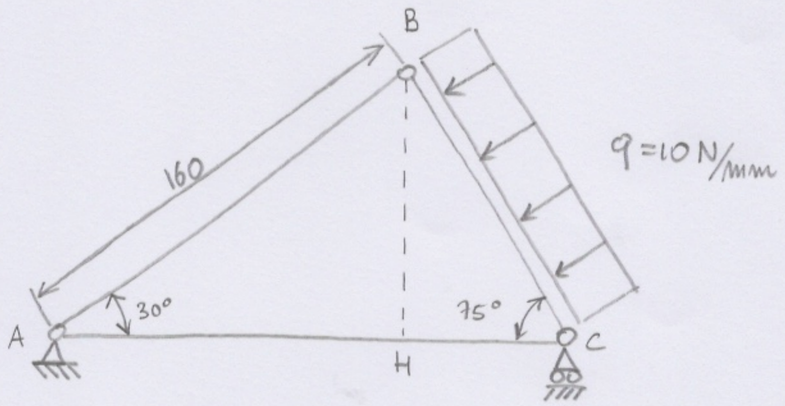
COMPITO 13/11



BILANCIO VINCOLI

NODO	GDV
A	$2 \cdot n = 4$
B	$2(n-1) = 2$
C	$2n-1 = 3$
TOT	9

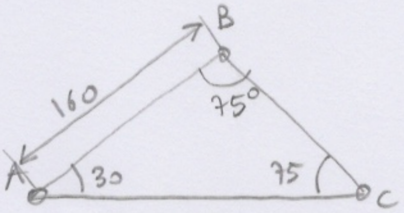
$GDL = 3 \cdot n = 9$

$GDV = GDL$
$\downarrow$
ISOSTATICA

ANALISI CINEMATICA → il triangolo ABC è un arco a 3 cerniere non allineate, di conseguenza è non labile. Inoltre è vincolato a terra in maniera non labile, quindi possiamo affermare che il sistema è NON LABILE.

CARATT. GEOMETRICHE

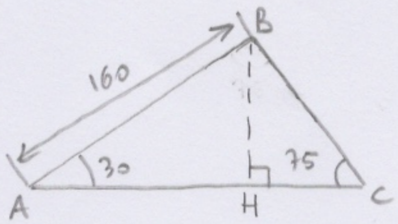
1° MODO → TEOR. DEI SENI



$$\frac{160}{\sin(75)} = \frac{L_{BC}}{\sin(30)} \Rightarrow L_{BC} = \frac{160}{\sin(75)} \cdot \sin(30) = 82.8221$$

$$\frac{L_{AC}}{\cancel{\sin(75)}} = \frac{L_{AB}}{\cancel{\sin(75)}} \Rightarrow L_{AC} = L_{AB} = 160$$

2° MODO → TRIG. ELEM.

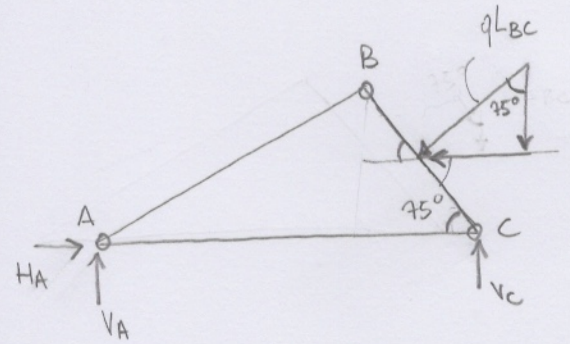


$$\overline{BH} = L_{AB} \cdot \sin(30) = 80$$

$$\overline{BC} = \frac{\overline{BH}}{\sin(75)} = 82.8221$$

$$\overline{AC} = \overline{AH} + \overline{HC} = L_{AB} \cdot \cos(30) + \overline{BC} \cdot \cos(75) = 160$$

EQUILIBRIO → REAZ. A TERRA



$\xrightarrow{+}$ $\underline{H_A} = qL_{BC} \cdot \sin(75) = \underline{800\,N}$

$\overset{+}{\uparrow}$ $V_A + V_C = qL_{BC} \cdot \cos(75)$

$A)$ $V_C \cdot L_{AC} - qL_{BC} \cdot \cos(75) \cdot \left(L_{AC} - \frac{L_{BC}}{2} \cdot \cos(75)\right) + qL_{BC} \cdot \sin(75) \cdot \frac{L_{BC}}{2} \cdot \sin(75) = \emptyset$

$$V_C = \frac{qL_{BC}C_{75}\left(L_{AC} - \frac{L_{BC}}{2}C_{75}\right) - q\frac{L_{BC}^2}{2}S_{75}^2}{L_{AC}} =$$

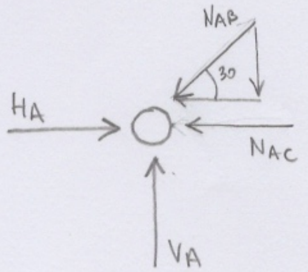
$\underline{V_C} \cong \emptyset \quad \underline{(-4.5475E{-14})\,N}$

$\underline{V_A} = \underline{qL_{BC} \cdot C_{75} = 214.3594\,N}$

Dal fatto che $V_C = \emptyset$ si evince che il risultante del carico passa per A;

APRO IN A (AC e AB SONO BIELLE SCARICHE)

NODO A



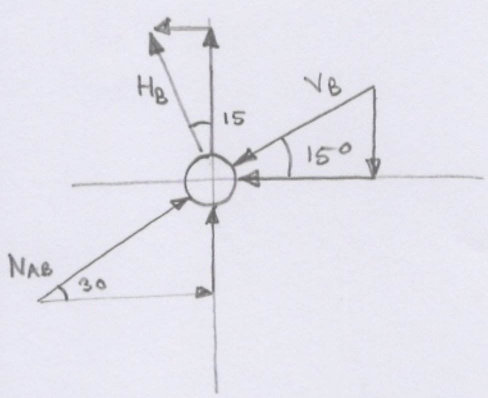
$\uparrow$ $V_A - N_{AB} \cdot S_{30} = \emptyset$

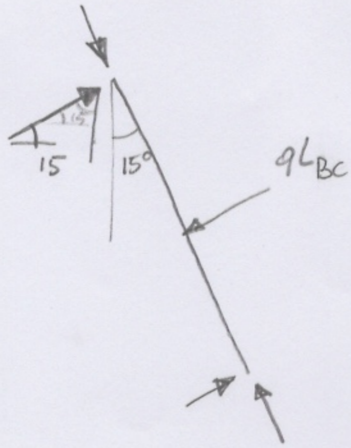
$\underline{N_{AB}} = \frac{V_A}{S_{30}} = \underline{428.7187\,N}$

$\rightarrow$ $H_A - N_{AC} - N_{AB} \cdot \cos(30) = \emptyset$

$\underline{N_{AC}} = -N_{AB} \cdot C_{30} + H_A = \underline{428.7187\,N}$

NODO B





$\uparrow^{+}$

$$N_{AB}\cdot S_{30} + H_B\cdot C_{15} - V_B\cdot S_{15} = \emptyset \longrightarrow H_B = \frac{V_B\cdot S_{15} - N_{AB}\cdot S_{30}}{C_{15}}$$

$\xrightarrow{+}$

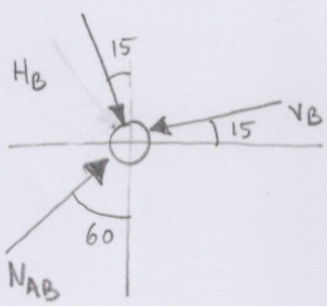
$$N_{AB}\cdot C_{30} - H_B\cdot S_{15} - V_B\cdot C_{15} = \emptyset$$

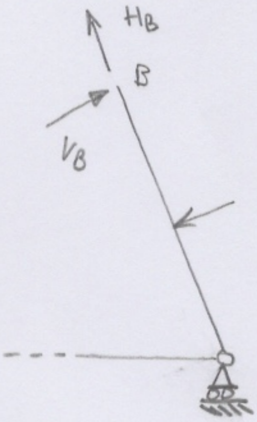
$$N_{AB}\cdot C_{30} - \frac{V_B\cdot S_{15} - N_{AB} S_{30}}{C_{15}}\cdot S_{15} - V_B\cdot C_{15} = \emptyset$$

$$N_{AB}\cdot C_{30} - V_B\cdot S_{15}\cdot \tan(15) + N_{AB}\cdot S_{30}\cdot \tan(15) - V_B\cdot C_{15} = \emptyset$$

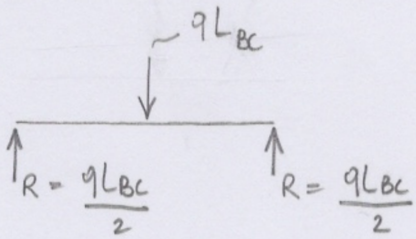
$$V_B = \frac{N_{AB}\cdot C_{30} + N_{AB}\cdot S_{30}\tan(15)}{C_{15} + S_{15}\cdot \tan(15)} = 414.1105\ N$$

$H_B = -110.3606\ N \rightarrow$ cambio segno e inverto le reazioni nel diagramma



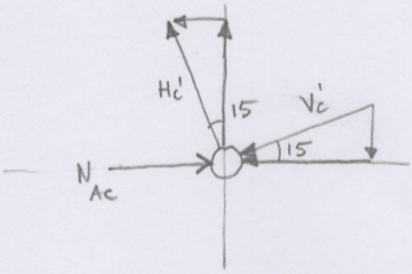


Piccola verifica



$R = V_B = 414.1105\ N$

VERIFICA SUL NODO C



$\xrightarrow{+}$

$$N_{AC} - V_C' \cdot C_{15} - H_C' \cdot S_{15} = \emptyset$$

$\overset{+}{\uparrow}$

$$H_C' \cdot C_{15} = V_C' \cdot S_{15}$$

$$H_C' = V_C' \cdot \tan(15)$$

$$N_{AC} - V_C' \cdot C_{15} - V_C' \tan(15) \cdot S_{15} = \emptyset$$

$$\underline{V_C'} = \frac{N_{AC}}{C_{15} + \tan(15) \cdot S_{15}} = \underline{414.1105\,N}$$

$$\underline{H_C'} = \underline{110.3606\,N} \qquad \underline{OK}!$$

AZIONI INTERNE

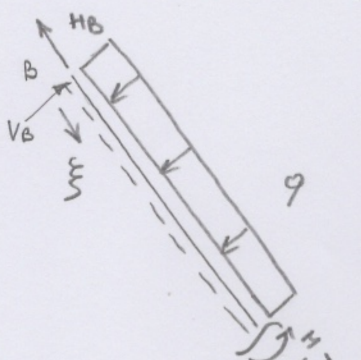
Nei tratti AB e AC abbiamo due bielle scariche, quindi l'unica azione interna è quella assiale:

AB → COMPRESSIONE $N = -428.7187\,N$

AC → COMPRESSIONE $N = -428.7187\,N$

TRATTO $\overline{BC}$

$$0 < \xi < L_{BC} = 82.8221$$



$$N = H_B = 110.3606\,N$$

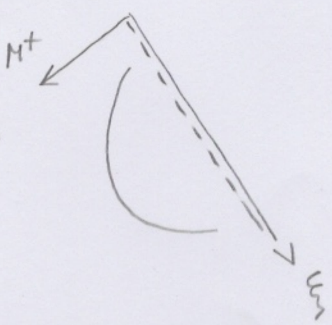
$$T = V_B - q\,\xi \quad \begin{cases} T(0) = V_B = 414.1105\,N \\ T(L_{BC}) = -414.1105\,N \end{cases}$$

$$T = \emptyset \quad \bar{\xi} = \frac{V_B}{q} = 41.4110\ mm = \left(\frac{L_{BC}}{2}\right)$$

$$M = V_B \cdot \xi - \frac{q\,\xi^2}{2} \quad \begin{cases} M(0) = \emptyset \\ M(\bar{\xi}) = 8.5744E3\ Nmm \\ M(L_{BC}) = \emptyset \quad \underbrace{(7.2760E-12)}_{ZERO} \end{cases}$$

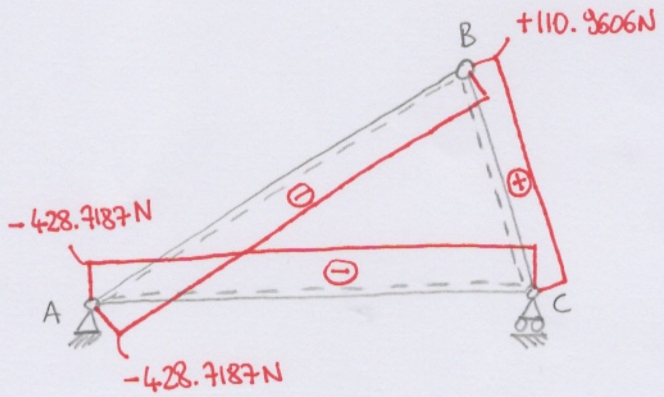
$$\frac{dM}{d\xi} = V_B - q\,\xi = T(\xi)$$

$$\frac{d^2M}{d\xi^2} = -q < \emptyset \quad f \text{ CONCAVA}$$

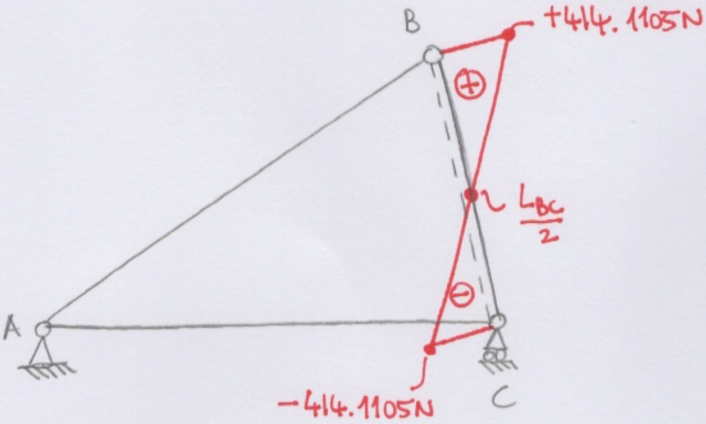


DIAGRAMMI AZIONI INTERNE

N



T



M