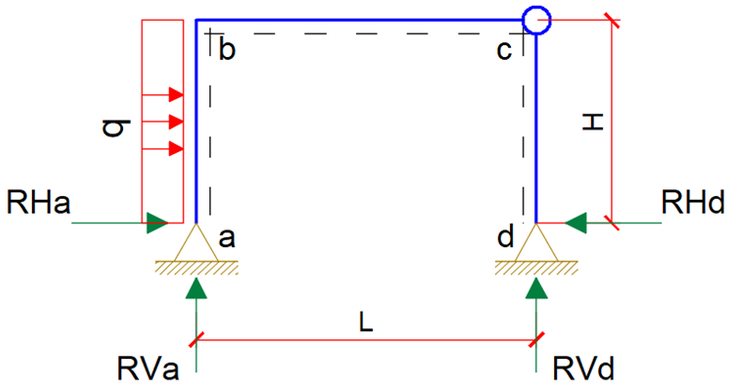
B2T4NA0608A

- Considerando somente os efeitos de momentos fletores calcular o deslocamento horizontal e a rotação do ponto "b".



$L := 6,0$ m $\quad q := 40,0$ kN/m

$H := 3,0$ m

- Todas as barras tem seção transversal retangular com dimensões:

$b := 0,15$ m base (entrante no plano do papel)

$h := 0,40$ m altura (assente ao plano do papel)

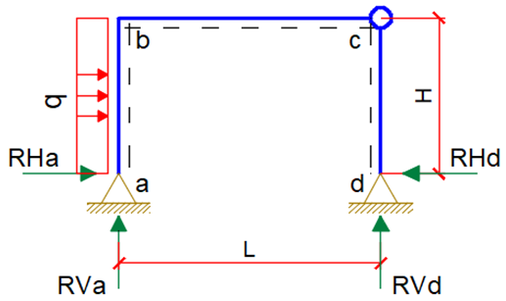
- Módulo de elasticidade e coef. de Poisson para todas as barras:

$E := 25 \cdot 10^{6}$ kN/m² $\quad \nu := 0,2$

Q01 - Qual o valor do deslocamento horizontal do ponto "b" [em "mm" e com positivo para direita] ?
Q02 - Qual o valor da rotação do ponto "b" [em "rad" e com positivo para antihorário] ?

Carregamento Real

$G := \frac{E}{2 \cdot (1+\nu)} = 1,0417 \cdot 10^{7}$ $\quad A := b \cdot h = 0,06$ $\quad I := \frac{b \cdot h^{3}}{12} = 0,0008000$ $\quad \chi := \frac{6}{5}$



Reações de Apoio:

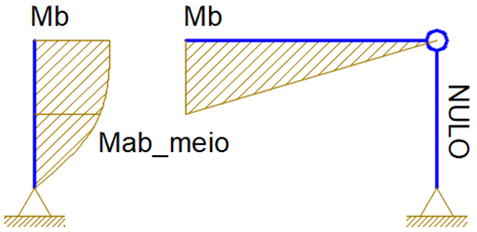
$RHd := 0$

$RHa := -q \cdot H = -120$

$RVa := \frac{1}{L} \cdot \left(\frac{q \cdot H^{2}}{2} + RHa \cdot H \right) = -30$

$RVd := -RVa = 30$

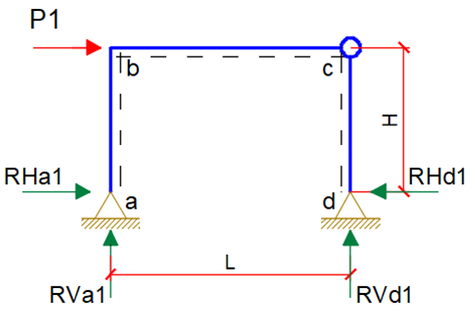
Diagrama e Momentos Fletores do Carregamento Real



$Mb := RVd \cdot L = 180$

$Mab_meio := -RHa \cdot \frac{H}{2} - \frac{q \cdot \left(\frac{H}{2}\right)^{2}}{2} = 135$

Carregamento Virtual para cálculo do deslocamento de translação horizontal em "b":

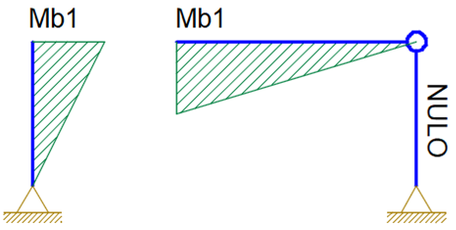


Reações de Apoio: $P1 := 1$

$RHd1 := 0$ $RHa1 := -P1$

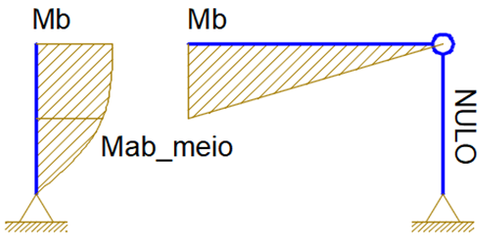
$RVa1 := \frac{1}{L} \cdot (RHa1 \cdot H) = -0,5$

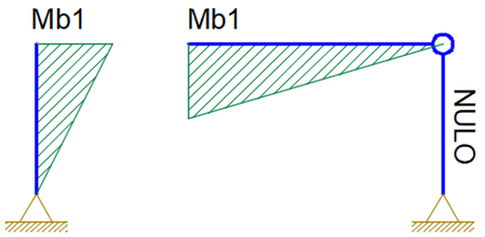
$RVd1 := -RVa1 = 0,5$



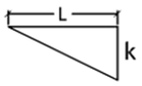
$Mb1 := RVd1 \cdot L = 3$

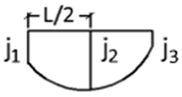
Cálculo do deslocamento horizontal no ponto "b":





Barra "ab":



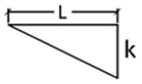


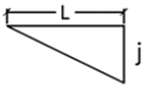
1/6 Lk(2j2+j3)

$k := Mb1 = 3$ $j3 := Mb = 180$ $j2 := Mab_meio = 135$

$mab1 := \frac{1}{6} \cdot H \cdot k \cdot (2 \cdot j2 + j3) \cdot \frac{1}{E \cdot I} = 0,03375$

Barra "bc":





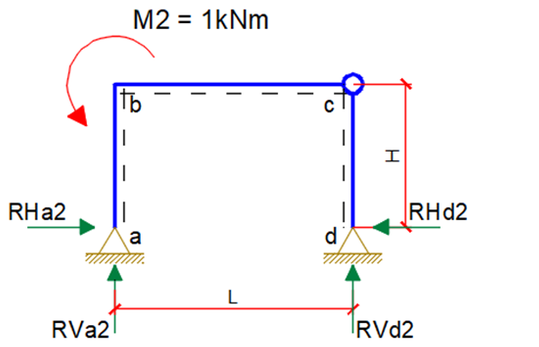
1/3 Ljk

$k := Mb1 = 3,000$ $j := Mb = 180,0$

$mbc1 := \frac{1}{3} \cdot L \cdot j \cdot k \cdot \frac{1}{E \cdot I} = 0,054$

$\delta_horiz_c := 1000 \cdot (mab1 + mbc1) = 87,75$

Carregamento Virtual para cálculo do deslocamento de rotação em "b":

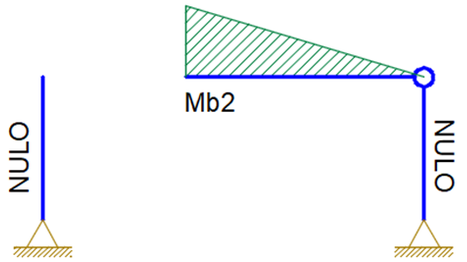


Reações de Apoio: $M2 := 1$

$RHa2 := 0$ $RHd2 := 0$

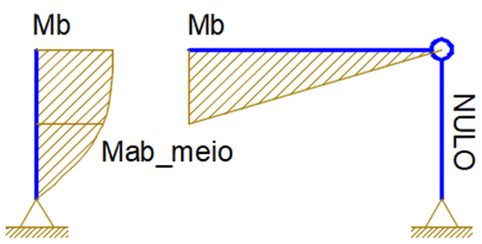
$RVa2 := \frac{1}{L} \cdot M2 = 0,1667$

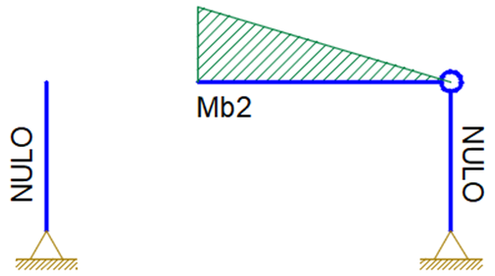
$RVd2 := -RVa2 = -0,1667$



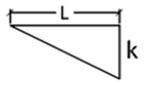
$Mb2 := RVd2 \cdot L = -1$

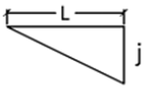
Cálulo da Rotação em "b":





Barra "bc":





1/3 Ljk

$k := Mb2 = -1,0000$ $j := Mb = 180,0000$

$mbc2 := \frac{1}{3} \cdot L \cdot j \cdot k \cdot \frac{1}{E \cdot I} = -0,018$

$\varphi_rot_c := mbc2 = -0,01800$

$Q01 := \delta_horiz_c = 87,75$

$Q02 := \varphi_rot_c = -0,018$