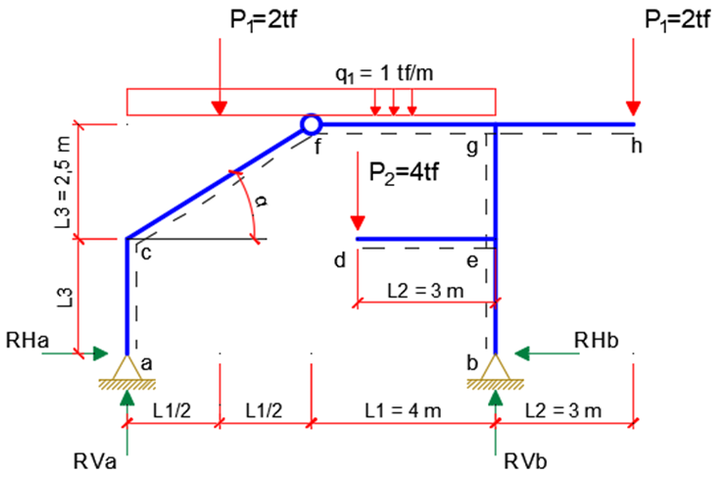
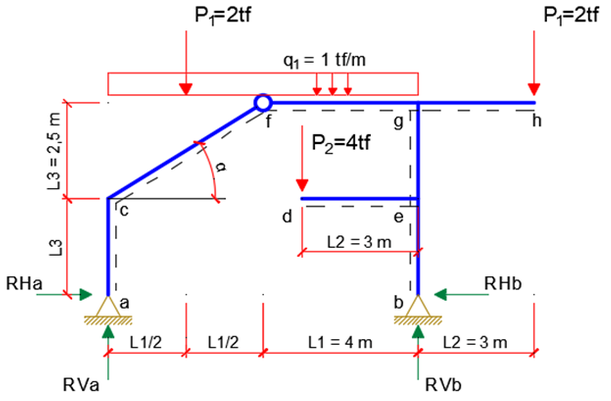
TE1_E06-01

Para o pórtico abaixo, determinar:
a) A reações de apoio ;
b) O diagrama de esforços cortantes do trecho ACF;
c) O diagrama de esforços normais do trecho ACF;



$L1 := 4\ m$ $L2 := 3\ m$ $L3 := 2,5\ m$ $P1 := 2\ tf$ $P2 := 4\ tf$ $q1 := 1\ \frac{tf}{m}$

Cálculo das Reações de Apoio:



ΣMa = 0 (+) antihorário

$$RVb \cdot 2 \cdot L1 - P1 \cdot (L2 + 2 \cdot L1) - P2 \cdot (2 \cdot L1 - L2) - P1 \cdot \frac{L1}{2} - q1 \cdot (2 \cdot L1) \cdot \frac{(2 \cdot L1)}{2} = 0$$

$$RVb := \frac{1}{2 \cdot L1} \cdot \left(P1 \cdot (L2 + 2 \cdot L1) + P2 \cdot (2 \cdot L1 - L2) + P1 \cdot \frac{L1}{2} + q1 \cdot 2 \cdot L1^{2} \right) = 9,75\ tf$$

ΣFv = 0 (+) para cima

$$RVa + RVb - 2 \cdot P1 - P2 - q1 \cdot 2 \cdot L1 = 0 \qquad RVa := -RVb + 2 \cdot P1 + P2 + q1 \cdot 2 \cdot L1 = 6,25\ tf$$

ΣMf = 0 olhando para a "a" (+) antihorário

$$RHa \cdot (2 \cdot L3) - RVa \cdot L1 + P1 \cdot \frac{L1}{2} + q1 \cdot L1 \cdot \frac{L1}{2} = 0$$

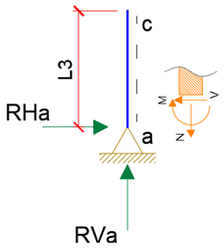
$$RHa := \frac{1}{2 \cdot L3} \cdot \left(RVa \cdot L1 - P1 \cdot \frac{L1}{2} - q1 \cdot L1 \cdot \frac{L1}{2} \right) = 2,6\ tf$$

ΣFh = 0 (+) para direita

$$RHa - RHb = 0$$

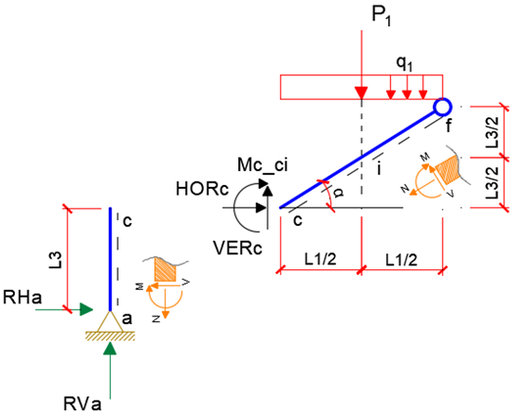
$$RHb := RHa = 2,6\ tf$$

Esforços nas Pontas das Barras e Equações:



$$Vac(x) := -RHa = -2,6\ tf$$

$$Nac(x) := -RVa = -6,25\ tf$$



$$Mc_ci := -RHa \cdot L3 = -6,5\ tf\ m$$

$$HORc := RHa = 2,6\ tf$$

$$VERc := RVa = 6,25\ tf$$

Relações Trigonométricas para o ângulo α indicado:

$$Lcif := \sqrt{L1^2 + L3^2} = 4,717\ m$$

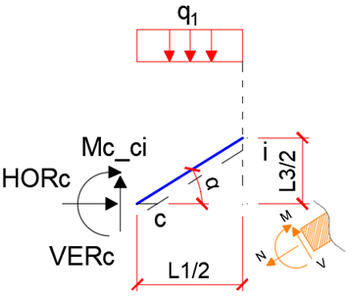
$$cos\alpha := \frac{L1}{Lcif} = 0,847998 \qquad sen\alpha := \frac{L3}{Lcif} = 0,529999$$

Cálculo dos Esforços Cortante e Axial no ponto "c" (via fórmula "enlatada"):

$$Nc_ci := -HORc \cdot cos\alpha - VERc \cdot sen\alpha = -5,5173\ tf$$

$$Vc_ci := -HORc \cdot sen\alpha + VERc \cdot cos\alpha = 3,922\ tf$$

Trecho "ci":

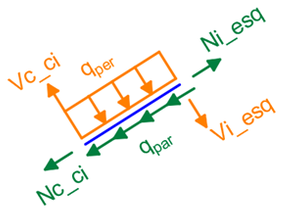


$$qper := q1 \cdot (cos\alpha)^2 = 0,7191\ \frac{tf}{m}$$

$$qpar := q1 \cdot cos\alpha \cdot sen\alpha = 0,4494\ \frac{tf}{m}$$

$$Vci(x) := Vc_ci - qper \cdot x$$

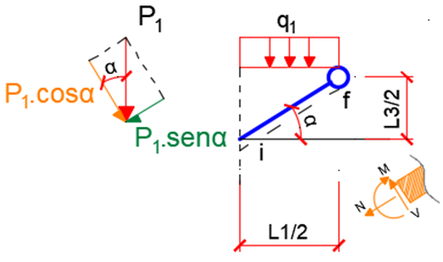
$$Nci(x) := Nc_ci + qpar \cdot x$$



$$Vi_esq_P1 := Vci\left(\frac{Lcif}{2}\right) = 2,226\ tf$$

$$Ni_esq_P1 := Nci\left(\frac{Lcif}{2}\right) = -4,4573\ tf$$

Trecho "if":

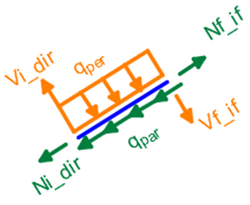


$$NP1 := P1 \cdot sen\alpha = 1,06\ tf$$

$$VP1 := P1 \cdot cos\alpha = 1,696\ tf$$

$$Vif(x) := Vi_esq_P1 - VP1 - qper \cdot x$$

$$Nif(x) := Ni_esq_P1 + NP1 + qpar \cdot x$$



$$Vf_if := Vif\left(\frac{Lcif}{2}\right) = -1,166\ tf$$

$$Nf_if := Nif\left(\frac{Lcif}{2}\right) = -2,3373\ tf$$

$Nac(x) := -RVa = -6,25\ tf$

$Vac(x) := -RHa = -2,6\ tf$

$Nc_ci := -HORc \cdot cos\alpha - VERc \cdot sen\alpha = -5,5173\ tf$

$Vc_ci := -HORc \cdot sen\alpha + VERc \cdot cos\alpha = 3,922\ tf$

$Ni_esq_P1 := Nci\left(\frac{Lcif}{2}\right) = -4,4573\ tf$

$Vi_esq_P1 := Vci\left(\frac{Lcif}{2}\right) = 2,226\ tf$

$Ni_dir_P1 := Nif(0) = -3,3973\ tf$

$Vi_dir_P1 := Vif(0) = 0,53\ tf$

$Nf_if := Nif\left(\frac{Lcif}{2}\right) = -2,3373\ tf$

$Vf_if := Vif\left(\frac{Lcif}{2}\right) = -1,166\ tf$

