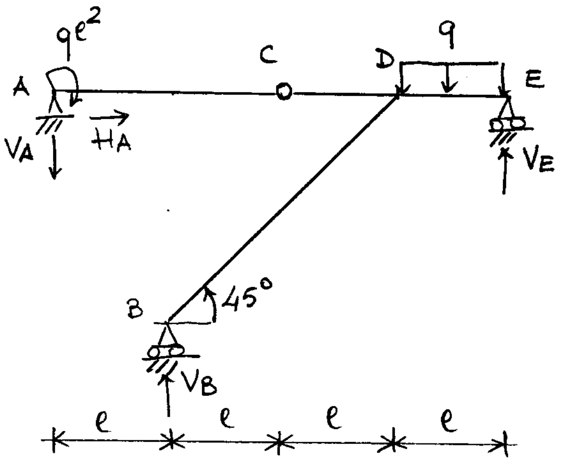
Risoluzione Es. 1

18/12/01



$H_A = 0$

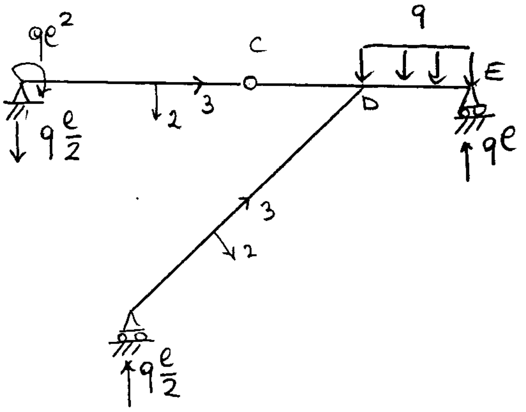
$C \circlearrowleft \quad V_A \cdot 2\ell - q\ell^2 = 0 \rightarrow \boxed{V_A = q\frac{\ell}{2}}$

$E \circlearrowleft \quad q\frac{\ell}{2}\,4\cancel{\ell} + q\frac{\ell^{\cancel{2}}}{2} - V_B \cdot 3\cancel{\ell} - q\ell^{\cancel{2}} = 0$

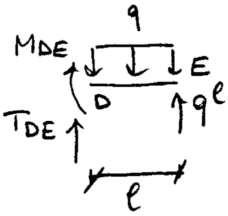
$\hookrightarrow \boxed{\cancel{3}V_B = \frac{\cancel{3}}{2}q\ell}$

$V_B + V_E = q\ell + q\frac{\ell}{2} = \frac{3}{2}q\ell$

$\hookrightarrow \boxed{V_E = q\ell}$

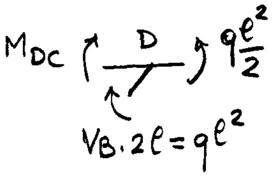


Calcoli

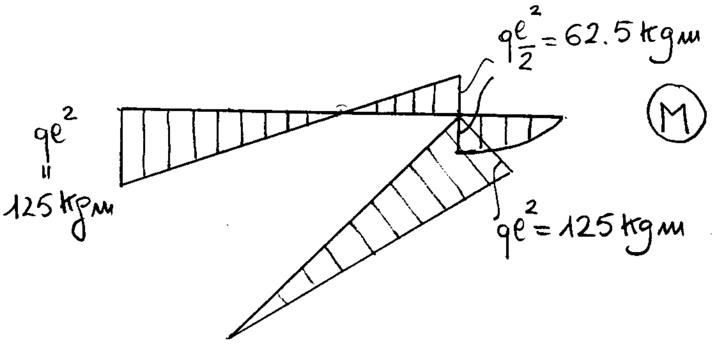


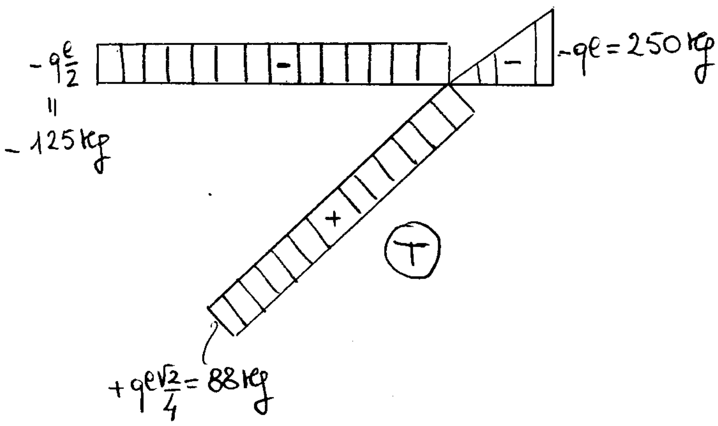
$T_{DE} = 0$

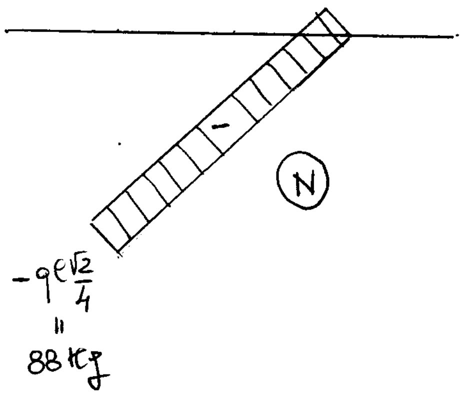
$M_{DE} = q\ell\frac{\ell}{2} = q\frac{\ell^2}{2}$



$M_{DC} = q\frac{\ell^2}{2} - q\ell^2 = -q\frac{\ell^2}{2}$

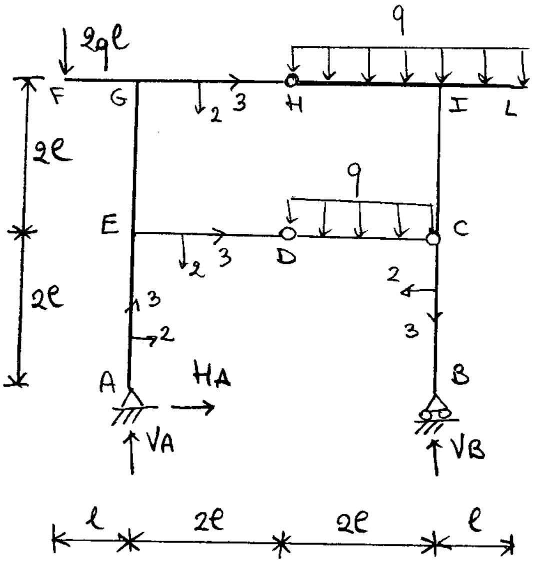






18/12/01

Risoluzione Es. 2



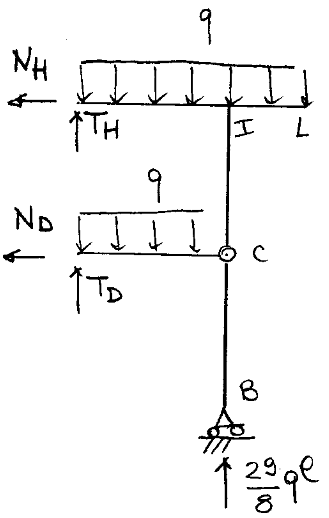
A↺ $V_B \cdot 4\cancel{\ell} - 2q\cancel{\ell}\cdot 3\ell - 3q\cancel{\ell}\,\frac{7}{2}\ell + 2q\ell^{\cancel{2}} = 0$

$\hookrightarrow 4V_B = q\ell\left(6+\frac{21}{2}-2\right)$

$= q\ell\left(4+\frac{21}{2}\right) = \frac{29}{2}q\ell$

$\hookrightarrow \boxed{V_B = \frac{29}{8}q\ell} = 3625$ kg

$\boxed{V_A} = 5q\ell + 2q\ell - \frac{29}{8}q\ell = \frac{56-29}{8}q\ell = \boxed{\frac{27}{8}q\ell} = 3375$ kg



C↺ $2q\ell^2 - 2\ell T_D = 0 \longrightarrow \boxed{T_D = q\ell} = 1000$ kg

$\boxed{T_H} = 5q\ell - \frac{29}{8}q\ell - q\ell = \frac{32-29}{8}q\ell = \boxed{\frac{3}{8}q\ell} = 375$ kg

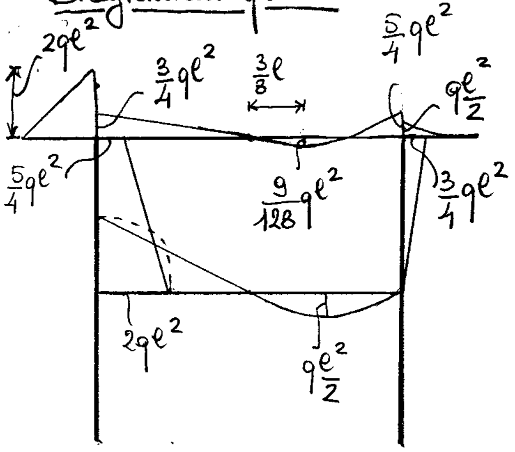
H↺ $\frac{29}{8}q\ell\cdot 2\cancel{\ell} - 3q\ell\cdot\frac{3}{2}\cancel{\ell} - 2q\ell^{\cancel{2}} - N_D\cdot 2\cancel{\ell} = 0$

$\hookrightarrow 2N_D = q\ell\left(\frac{29}{4} - \frac{9}{2} - 2\right) = q\ell\left(\frac{29-18-8}{4}\right) = \frac{3}{4}q\ell$

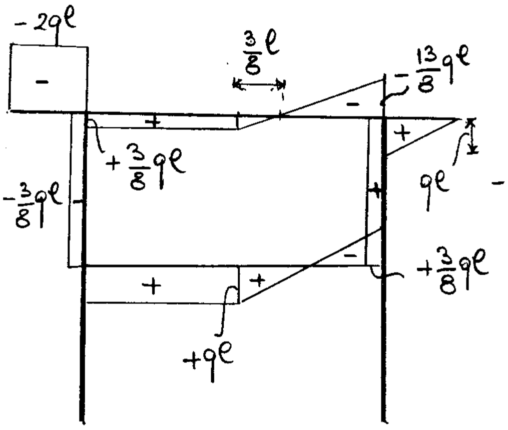
$\hookrightarrow \boxed{N_D = \frac{3}{8}q\ell} = 375$ kg

$\boxed{N_H} = -N_D = \boxed{-\frac{3}{8}q\ell} = -375$ kg

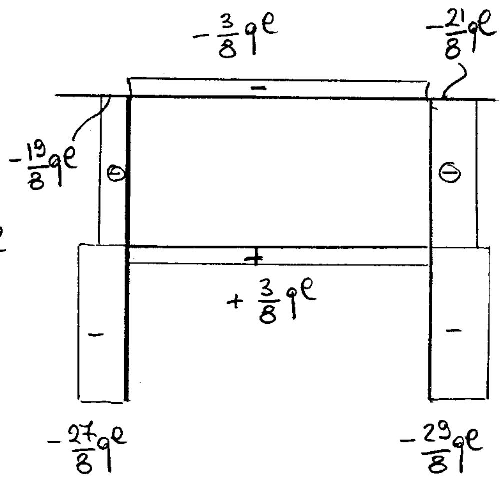
Diagrammi quotati:



(M)



(T)



(N)

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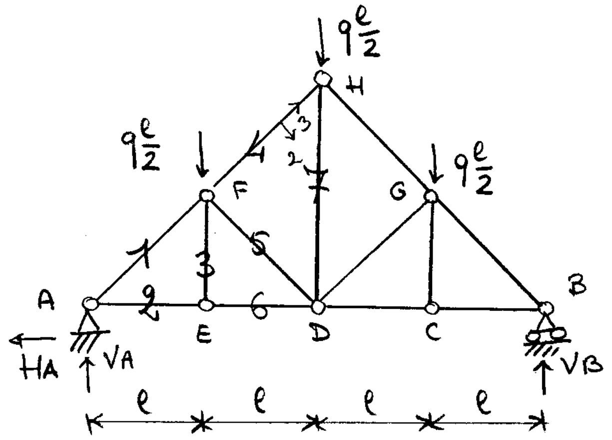
Risoluzione Es. 3



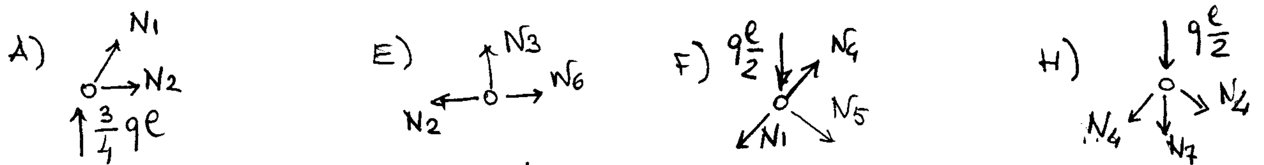
Calcolo dello stato primario di sollecitazione

Per simmetria: $V_A = V_B = \frac{1}{2}\left(\frac{3}{2}q\ell\right) = \frac{3}{4}q\ell \overset{!}{=} 1500\ \text{kg}$

		(kg)			(kg)
1	$-\frac{3\sqrt{2}}{4}q\ell$	-2121	5	$-q\ell\frac{\sqrt{2}}{4}$	-707
2	$+\frac{3}{4}q\ell$	$+1500$	6	$+\frac{3}{4}q\ell$	$+1500$
3	0	0	7	$+q\frac{\ell}{2}$	1000
4	$-\frac{\sqrt{2}}{2}q\ell$	-1414			

(Altre aste: per simmetria)

Equilibri ai nodi:



A) $\begin{cases} N_1\frac{\sqrt{2}}{2} = -\frac{3}{4}q\ell \\ N_2 = -N_1\frac{\sqrt{2}}{2} = +\frac{3}{4}q\ell \end{cases}$

E) $\begin{cases} N_6 = N_2 \\ N_3 = 0 \end{cases}$

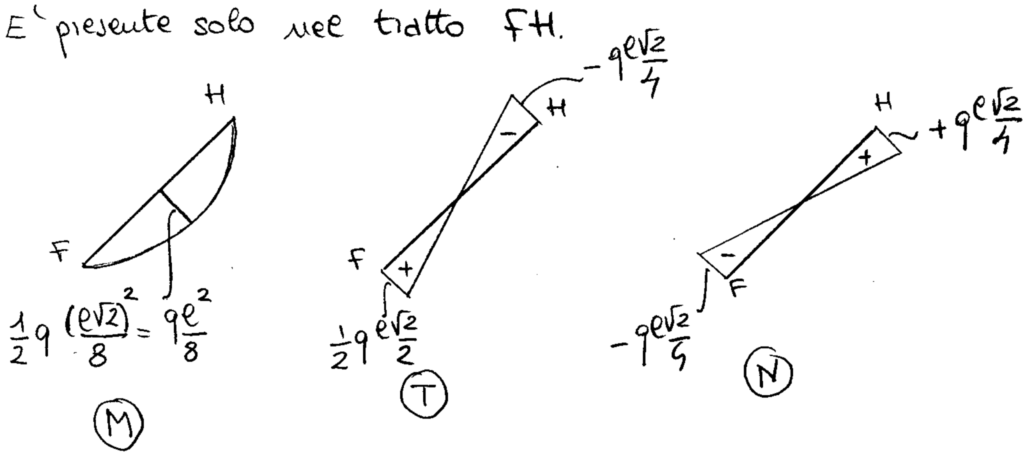
F) $\begin{cases} N_5 = -q\frac{\ell}{2}\frac{\sqrt{2}}{2} \\ N_4 = N_1 + q\ell\frac{\sqrt{2}}{4} = -\frac{\sqrt{2}}{2}q\ell \end{cases}$

H) $\begin{cases} N_4\frac{\sqrt{2}}{2} = N_4\frac{\sqrt{2}}{2} \\ N_7 = -q\frac{\ell}{2} - 2N_4\frac{\sqrt{2}}{2} \end{cases}$

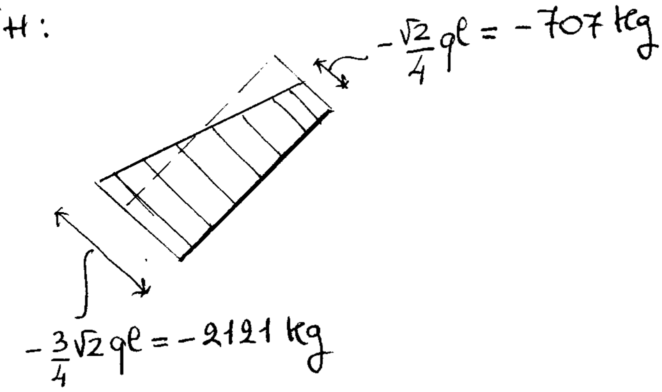
$\overset{\uparrow}{=} -q\frac{\ell}{2} + q\ell = q\frac{\ell}{2}$

Stato secondario di sollecitazione

E' presente solo nel tratto FH.

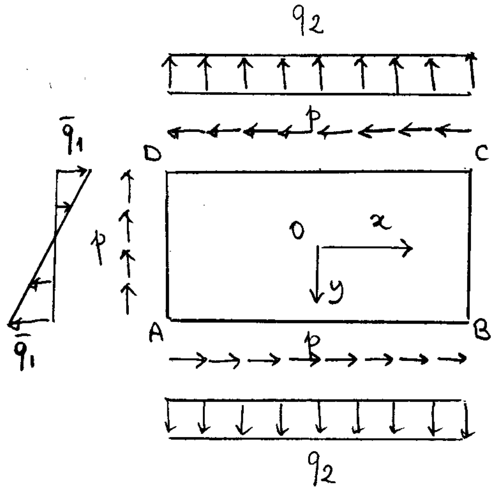


Sforzo normale complessivo in FH:



Risoluzione Es. 4

18/12/01



$p = 30$ kg/cm^2

$\bar{q}_1 = 10$ kg/cm^2

$q_2 = 20$ kg/cm^2

Tensore di Cauchy:

$$\underset{\sim}{T} = \begin{bmatrix} ay & c \\ c & b \end{bmatrix}$$

• Azioni superficiali su AB ($\underset{\sim}{n} = (0,1)$):

$$\underset{\sim}{T}\underset{\sim}{n} = \begin{bmatrix} c \\ b \end{bmatrix} \qquad \underset{\sim}{q_2} = \underset{\sim}{T}\underset{\sim}{n} \cdot \underset{\sim}{n} = b = 20 \text{ kg/cm}^2$$

$$\underset{\sim}{p} = c = 30 \text{ kg/cm}^2$$

• Azioni superficiali su BC ($\underset{\sim}{n} = (1,0)$):

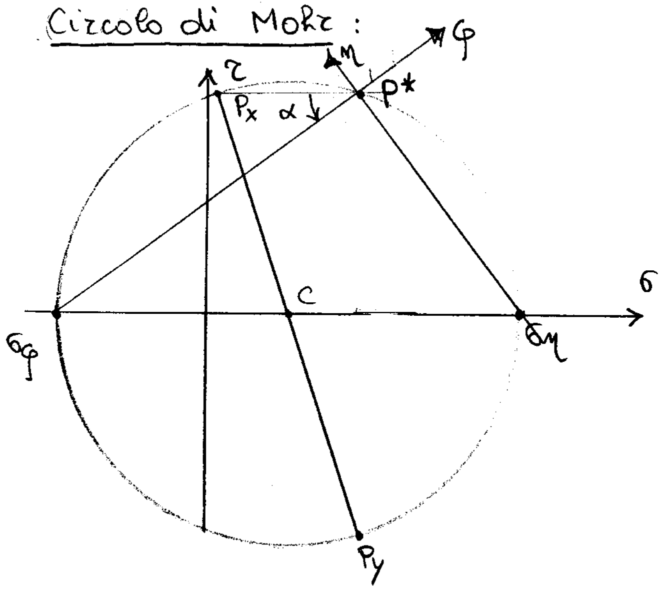
$$\underset{\sim}{T}\underset{\sim}{n} = \begin{bmatrix} ay \\ c \end{bmatrix} \qquad \underset{\sim}{q_1} = ay \qquad \underset{\sim}{p} = c$$

Altri lati (per simmetria). Le azioni superficiali sono distribuite come rappresentato in figura.

Nel punto $(d; d/4)$ con $d = 10$ cm, si ha:

$$\underset{\sim}{T} = \begin{bmatrix} \frac{5}{2} & 30 \\ 30 & 20 \end{bmatrix} \quad \left(\text{in } \frac{\text{kg}}{\text{cm}^2}\right)$$

Circolo di Mohr:



$P_x = \left(\frac{5}{2}; 30\right)$

$P_y = (20; -30)$

$$C = \left(\frac{5/2 + 20}{2}; 0\right) = (11,25; 0)$$

$$R = \sqrt{\left(\frac{2,5-20}{2}\right)^2 + 30^2} = 31,25$$

$\sigma_\varphi = 11,25 - 31,25 = -20$ kg/cm^2

$\sigma_\eta = 11,25 + 31,25 = 42,5$ kg/cm^2

$$\alpha = \frac{1}{2} \operatorname{arctg}\left(\frac{-30 \cdot 2}{2,5-20}\right) = 0,643 \simeq 37^\circ$$

Per via analitica

Eq.ne secolare: $\lambda^2 - \frac{45}{2}\lambda - 850 = 0$

Soluzioni: $\lambda_1 = -20$; $\lambda_2 = 42,5$. (tensioni principali).

Direzione principale di λ_2:

$$\begin{cases} \left(\frac{5}{2} - 42,5\right) n_1 + 30 n_2 = 0 \\ n_1^2 + n_2^2 = 1 \end{cases} \rightarrow \begin{cases} n_1 = \frac{3}{5} \\ n_2 = \frac{4}{5} \end{cases}$$

Le direzioni principali di tensione sono $\underset{\sim}{n} = \left(\frac{3}{5}; \frac{4}{5}\right)$, che corrisponde a λ_2, e la ortogonale $\underset{\sim}{v} = \left(\frac{4}{5}; -\frac{3}{5}\right)$, che corrisponde a λ_1.