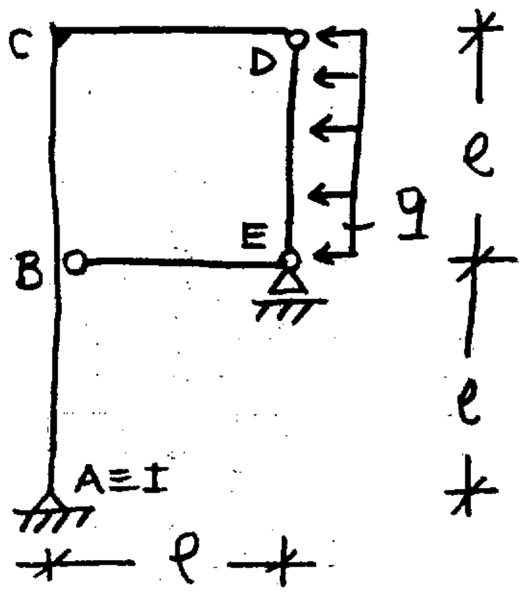
(2)



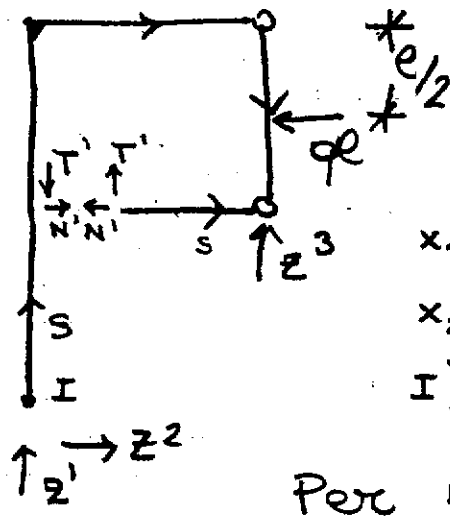
Incognite $m+\sigma=6$; Eq. $3+n_c=6$

$m=3 \quad \sigma=3 \quad n_c=\cancel{3}\ 2$

Pongo $A\equiv I$ (polo)

<u>Analisi statica</u>

Sostituisco ai vincoli le reazioni vincolari e al carico distribuito uno concentrato equivalente (<u>solo</u> per determinare le reazione vincolari).



Equazioni di equilibrio:

$$\begin{cases} x_1) & z^2-q\ell=0 \\ x_2) & z^1+z^3=0 \\ I) & z^3+q\ell\frac{3}{2}\ell=0 \end{cases} \Rightarrow \begin{cases} z^1=\frac{3}{2}q\ell \\ z^2=q\ell \\ z^3=-\frac{3}{2}q\ell \end{cases}$$

Per rendere il sistema semplicemente connesso devo rimuovere n_c-1 vincoli interni e li sostituisco con le corrispondenti sollecitazione interne (T', N') nel punto B (trave BE) in cui ho già $M'=0$. Scrivo le equazioni ausiliarie:

$$\begin{matrix} M_E=0 \\ M_D=0 \end{matrix} \begin{cases} T'\ell=0 \\ -N'\ell-q\frac{\ell^2}{2}=0 \end{cases} \Rightarrow \begin{matrix} T'=0 \\ N'=-q\ell/2 \end{matrix}$$

Caratteristiche di sollecitazione:

TRAVE <u>AB</u> $\quad N_A=-\frac{3}{2}q\ell$; $T_A=-q\ell$; $M_A=0$

N_A costante $\Rightarrow N(s)=N_A=-\frac{3}{2}q\ell$

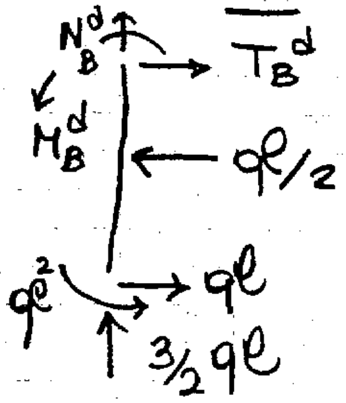
ES2.7/

T costante $\Rightarrow T(s) = T_A = -q\ell$

M lineare $\Rightarrow M(s) = M_A + T_A s = -q\ell s$

$s \in [0, \ell] \qquad M_B^s \text{ (Trave ABC)} = -q\ell^2$

TRAVE <u>BC</u> Sfrutto l'equilibrio del nodo B



$T_B^d = -q\ell/2 \qquad N_B^d = -\frac{3}{2} q\ell$

$M_B^d = -q\ell^2$

N costante $\Rightarrow N(s) = N_B^d = -\frac{3}{2} q\ell$

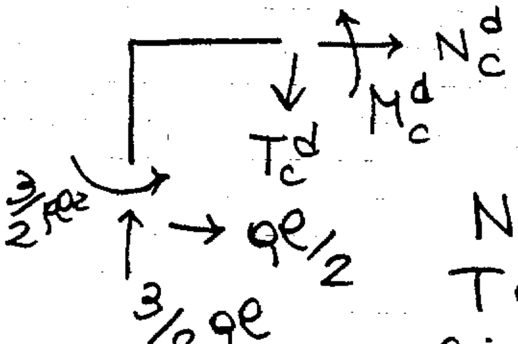
T costante $\Rightarrow T(s) = T_B^d = -q\ell/2$

M lineare $\Rightarrow M(s) = M_B^d + T_B^d s =$

$= -q\ell^2 - q\ell/2\, s$

$s \in [0, \ell] \qquad M_C^s = -3/2\, q\ell^2$

TRAVE <u>CD</u> Sfrutto l'equilibrio del nodo C



$N_C^d = -q\ell/2 \qquad T_C^d = 3/2\, q\ell$

$M_C^d = -3/2\, q\ell^2$

N costante $\Rightarrow N(s) = N_C^d = -q\ell/2$

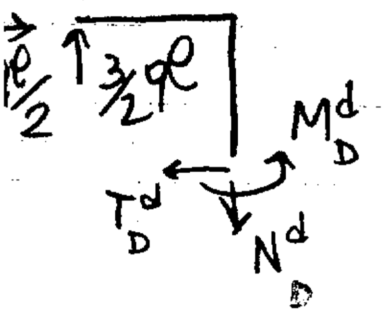
T costante $\Rightarrow T(s) = T_C^d = 3/2\, q\ell$

M lineare $\Rightarrow M(s) = M_C^d + T_C^d s =$

$s \in [0, \ell] \qquad = -3/2\, q\ell^2 + 3/2\, q\ell s \Rightarrow M_D^s = 0$

(cerniera)

TRAVE <u>DE</u> Sfrutto l'equilibrio del nodo D



$N_D^d = 3/2\, q\ell \quad T_D^d = q\ell/2 \quad M_D^d = 0$

N costante $\Rightarrow N(s) = N_D^d = \frac{3}{2} q\ell$

T lineare $\Rightarrow T(s) = T_D^d - qs =$

$= q\ell/2 - qs$

$s \in [0, \ell] \Rightarrow T_E^s = -q\ell/2$

ES2.2

M parabolico (curvatura negativa, concavo)

$\Rightarrow M(s) = M_D^d + T_D^d s - q s^2/2 =$

$= 0 + q\ell/2\, s - q s^2/2 \qquad s \in [0, \ell]$

$\Rightarrow M_E^S = 0$ (cerniera); max rel. $M_G = q\ell^2/8$

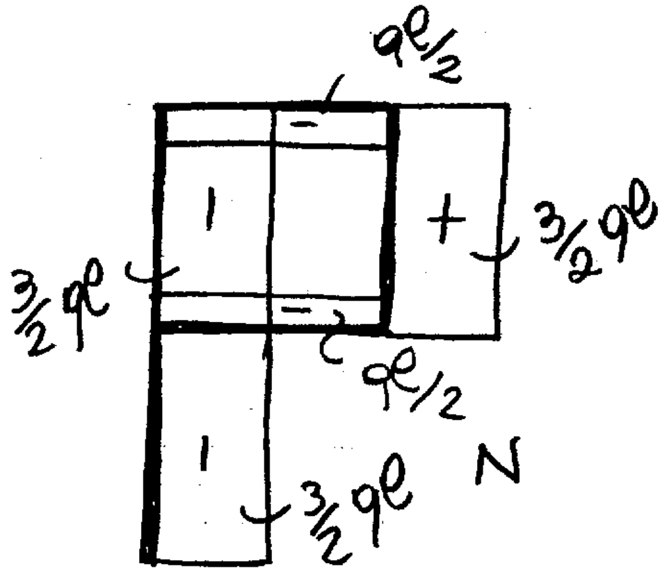
TRAVE BE Percorrendo la trave da B verso E

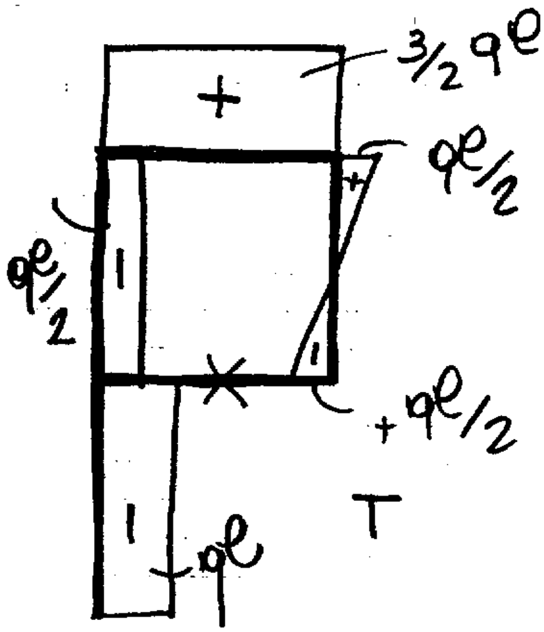
T costante $T_B^{BE} = T' = 0 \quad T(s) = T' = 0;$

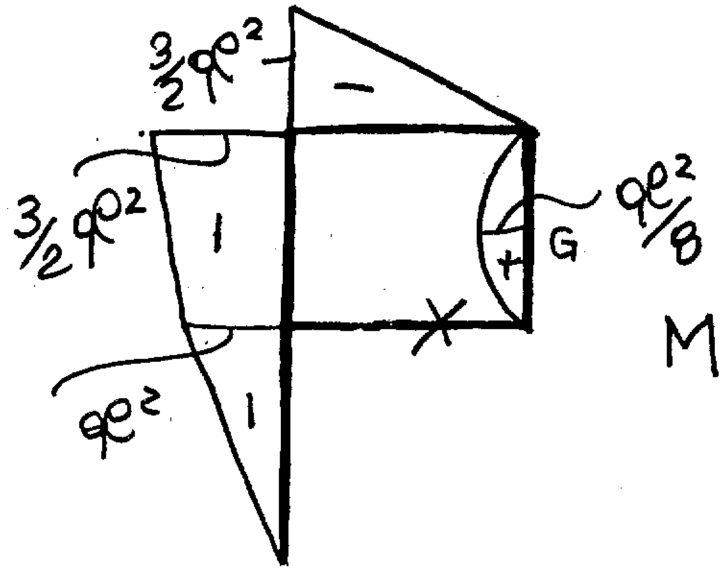
M costante $(T = 0) \Rightarrow M(s) = M_B^{BE} = 0;$

N costante $\Rightarrow N(s) = N' = -q\ell/2 -$

Diagrammi delle caratteristiche di sollecitazione:

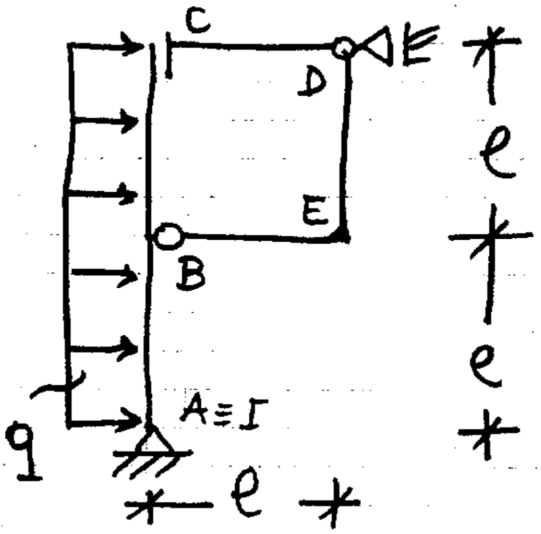






ES 2.3

(4)



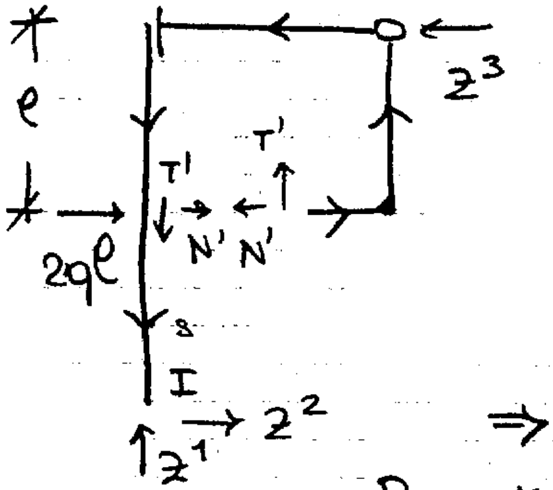
Incognite $m+\sigma=6$; Eq. $3+n_c=6$

$m=3 \quad \sigma=3 \quad n_c=3$

Pongo $A\equiv I$ (polo)

Analisi statica

Sostituisco ai vincoli le reazioni vincolari e al carico distribuito uno concentrato equivalente (solo per determinare le reazioni vincolari).



Equazioni di equilibrio:

$$\begin{array}{ll} X_1) & z^2 - z^3 + 2ql = 0 \\ X_2) & z^1 = 0 \\ I) & z^3\, 2l - 2ql^2 = 0 \end{array}$$

$$\Rightarrow \quad z^1 = 0 \quad z^2 = -ql \quad z^3 = ql$$

Per rendere il sistema semplicemente connesso devo rimuovere n_c-1 vincoli interni e li sostituisco con le corrispondenti sollecitazioni interne (T', N'), nel punto B (trave BE) in cui ho già $M'=0$. Scrivo le equazioni ausiliarie:

$$\begin{array}{l} M_D = 0 \\ T_C = 0 \end{array} \left\{ \begin{array}{l} -N'l - T'l = 0 \\ T' = 0 \end{array} \right. \Rightarrow \left\{ \begin{array}{l} N' = 0 \\ T' = 0 \end{array} \right.$$

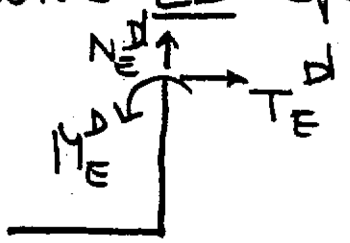
Caratteristiche di sollecitazione:

TRAVE BE   N costante $N(s) = N' = 0$

T costante $T(s) = T' = 0$

M costante $M(s) = M' = 0$ ES4.1

TRAVE ED Sfrutto l'equilibrio del nodo E



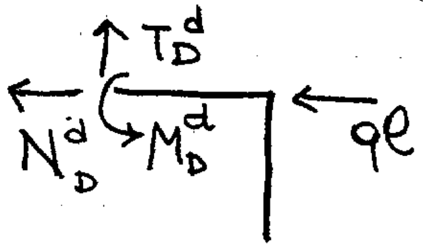
$M_E^d = T_E^d = M_E^d = 0$

N costante $\Rightarrow N(s) = N_E^d = 0$

T costante $\Rightarrow T(s) = T_E^d = 0$

M costante $\Rightarrow M(s) = M_E^d = 0$

TRAVE DC Sfrutto l'equilibrio del nodo D



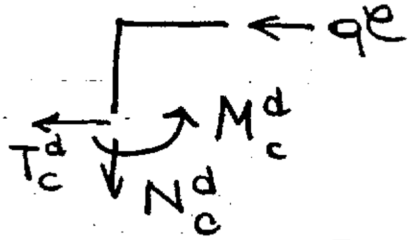
$N_D^d = -q\ell \quad T_D^d = 0 \quad M_D^d = 0$

N costante $\Rightarrow N(s) = N_D^d = -q\ell$

T costante $\Rightarrow T(s) = T_D^d = 0$

M costante $\Rightarrow M(s) = M_D^d = 0$

TRAVE CA (nel nodo B, dalla trave BE ho $N' = T' = M' = 0$ $\Rightarrow$ posso considerare l'intera trave CA). Sfrutto l'equilibrio del nodo C.



$N_C^d = 0 \quad T_C^d = -q\ell \quad M_C^d = 0$

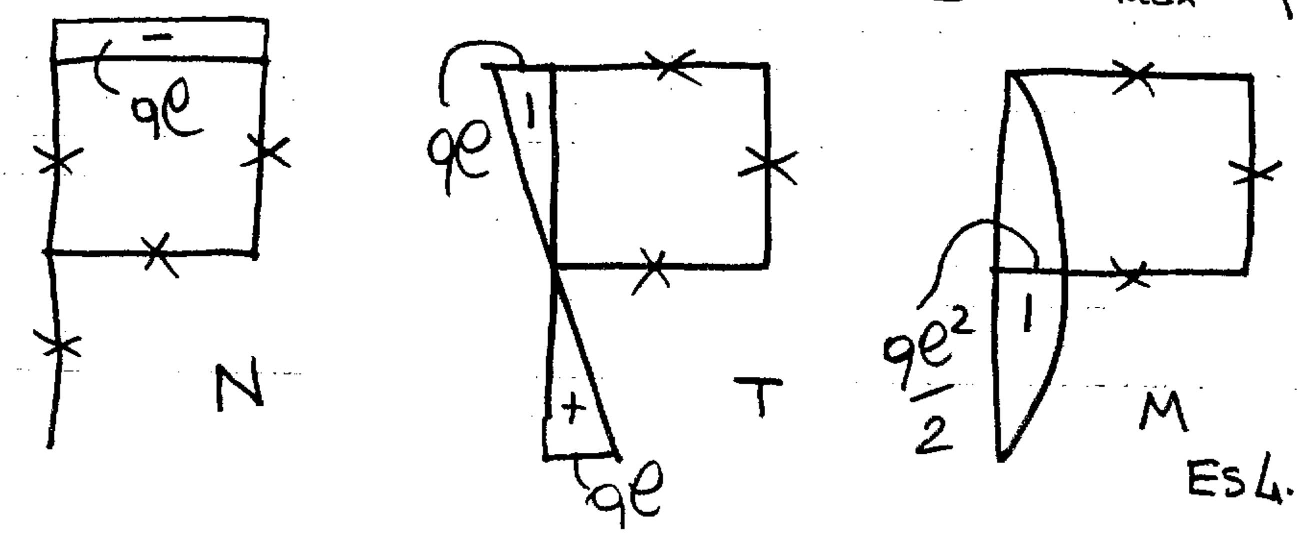
N costante $\Rightarrow N(s) = N_C^d = 0$

T lineare $\Rightarrow T(s) = T_C^d + qs = -q\ell + qs$; $s \in [0, 2\ell]$ $\quad T_A = +q\ell$

M parabolico (curvatura positiva, convesso)

$M(s) = M_C^d + T_C^d s + qs^2/2 = -q\ell s + qs^2/2 \quad M_A = 0$

M(s) massimo relativo in B $\quad M_{max} = q\ell^2/2$



Es4.2