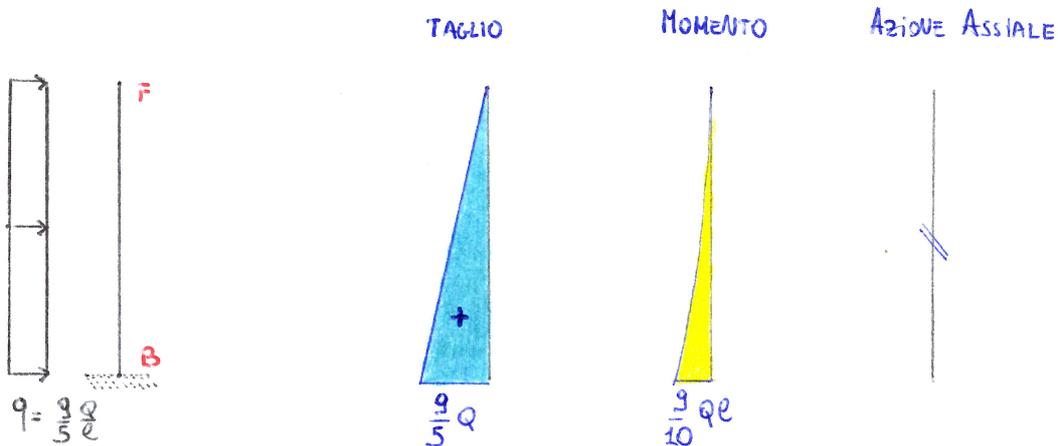


Dati:

$$q = \frac{9}{5} \frac{Q}{e}$$

$$w = 2 Q e$$

• Si osserva come l'asta BF sia un'appendice isostatica, può quindi essere risolta semplicemente con gli equilibri e quindi "staccata" dalla struttura principale:



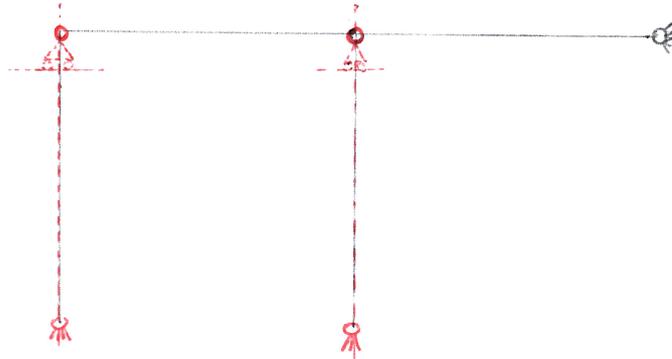
• Si valuta quindi il grado di iperstaticità della struttura:

$$G.d.V. = 3 + 3 + 2 = 8$$

$$G.d.L. = 1 \times 3 = 3$$

→ STRUTTURA 5 VOLTE IPERSTATICA

• Si valuta se il telaio sia a nodi fissi o spostabili.



→ Si osserva che non sono possibili dei cinetismi.
Il telaio è quindi a nodi fissi

• Convenzioni adottate nella risoluzione del telaio:

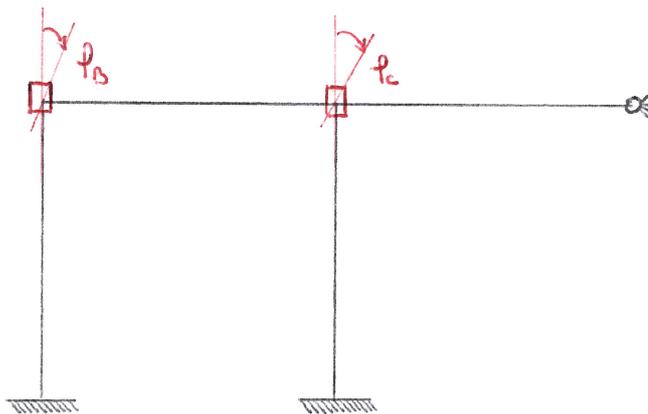


rotazioni



momenti

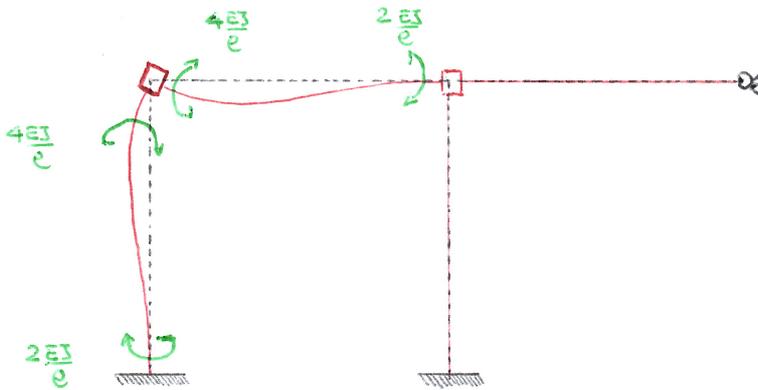
• Si decide di risolvere il telaio adottando il metodo degli spostamenti,
le cui incognite sono: p_B ; p_C



Da cui il sistema risolvente (SISTEMA DELLE EQUAZIONI DI EQUILIBRIO)

$$\begin{cases} \sum M_B = 0 \\ \sum M_C = 0 \end{cases} \begin{cases} M_{BB} P_B + M_{BC} P_C + M_{BO} = 0 \\ M_{CB} P_B + M_{CC} P_C + M_{CO} = 0 \end{cases}$$

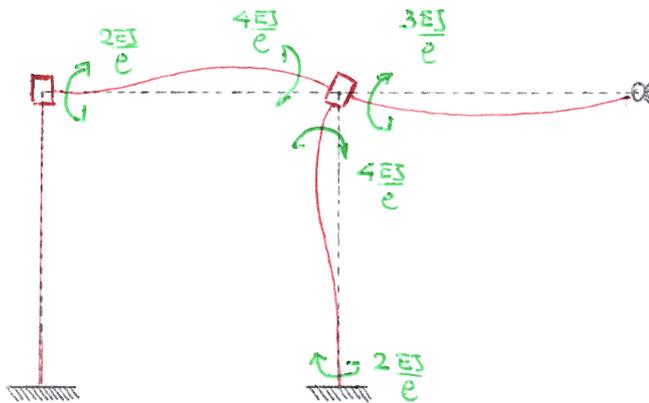
• CASO 1: $P_B = 1$



$$M_{BB} = + 8 \frac{EI}{e}$$

$$M_{CB} = + 2 \frac{EI}{e}$$

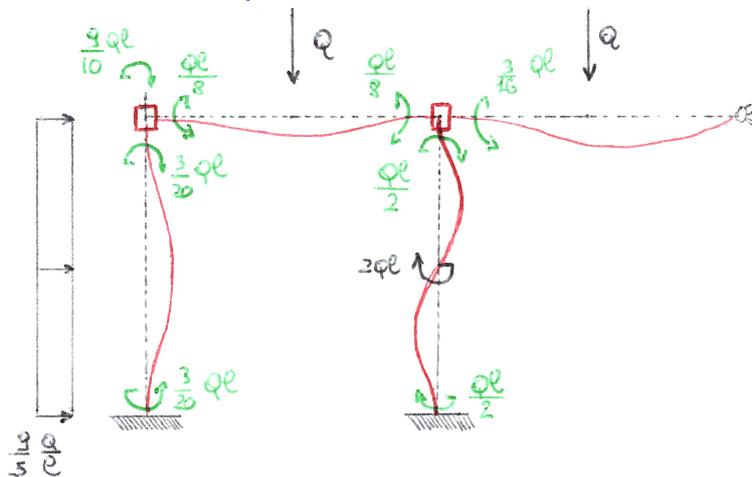
• CASO 2: $P_C = 1$



$$M_{BC} = + 2 \frac{EI}{e}$$

$$M_{CC} = + 11 \frac{EI}{e}$$

• CASO 3: $Q \neq 0; q \neq 0; w \neq 0$



$$\begin{aligned} M_{BO} &= \frac{3}{20} ql - \frac{1}{8} ql - \frac{9}{10} ql \\ &= - \frac{7}{8} ql \end{aligned}$$

$$\begin{aligned} M_{CO} &= + \frac{ql}{8} + \frac{ql}{2} - \frac{3}{16} ql \\ &= + \frac{7}{16} ql \end{aligned}$$

Sistema Risolvente

$$\begin{cases} + 8 \frac{EJ}{e} p_B + 2 \frac{EJ}{e} p_C - \frac{7}{8} ql = 0 & 1) \\ + 2 \frac{EJ}{e} p_B + 11 \frac{EJ}{e} p_C + \frac{7}{16} ql = 0 & 2) \end{cases}$$

moltiplico l'equazione 2) per 4 e la sottraggo alla 1)

$$2 \frac{EJ}{e} p_C - 44 \frac{EJ}{e} p_C - \frac{7}{8} ql - \frac{7}{4} ql = 0$$

$$- 42 \frac{EJ}{e} p_C - \frac{21}{8} ql = 0 \rightarrow p_C = - \frac{1}{16} \frac{ql^2}{EJ}$$

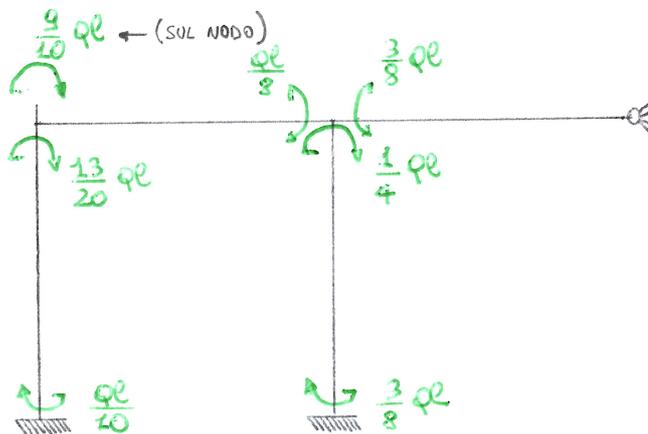
sostituendo p_C in 1) si trova:

$$p_B = + \frac{1}{8} \frac{ql^2}{EJ}$$

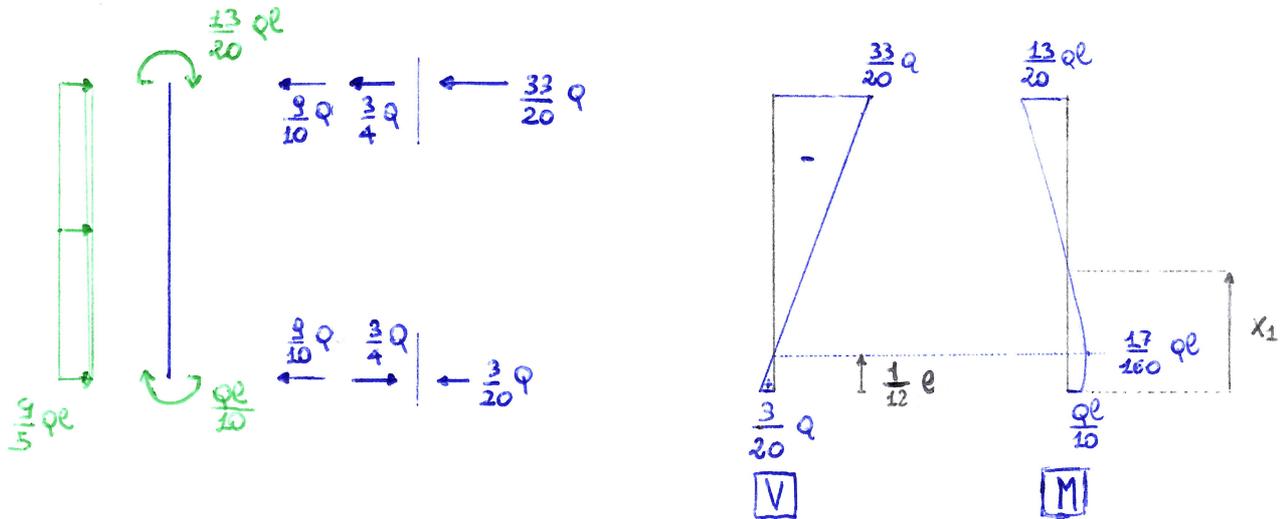
In conclusione:

$$\begin{cases} p_B = \frac{1}{8} \frac{ql^2}{EJ} \\ p_C = - \frac{1}{16} \frac{ql^2}{EJ} \end{cases}$$

• Si passa al calcolo delle azioni interne:



ASTA AB



$$M_{max} = M\left(\frac{1}{12}e\right) = \frac{3}{20}q \cdot \frac{1}{12}e + \frac{qe}{10} - \frac{q}{5} \cdot \frac{q}{e} \left(\frac{1}{12}e\right)^2 \cdot \frac{1}{2} = \frac{17}{160}qe$$

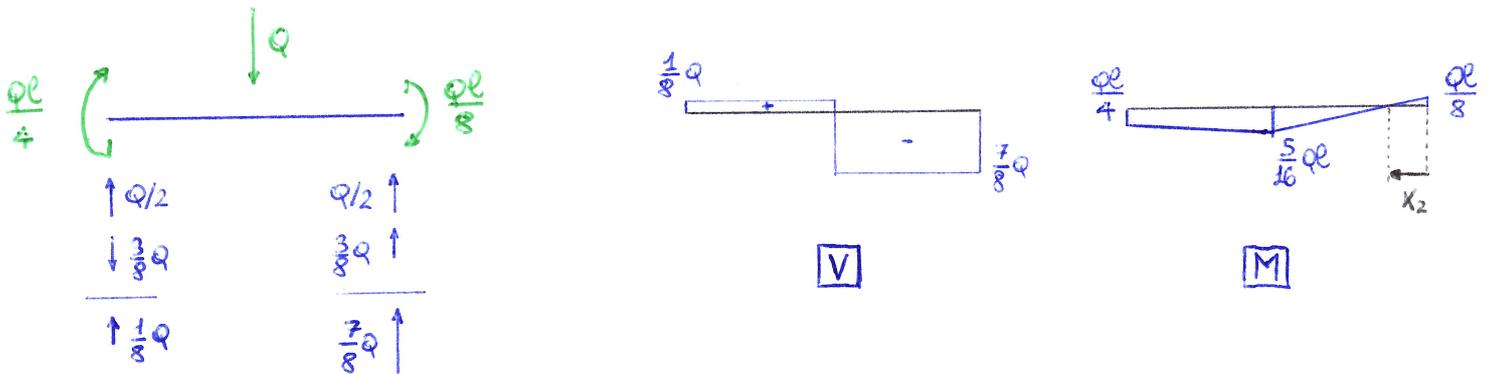
$$x_1 = ? \quad M(x) = \frac{3}{20}q \cdot x + \frac{qe}{10} - \frac{q}{5} \frac{q}{e} \frac{x^2}{2}$$

impiego $M(x) = 0$

$$0 = x^2 - \frac{1}{6}ex - \frac{1}{9}e^2 \quad \rightarrow \quad x_{1/2} = \frac{1}{2} \left[\frac{1}{6}e \pm \sqrt{\frac{1}{36}e^2 + \frac{4}{9}e^2} \right]$$

$$x_1 \approx 0,426e$$

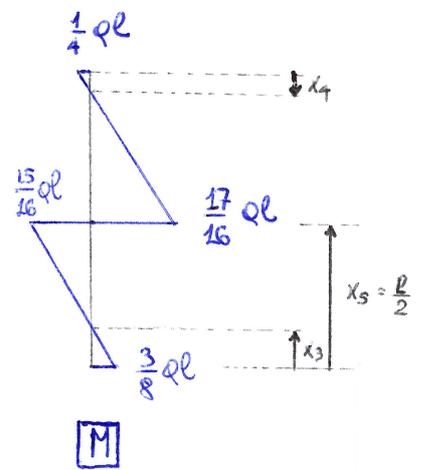
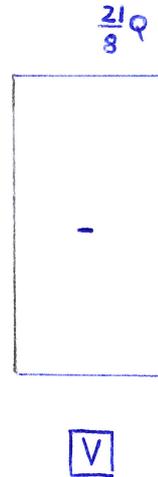
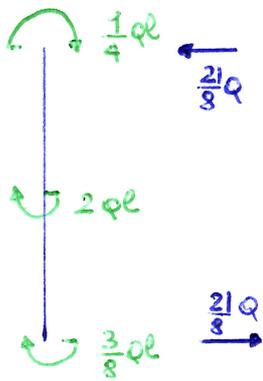
ASTA BC



$$M_{max} = M\left(\frac{e}{2}\right) = \frac{qe}{4} + \frac{1}{8}q \cdot \frac{e}{2} = \frac{5}{16}qe$$

$$x_2 = ? \quad \frac{7}{16}qe = \frac{e}{2} = \frac{1}{8}qe \cdot x_2 \quad \rightarrow \quad x_2 = \frac{1}{7}e \approx 0,14e$$

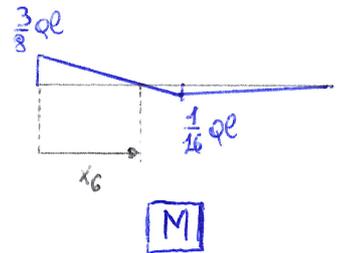
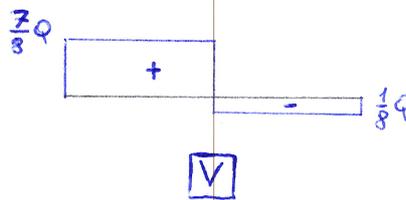
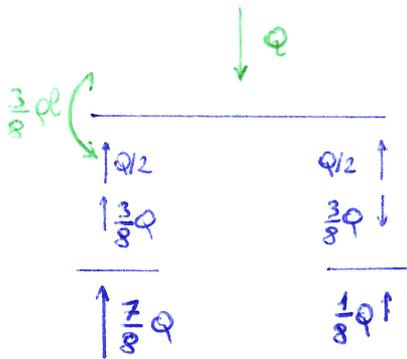
ASTA CD



$$x_3 = ? \quad \frac{21}{16} ql : \frac{l}{2} = \frac{3}{8} ql : x_3 \quad \rightarrow \quad x_3 = \frac{1}{7} l \approx 0,14 l$$

$$x_4 = ? \quad \frac{21}{16} ql : \frac{l}{2} = \frac{1}{4} ql : x_4 \quad \rightarrow \quad x_4 = \frac{2}{21} l \approx 0,095 l$$

ASTA CE

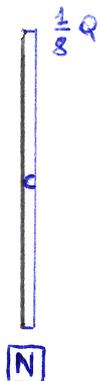


$$M_{max} = M(l/2) = -\frac{3}{8} ql + \frac{7}{8} Q \frac{l}{2} = +\frac{1}{16} ql$$

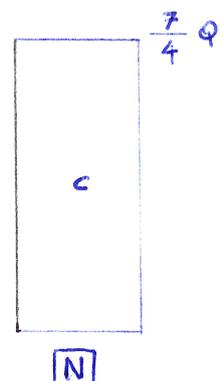
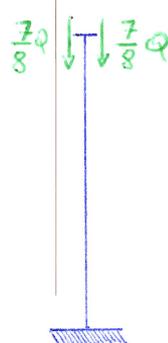
$$x_6 = ? \quad \frac{7}{16} ql : \frac{l}{2} = \frac{3}{8} ql : x_6 \quad \rightarrow \quad x_6 = \frac{3}{7} l \approx 0,428 l$$

Azioni Assiali

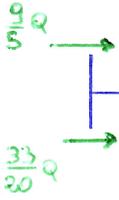
ASTA AB



ASTA CD

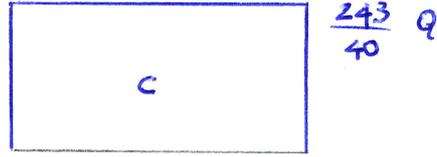
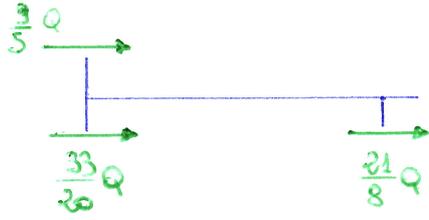


ASTA BC



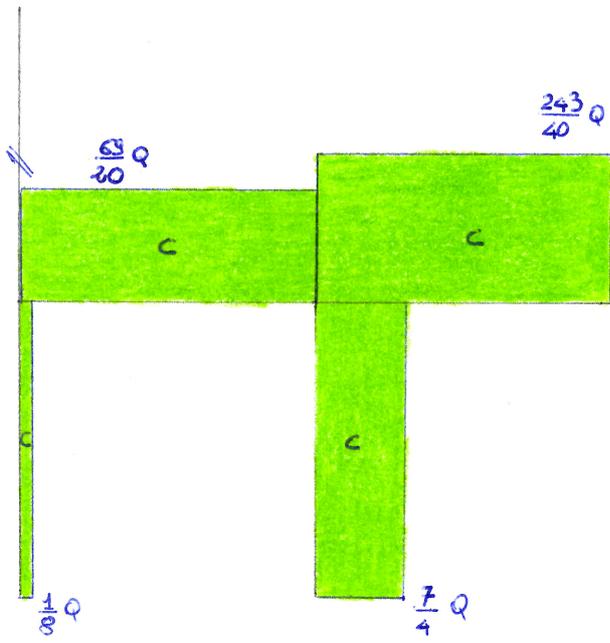
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ASTA CE

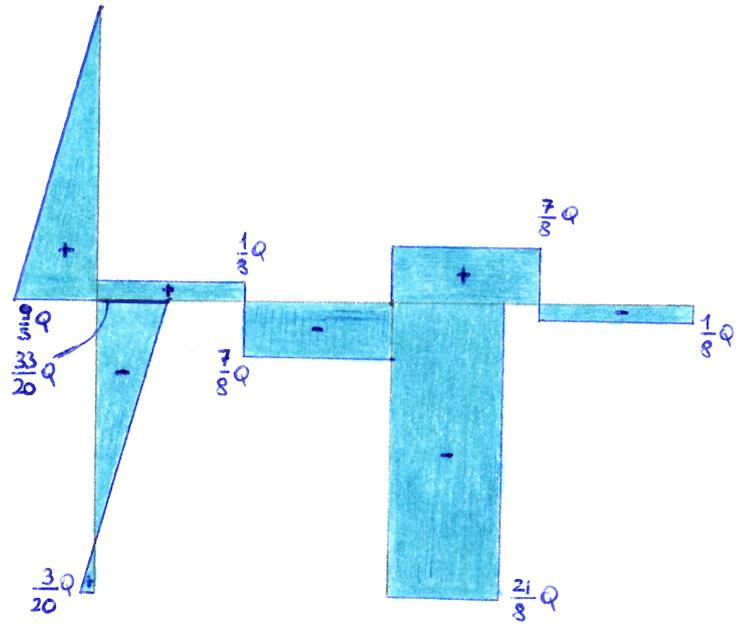


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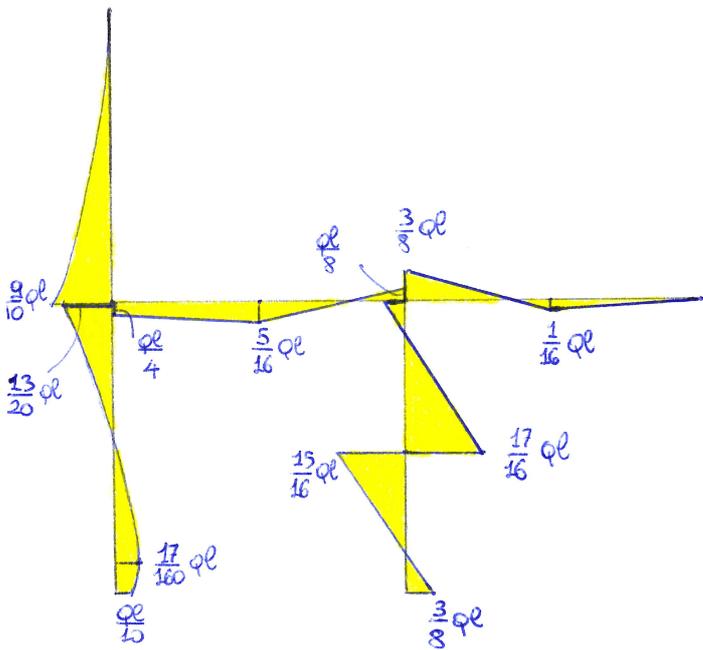
Grafiici finali:



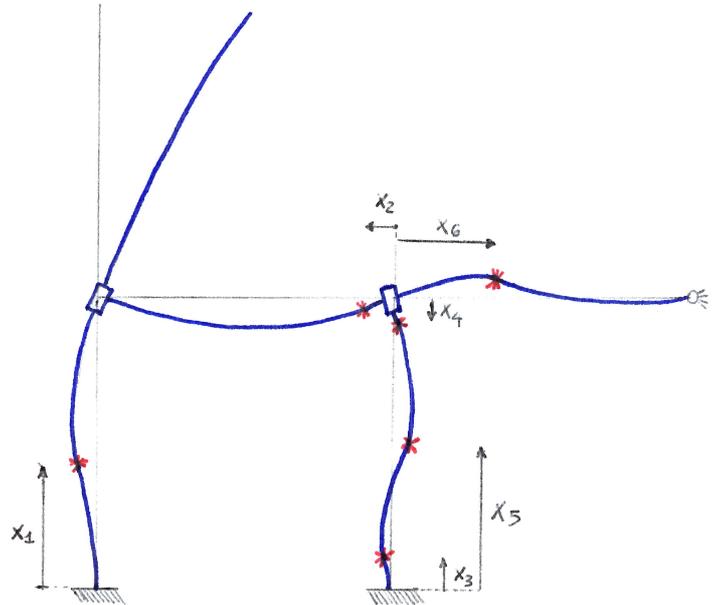
AZIONE ASSIALE



TAGLIO



MOMENTO



DEFORMATA QUALITATIVA