

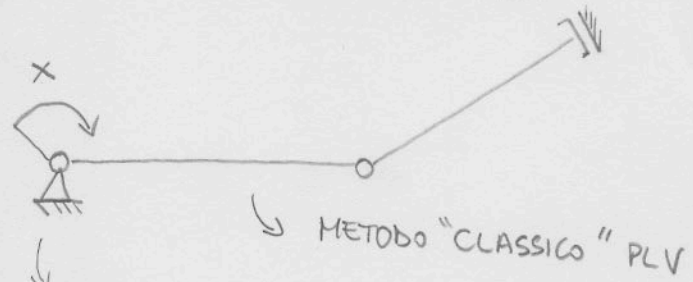
$\alpha = 34,8920^\circ$

$A = \frac{\pi \cdot 3^2}{4} = 63,6173 \text{ mm}^2 \quad \chi = \frac{10}{8}$

$J = \frac{\pi D^4}{64} = 322,0623$

$G = \frac{E}{2(1+\nu)} = 26316 \text{ MPa}$

METODO DI MÜLLER-BRESLAU: PLV SEMPLIFICATO GRAZIE AL PRINCIPIO DI SOVRAPPOSIZIONE DEGLI EFFETTI.



NODO	q DV
A	3
B	2
C	2
TOT	7

$q_{DL} = 6$

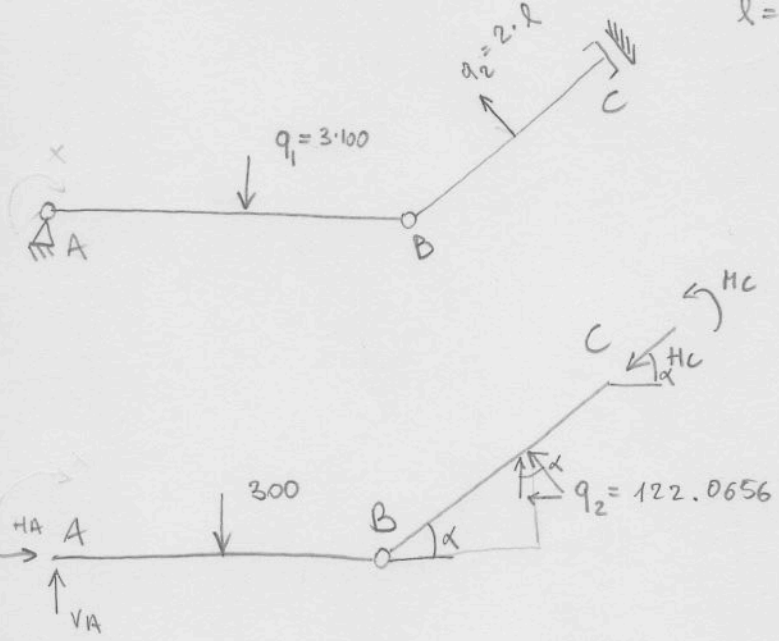
1 VOLTA IPERSTATICA

Ho rimosso un grado di vincolo

ponendo attenzione nel non rendere labile la struttura.

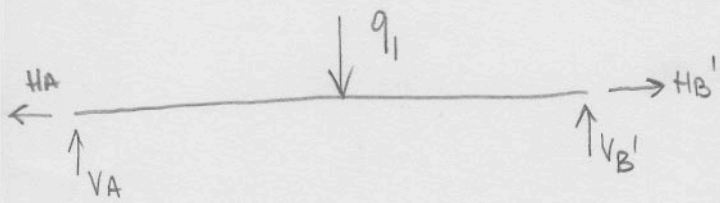
**STRUTTURA Ø** → Elimino il grado di vincolo che rende iperstatica la struttura.

$l = \sqrt{50^2 + 35^2} = 61,0328 \text{ mm}$

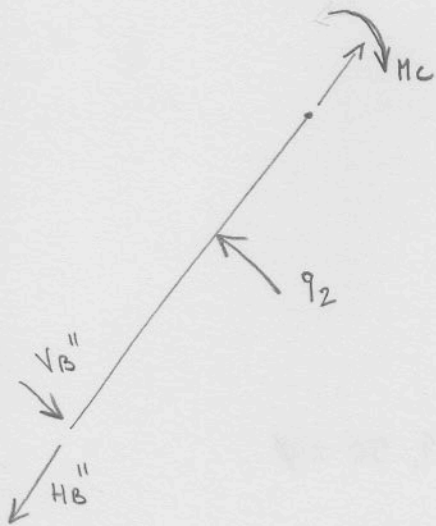


4 incognite e 3 eqs. di spawibili. Non volens oens opvu le ceniene.

TRATTO A-B



TRATTO B-C



$$\sum B) \quad q_1 \cdot 50 - V_A \cdot 100 = 0$$

$$V_A = \frac{q_1 \cdot 50}{100} = 150 \text{ N}$$

$$V_B' = q_1 - V_A = 150 \text{ N}$$

$$H_A = H_B'$$

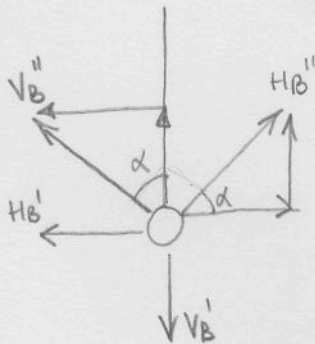
$$\sum B) \quad -H_C + q_2 \cdot \frac{l}{2} = 0$$

$$H_C = q_2 \cdot \frac{l}{2} = 3725 \text{ Nmm}$$

$$V_B'' = q_2 = 122.0656 \text{ N}$$

$$H_C = H_B'' = 87.1887 \text{ N}$$

NODO B



$$V_B'' \cdot c\alpha + H_B'' \cdot s\alpha - V_B' = 0$$

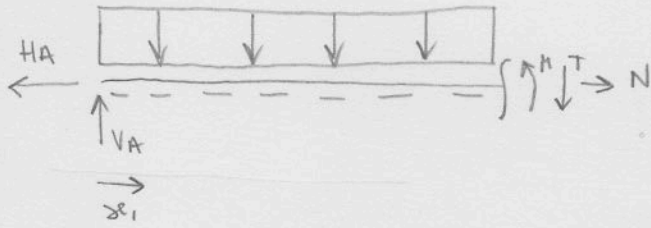
$$H_B'' = \frac{V_B' - V_B'' c\alpha}{s\alpha} = 87.1887$$

$$-H_B' - V_B'' \cdot s\alpha + H_B'' \cdot c\alpha = 0$$

$$H_B' = -V_B'' \sin(\alpha) + H_B'' \cdot c(\alpha) = 1.4286 \text{ N}$$

OK

$0 < x_1 < 100$

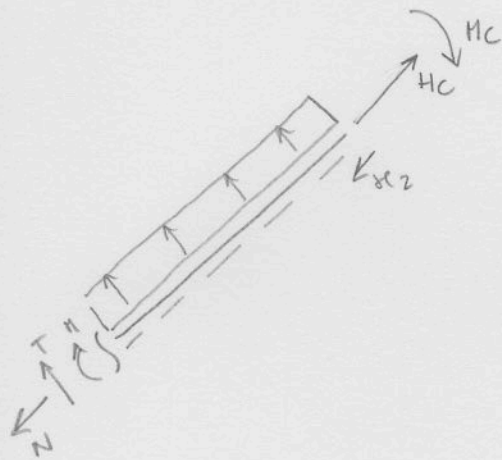


$N_{\emptyset} = H_A = 1.4286$

$T_{\emptyset} = V_A - q \cdot x_1 = V_A - 3 \cdot x_1$

$M_{\emptyset} = V_A \cdot x_1 - q \frac{x_1^2}{2}$

$0 < x_2 < l = 61.0328$

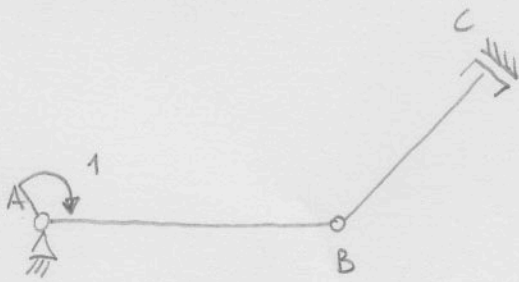


$N_{\emptyset} = H_c = 87.1837N$

$T_{\emptyset} = -q_2 \cdot x_2$

$M_{\emptyset} = -H_c + \frac{q_2 x_2^2}{2}$

STRUTTURA ① → strutture fittizie associate, solo le coppie unitarie del qdv soppresso.



TRATTO A-B



$\sum A) -1 + V_B' \cdot 100 = 0$

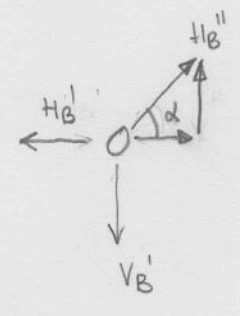
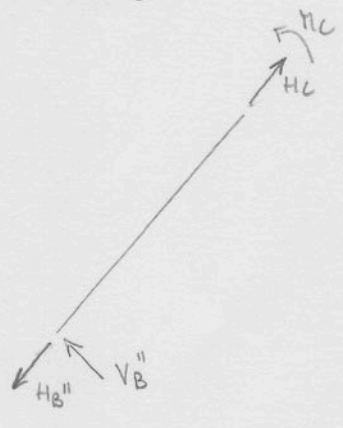
$V_B' = \frac{1}{100} = 0.01$

$V_A + V_B' = 0$

$V_A = -V_B' = -0.01 \rightarrow V_A' = 0.01$

T R A T O B - C

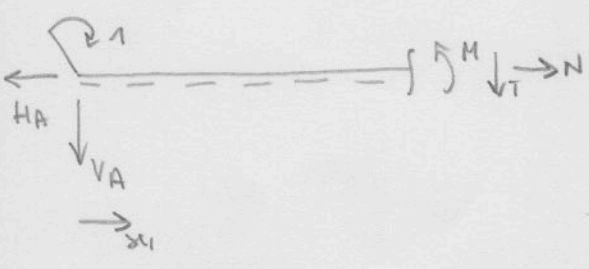
$V_B'' = \emptyset$       N O B O      B  
 $H_C = H_B'' = 0.0174 \text{ N}$   
 $H_C = \emptyset$



$H_B'' \cdot \sin \alpha - V_B' = \emptyset$        $H_B'' = \frac{V_B'}{\sin \alpha} = 0.0174 \text{ N}$

$H_B' = H_B'' \cdot \cos \alpha = 0.0143 \text{ N}$

$0 < x_1 < 100$

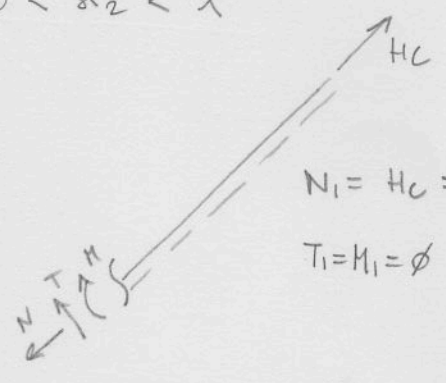


$N_1 = H_A = 0.0143 \text{ N}$

$T_1 = -V_A = -0.0100 \text{ N}$

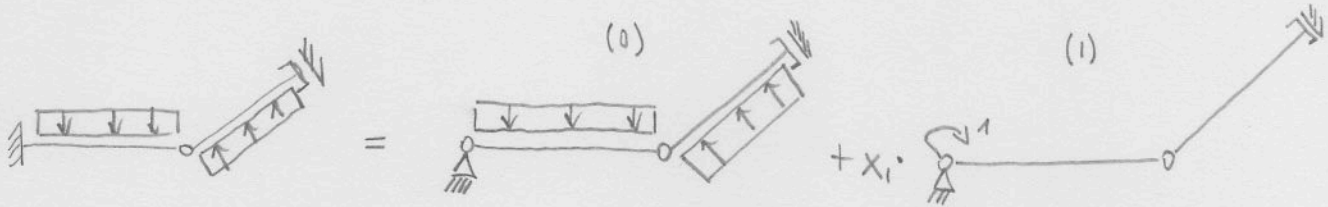
$M_1 = -V_A \cdot x_1 + 1$

$0 < x_2 < l$



$N_1 = H_C = 0.0174 \text{ N}$

$T_1 = H_1 = \emptyset$



$$N = N_0 + x_1 N_1$$

$$T = T_0 + x_1 T_1$$

$$M_c = M_0 + x_1 M_1$$

$N_0$	$N_1$
$T_0$	$T_1$
$M_0$	$M_1$

$$M_{|_{10}} = \int_x \left( \frac{N_1 N_0}{EA} + \chi \frac{T_1 T_0}{GA} + \frac{M_1 M_0}{EJ} \right) ds \quad M_{|_1} = \emptyset \rightarrow \text{non ci sono cedimenti}$$

$$M_{|_{11}} = \int_x \left( \frac{N_1 N_1}{EA} + \chi \frac{T_1 T_1}{GA} + \frac{M_1 M_1}{EJ} \right) ds$$

$$M_{|_1} = M_{|_{10}} + x M_{|_{11}} \quad x = - \frac{M_{|_{10}}}{M_{|_{11}}}$$

$$M_{|_{10}} = \int_0^{100} \frac{N_1 N_0}{EA} dx_1 + \chi \int_0^{100} \frac{T_1 T_0}{GA} dx_1 + \int_0^{100} \frac{M_1 M_0}{EJ} dx_1 + \int_0^l \frac{N_0 N_1}{EA} dx_2 =$$

$$= 4.5828e-7 + \emptyset + 0.0055 + 2.0838e-5 = 0.0056$$

$$M_{|_{11}} = \int_0^{100} \frac{N_1^2}{EA} dx_1 + \chi \int_0^{100} \frac{T_1^2}{GA} dx_1 + \int_0^{100} \frac{M_1^2}{EJ} dx_1 + \int_0^l \frac{N_1^2}{EA} dx_2 =$$

$$= 4.5828e-3 + 6.6363e-3 + 1.4786e-6 + 4.1645e-3 = 1.4340e-2$$

$$X = \frac{-\eta_{110}}{\eta_{11}} = -3725.6310 \text{ Nmm}$$

EQUAZ. AZ. INTERNE

$$0 < x < 100$$

$$N = N_0 + x N_1 = H_A + x \cdot 0.0143 = -51.7847 \text{ N}$$

$$T = T_0 + x T_1 = 187.2563 - 3x_1 \begin{cases} T(0) = 187.2563 \text{ N} \\ T = 0 \text{ m } \tilde{x}_1 = 62.4188 \text{ mm} \\ T(100) = -112.7437 \text{ N} \end{cases}$$

$$M = M_0 + x M_1 = 187.2563 x_1 - \frac{3x_1^2}{2} - 3725.6310 \begin{cases} M(0) = -3725.6310 \text{ Nmm} \\ M(\tilde{x}_1) = 2118.5233 \text{ Nmm} \\ M(100) = 0 \end{cases}$$

$$\frac{d^2(M)}{dx_1} = -3 < 0 \text{ F. CONCAVA}$$



$$0 < x_2 < l$$

$$N = N_0 + x_1 N_1 = H_C + x_1 \cdot 0.0174 = 22.2224 \text{ N}$$

$$T = T_0 + x_1 T_1 = -2x_2 \begin{cases} T(0) = 0 \\ T(l) = -122.0656 \text{ N} \end{cases}$$

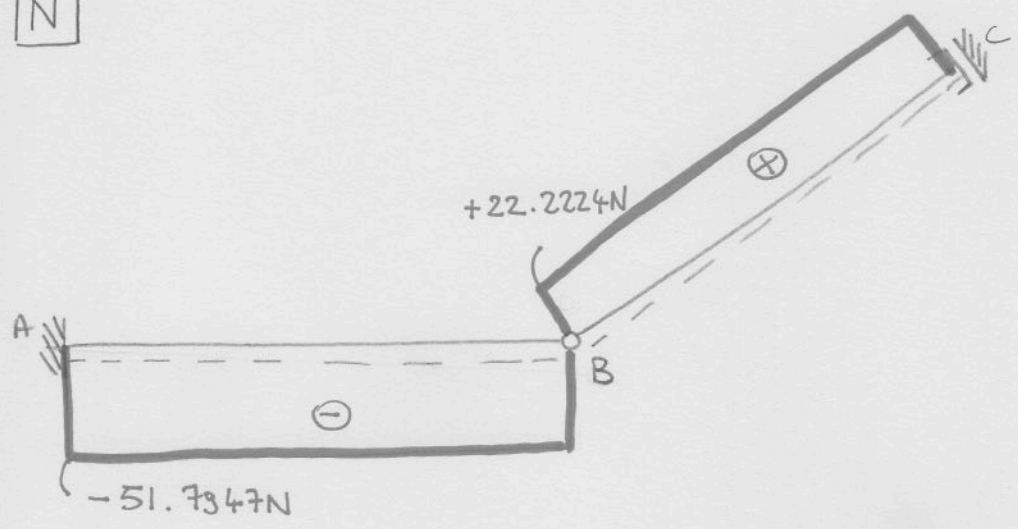
$$M = M_0 + x_1 M_1 = x_2^2 - 3725 = \begin{cases} M(0) = -3725 \\ M(l) = 0 \end{cases}$$

$$\frac{d^2 M}{dx_2} > 0 \text{ CONVESSA}$$

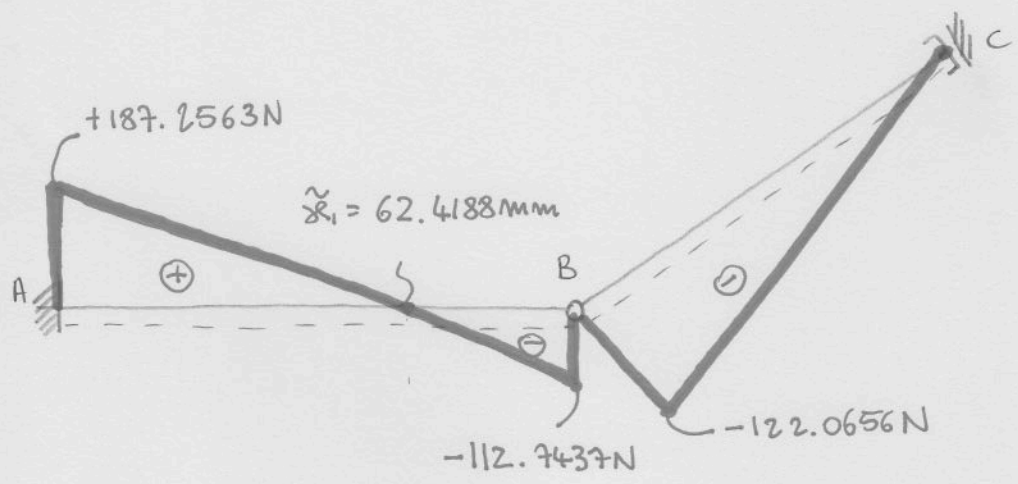


# DIAGRAMMI AZIONI INTERNE

N



T



M

