Equazione della trave tesa $(EAw')' + p = 0$

E modulo di Young

A area della sezione

Equazione della linea elastica $(EIv'')'' = q$

I mom. d'in. sezione

EA rigidezza assiale $N = EA\varepsilon$

$[I] = L^4$

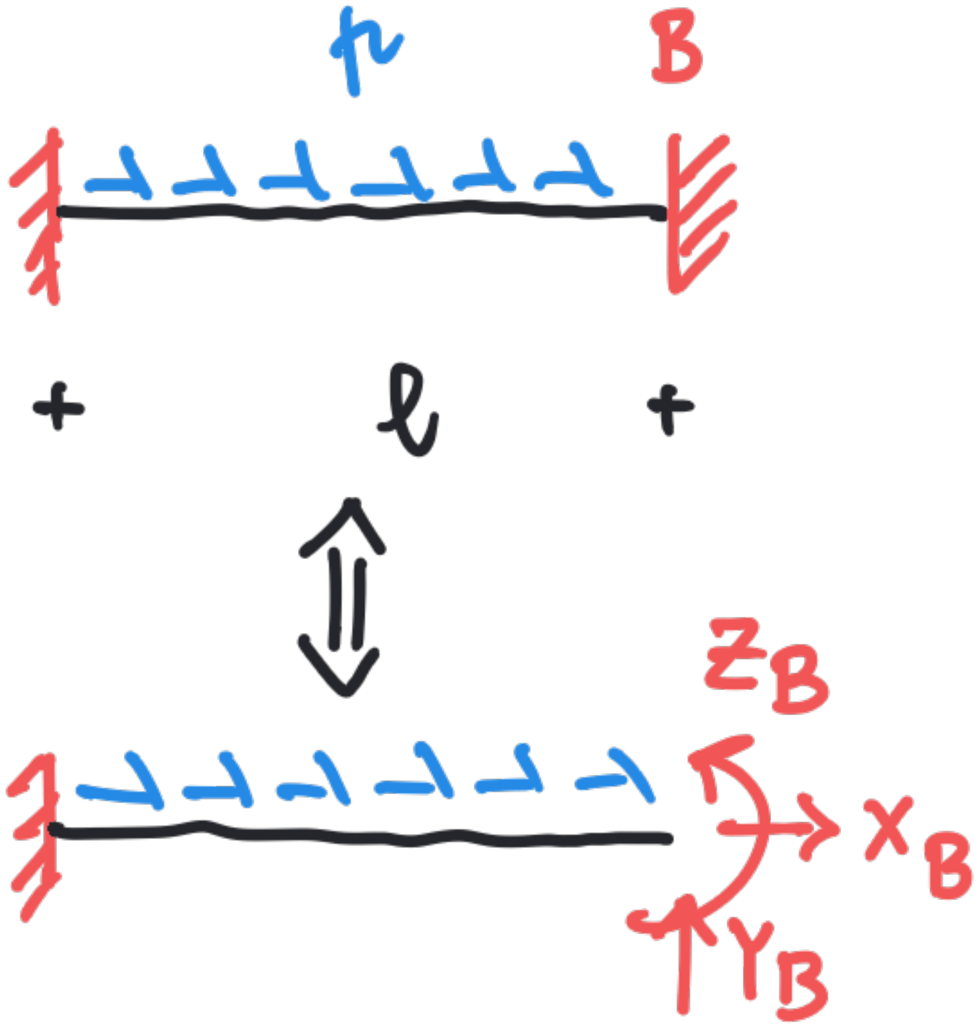
EI rigidezza flessionale $M = EI\chi$

$\varepsilon = w'$ dilatazione

$\chi = -v''$ curvatura.

$$\Delta T_m = \frac{1}{2}(T^+ + T^-)$$

ESEMPIO



? forza normale

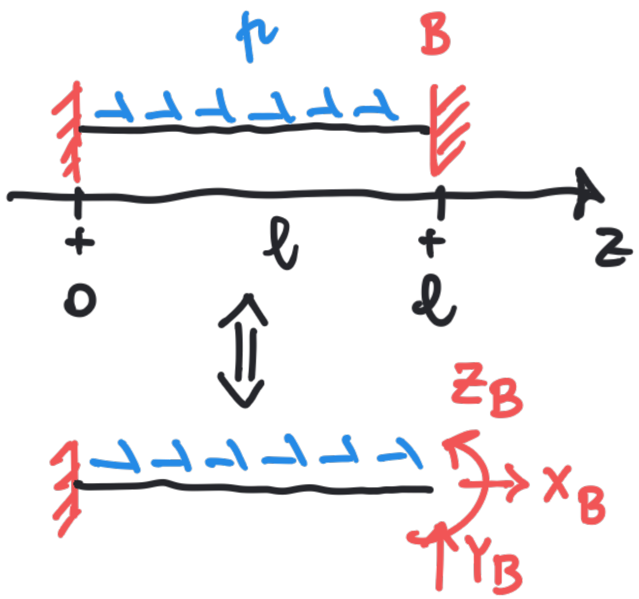
Statica $l = 0$

$$n - m = l - i$$

$$3 - 6 = -i \Rightarrow i = 3$$

$i = 3$ $l = 0$ (stat. det)

ESEMPIO



? forza normale

Statica $\quad l = 0$

$n - m = l - i$

$3 - 6 = -i \quad \Rightarrow \quad i = 3$

$$\begin{cases} (EA\,w')' + p = 0 \\ w(0) = 0 \\ w(l) = 0 \end{cases}$$

2° ordine (2 c.c.)

EA = cost.

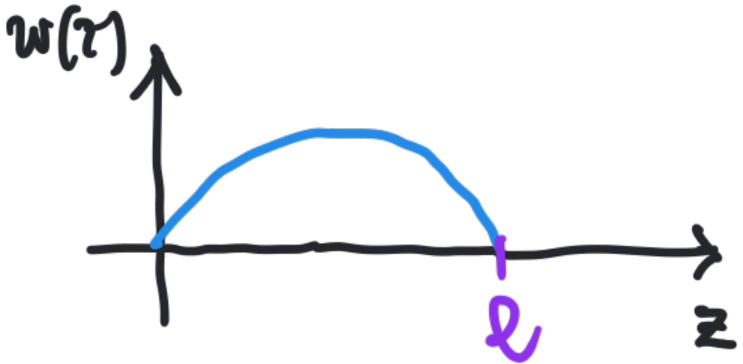
Ben posto

∃! soluz.

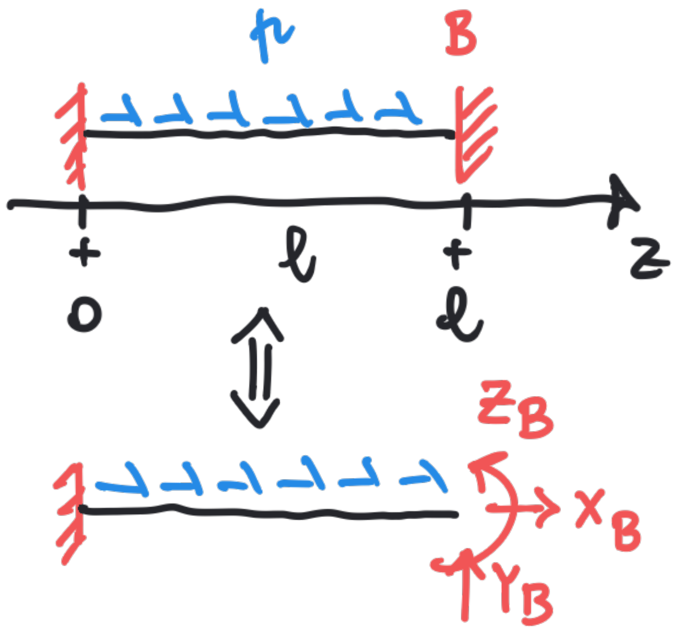
Soluz: $w(z) = \dfrac{pl^2}{2EA} \, \dfrac{z}{l} \left(1 - \dfrac{z}{l}\right)$

$$\left[\frac{pl^2}{EA}\right] = \cancel{F}\,\cancel{L^{-1}}\,\cancel{L^2}\,(\cancel{F}\,L^{-2})^{-1}\,\cancel{L^{-2}} = L \quad !$$

L^2



ESEMPIO



? forza normale

$$N = EA\varepsilon = EA w'$$

$$= \frac{p\ell}{2}\left(1 - 2\frac{z}{\ell}\right)$$

$$w'(z) = \frac{p\ell^2}{2EA}\left(\frac{1}{\ell} - 2\frac{z}{\ell^2}\right)$$

$$= \frac{p\ell}{2EA}\left(1 - 2\frac{z}{\ell}\right)$$

$$\begin{cases} (EA\, w')' + p = 0 \\ w(0) = 0 \\ w(\ell) = 0 \end{cases}$$

2° ordine (2 c.c.)

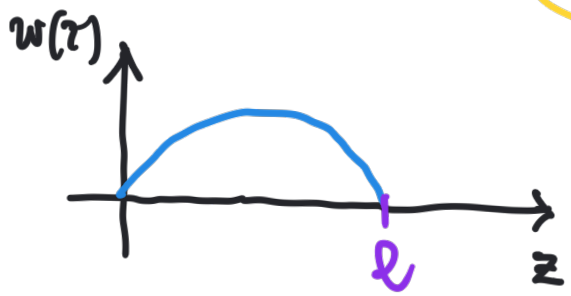
EA = cost.

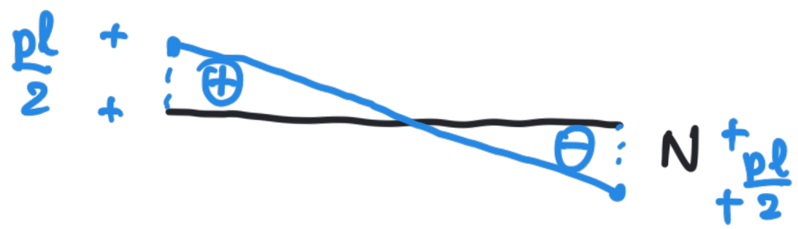
Ben posto

∃! soluz.

Soluz: $w(z) = \frac{p\ell^2}{2EA}\, \frac{z}{\ell}\left(1 - \frac{z}{\ell}\right)$

$$\left[\frac{p\ell^2}{EA}\right] = \cancel{F}\, \cancel{L^{-1}}\, \cancel{L^2}\, (\cancel{F}\, L^{-2})^{-1}\, \cancel{L^{-2}} = L \qquad L^{2}$$

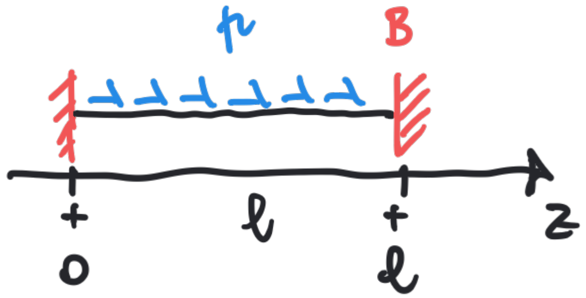




$$N(0) = \frac{p\ell}{2}$$

$$N(\ell) = -\frac{p\ell}{2}$$

ESEMPIO



? forza normale

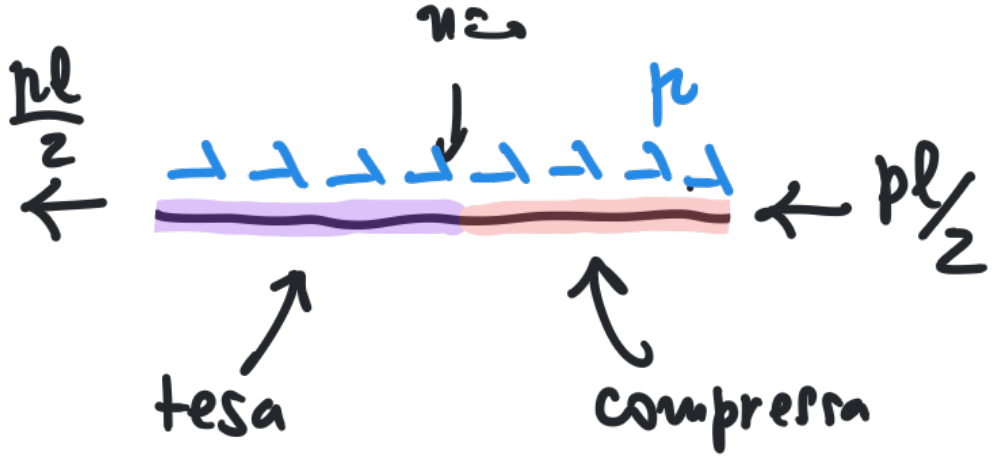
$$N = EA\varepsilon = EA\,w'$$

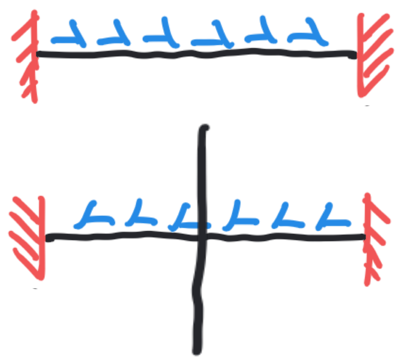
$$= \frac{pl}{2}\left(1 - 2\frac{z}{l}\right)$$

$$w'(z) = \frac{pl^2}{2EA}\left(\frac{1}{l} - 2\frac{z}{l^2}\right)$$

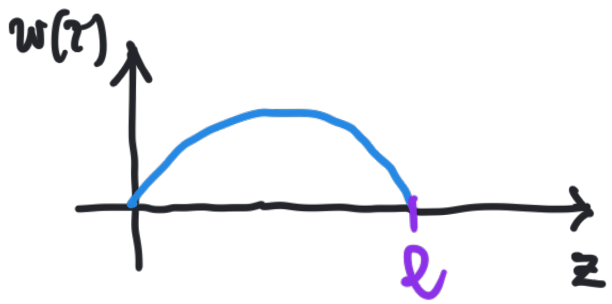
$$= \frac{pl}{2EA}\left(1 - 2\frac{z}{l}\right)$$

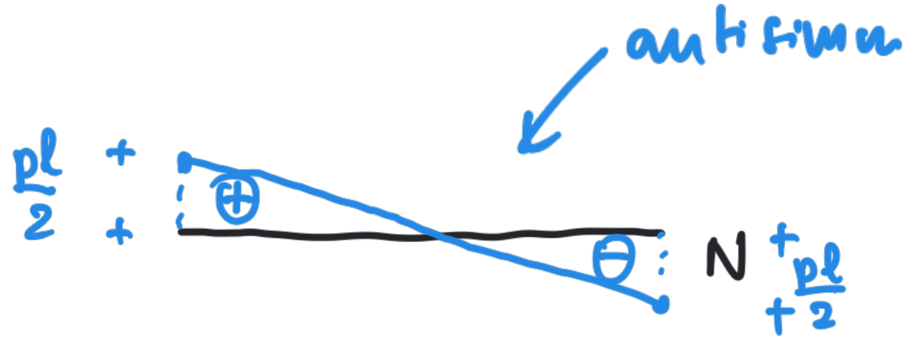
$$w(z) = \frac{pl^2}{2EA}\,\frac{z}{l}\left(1 - \frac{z}{l}\right)$$





Soluz:

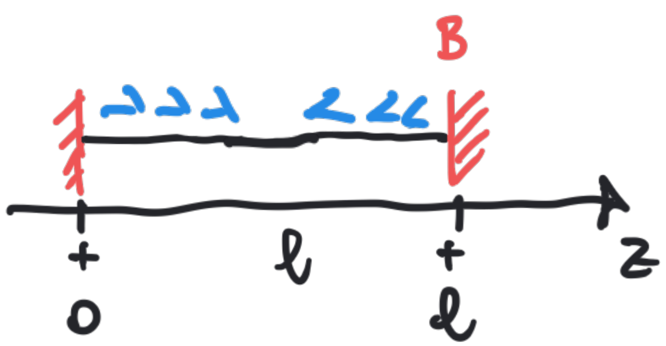




$$N(0) = \frac{pl}{2}$$

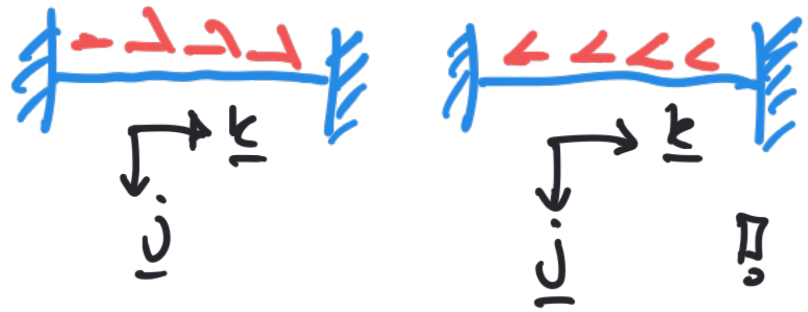
$$N(l) = -\frac{pl}{2}$$

ESEMPIO

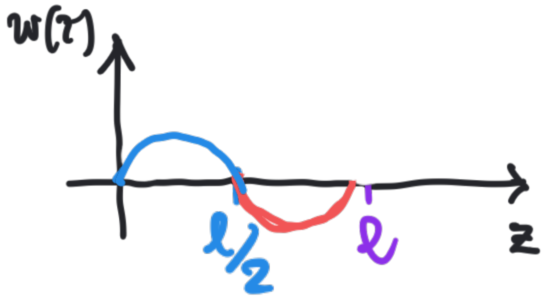


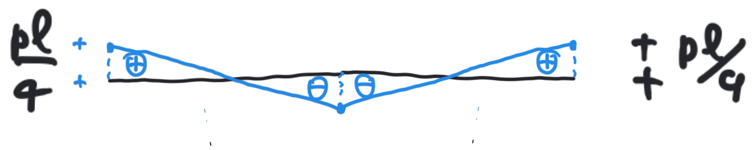
N non dipende da $\underline{k}$

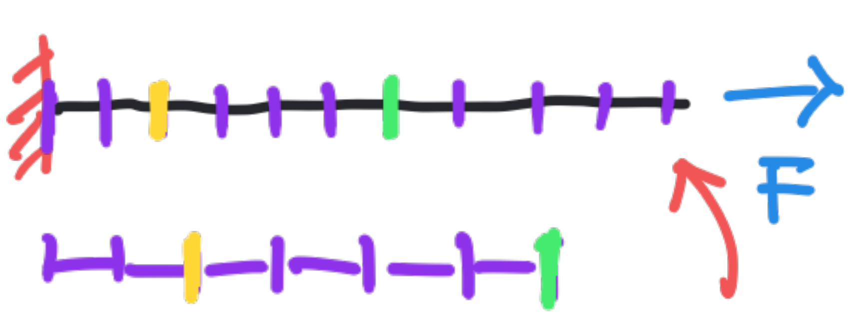
w dipende da $\underline{k}$



Soluz:







$$\boxed{N = F}$$

$$w(z) = \underbrace{w(0)}_{=0} + \int_0^z \varepsilon(s)\,ds$$

Potrei usare $N = F = EA\,w'$

$$\begin{cases} (EA\,w')' = 0 \\ w(0) = 0 \\ w'(l) = \dfrac{F}{EA} \end{cases}$$

si può risolvere, ma non conviene....

$$\begin{cases} w' = F/EA \\ w(0) = 0 \end{cases}$$

$$w(z) = \underbrace{c_1}_{0} + \underbrace{c_2}_{\frac{F}{EA}} z = \frac{F}{EA} z$$

$+\ \dfrac{Fl}{EA}$

w