa$$

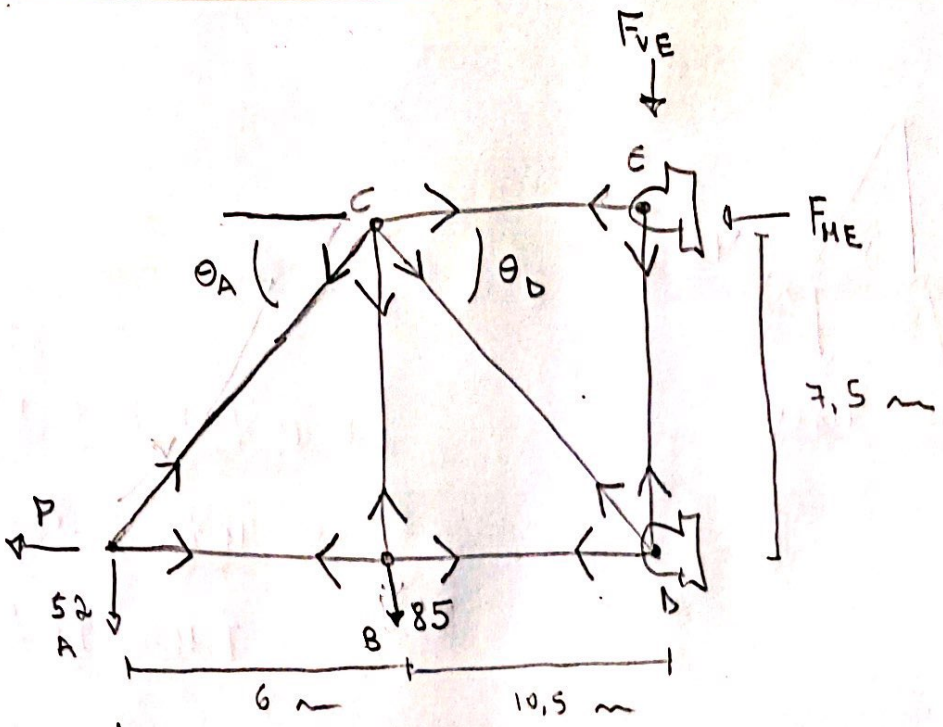
- $102,9\ MPa < 250\ MPa$, logo o critério de resistência é válido.

↳ Critério de estabilidade $\sigma \leq \frac{\sigma_{cr}}{n}$

$$\frac{P}{A} \leq \frac{P_{cr}}{A \cdot n_p} \rightarrow P \leq \frac{779,8}{2} \Rightarrow P \leq 389,9\ KN$$

↳ Ou seja, a carga admissível no sistema é $389,9\ KN$

2)



- $\theta_A = tg^{-1}\left(\frac{7,5}{6}\right) = 0,89$
- $\theta_D = tg^{-1}\left(\frac{7,5}{10,5}\right) = 0,62$

$\rightarrow NAC = 9,6$ m

$\rightarrow 12,9$ m

$\Sigma F_{HA} = N_{AB} - P + N_{AC} \cdot \cos\theta_A = 0$

$\Sigma F_{VA} = -52 + N_{AC} \cdot \operatorname{sen}\theta_A = 0$

$\Sigma F_{HB} = -N_{AB} + N_{BD} = 0$

$\Sigma F_{VB} = N_{CB} - 85 = 0 \rightarrow N_{CB} = 85$

$\Sigma F_{HC} = -N_{AB} \cdot \cos\theta_A + N_{CE} + N_{CD} \cdot \cos\theta_D = 0$

$\Sigma F_{VC} = -N_{CB} - N_{AC} \cdot \operatorname{sen}\theta_A - N_{CD} \cdot \operatorname{sen}\theta_D = 0$

$\Sigma F_{HD} = -N_{BD} - N_{CD} \cdot \cos\theta_D - H_D = 0$

$\Sigma F_{VD} = N_{ED} + N_{CD} \cdot \operatorname{sen}\theta_D = 0$

$\Sigma F_{HE} = -H_E - N_{CB} = 0$

$\Sigma F_{VE} = -V_E - N_{ED} = 0$

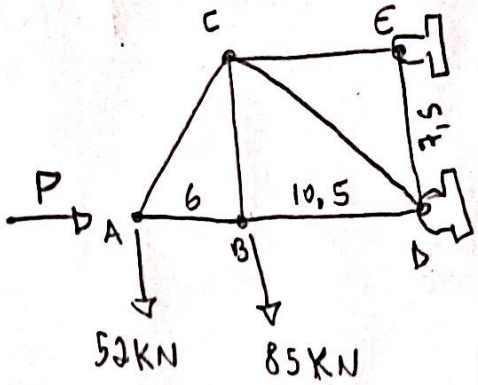
$\rightarrow H_E = 233,4$ KN $\rightarrow$

$V_E = 137,0$ KN $\uparrow$

$H_D = P + 233,4$ $\leftarrow$

2)

↳ Continuação:



- $F_{HB} = P + 233.4$ KN ←
- $F_{HE} = 233.4$ KN →
- $F_{VE} = 137$ KN ↑

Trecho	F	$\frac{\partial F}{\partial P}$	F (P=0KN)	L	$\left(\frac{\partial F}{\partial P}\right) \cdot F \cdot L$
AB	$-P - 41,6$ KN	-1	$-41,6$ KN	6.000 mm	249,6 KN.mm
AC	66,59 KN	0	66,59 KN	9.604,6 mm	0
BC	85 KN	0	85 KN	7.500 mm	0
BD	$-P - 41,6$ KN	-1	$-41,6$ KN	10.500 mm	436,8 KN.mm
CD	$-235,7$ KN	0	$-235,7$ KN	12.903,4 mm	0
CE	233,4	0	233,4 KN	10.500 mm	0
DE	137 KN	0	137 KN	7.500 mm	0

Castigliano: $\Delta_A = \frac{1}{A_E} \sum N \cdot \frac{\partial N}{\partial P} \cdot L$

↳ $\Delta_A = \frac{1}{AE} \left(N_{AB} \cdot \frac{\partial N_{AB}}{\partial P} \cdot L_{AB} + N_{BD} \cdot \frac{\partial N_{BD}}{\partial P} \cdot L_{BD} \right)$

↳ $\Delta_A = \frac{1}{3,2 \times 10^5} \cdot \left(-11,6 \cdot (-1) \cdot 6 + (-41,6) \cdot (-1) \cdot 10,5 \right)$

↳ $\Delta_A = \frac{(686.400,000 \text{ N})}{(1,6 \text{ mm}^2)(200.000 \text{ N/mm}^2)}$ ↳ $\Delta_A = 0,00215$ m ou 2,15 mm ↓