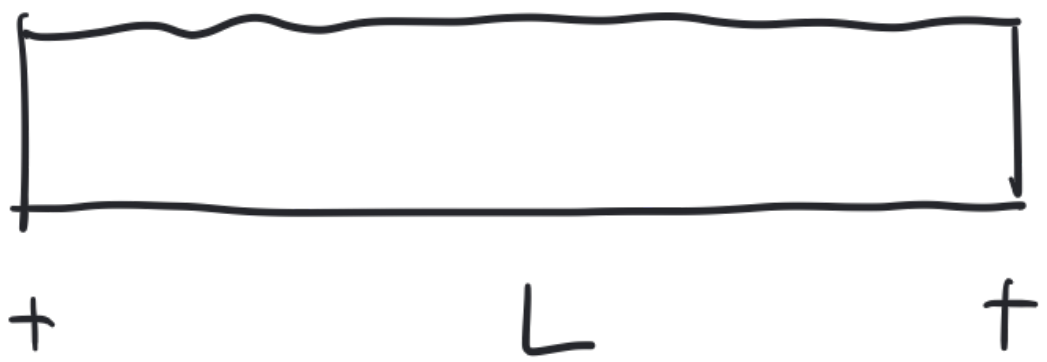
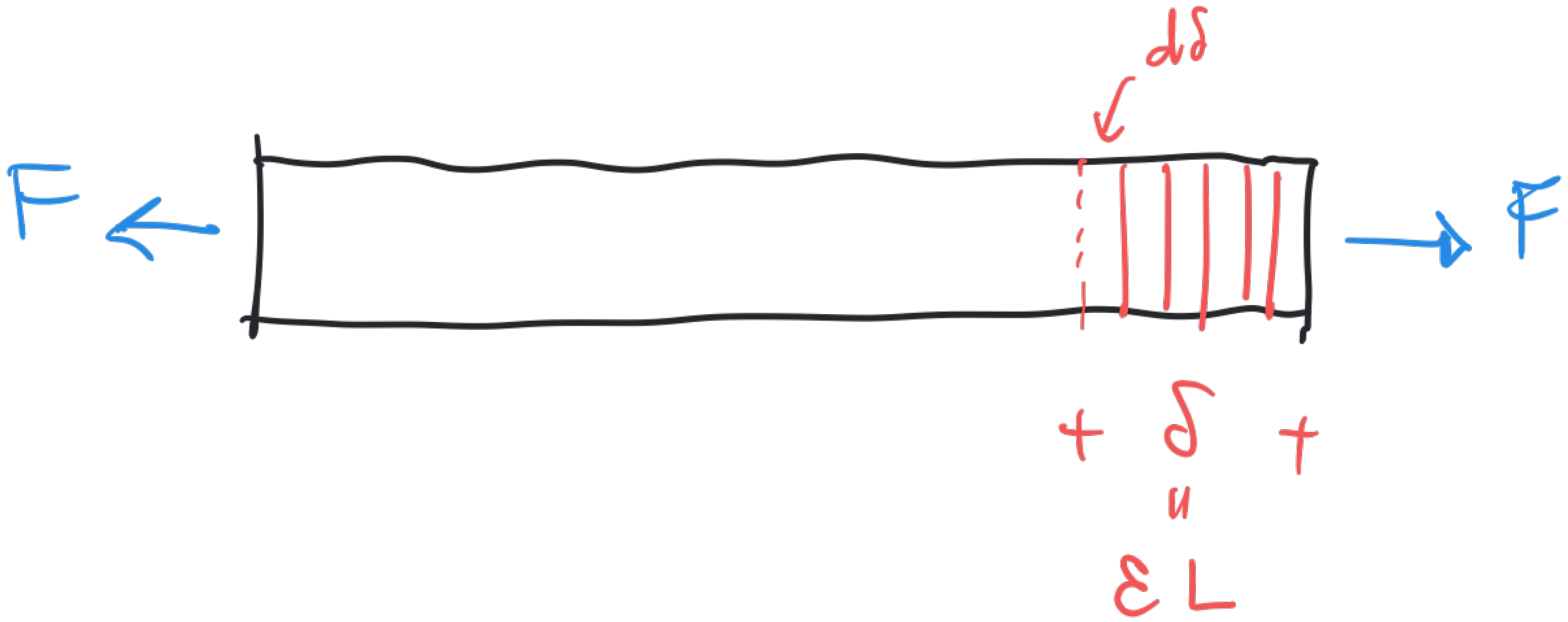




$$\delta = \frac{F}{EA} L \Rightarrow F = EA \frac{\delta}{L}$$

$$d\mathcal{L} = F\, d\delta = EA \frac{\delta}{L} d\delta$$

$$\mathcal{L} = \int_0^{\delta} EA \frac{\bar{\delta}}{L} d\bar{\delta} = \frac{1}{2} EA \frac{\delta}{L} \delta$$

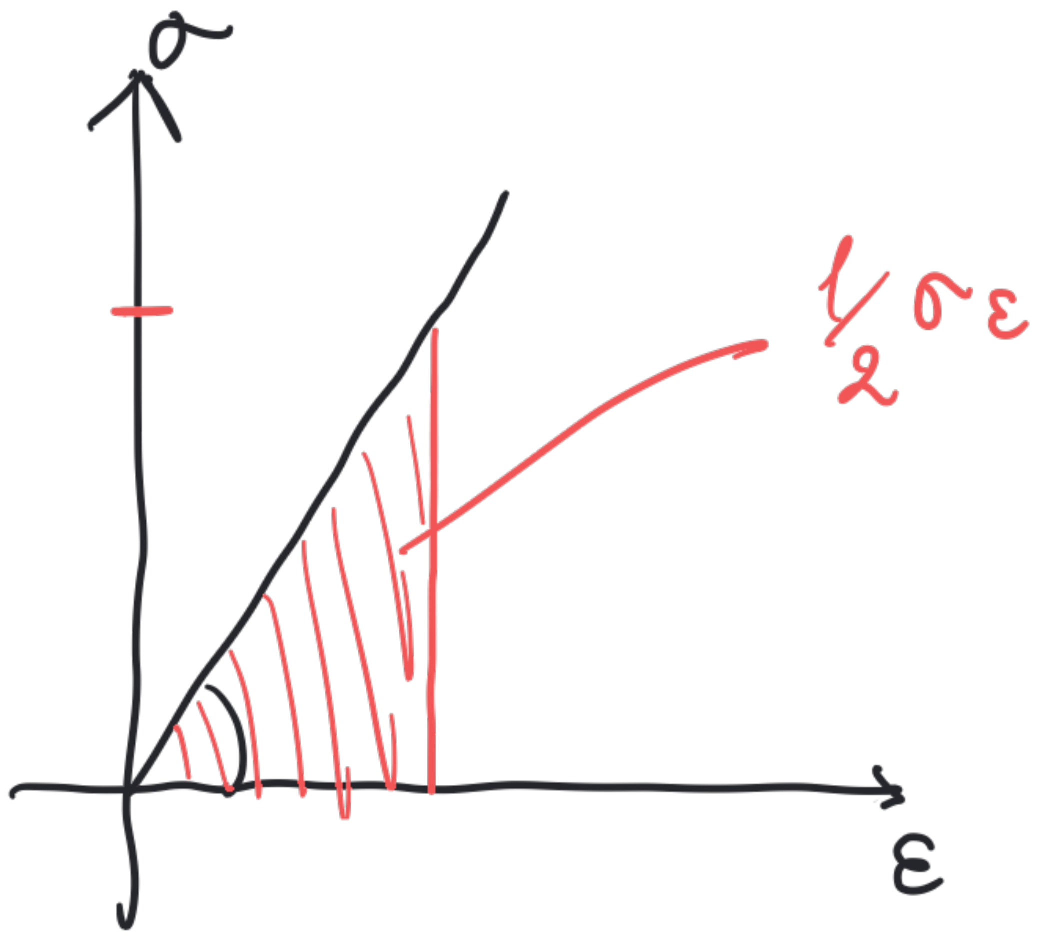
$$\mathcal{L} = \frac{1}{2} F \delta = \frac{1}{2} \frac{F^2}{EA/L} = \underbrace{\frac{1}{2} \frac{EA}{L} \delta^2}_{\mathcal{L}_{est}}$$

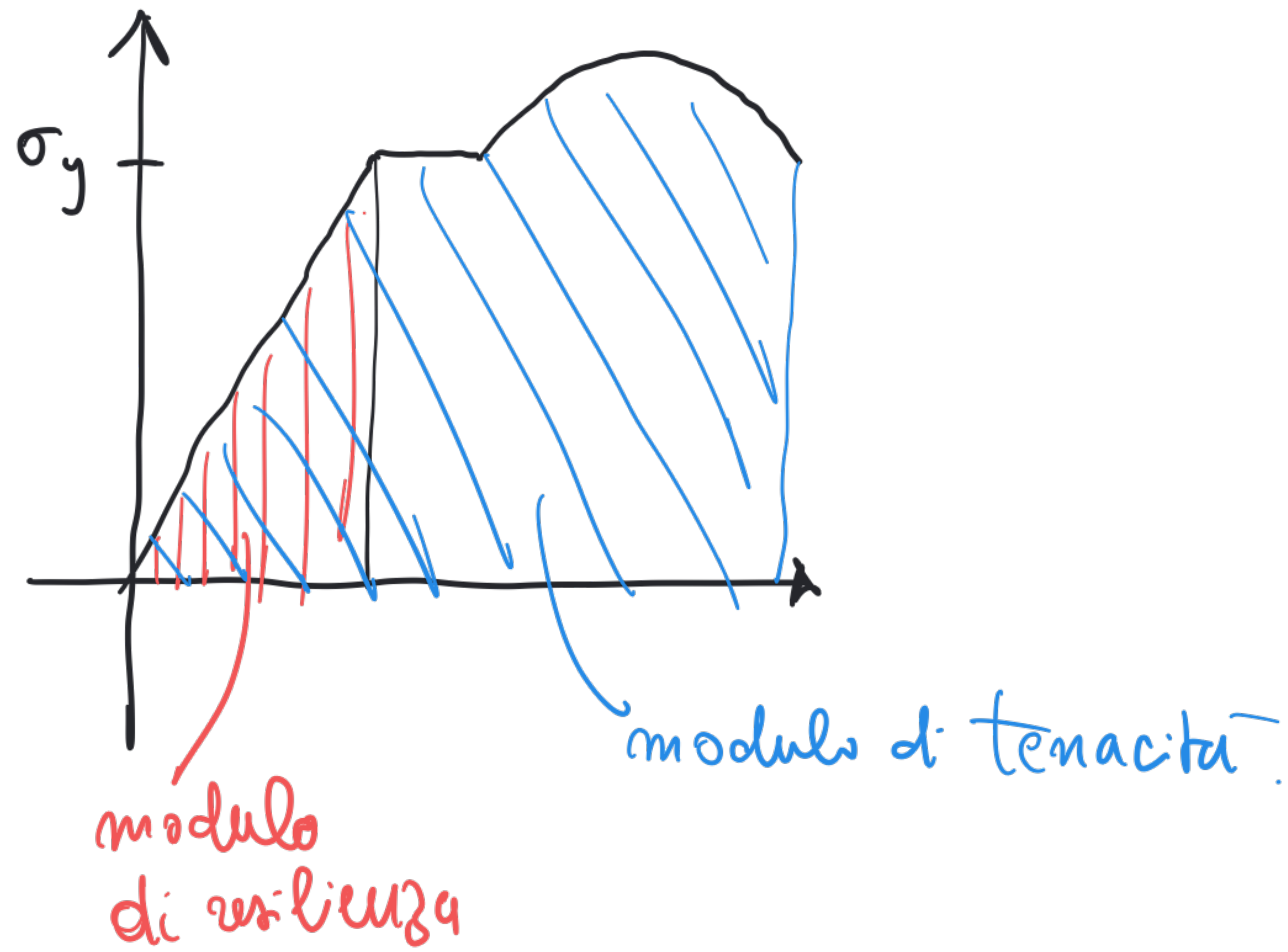
$$\ell = \frac{1}{2} N \frac{\delta}{L} L = \left(\frac{1}{2} N \varepsilon\right) L \leftarrow \mathcal{L}_{int}$$

$$\frac{\mathcal{L}}{L} = \frac{1}{2} N \varepsilon = \frac{1}{2} \frac{N^2}{EA} = \frac{1}{2} EA \varepsilon^2$$

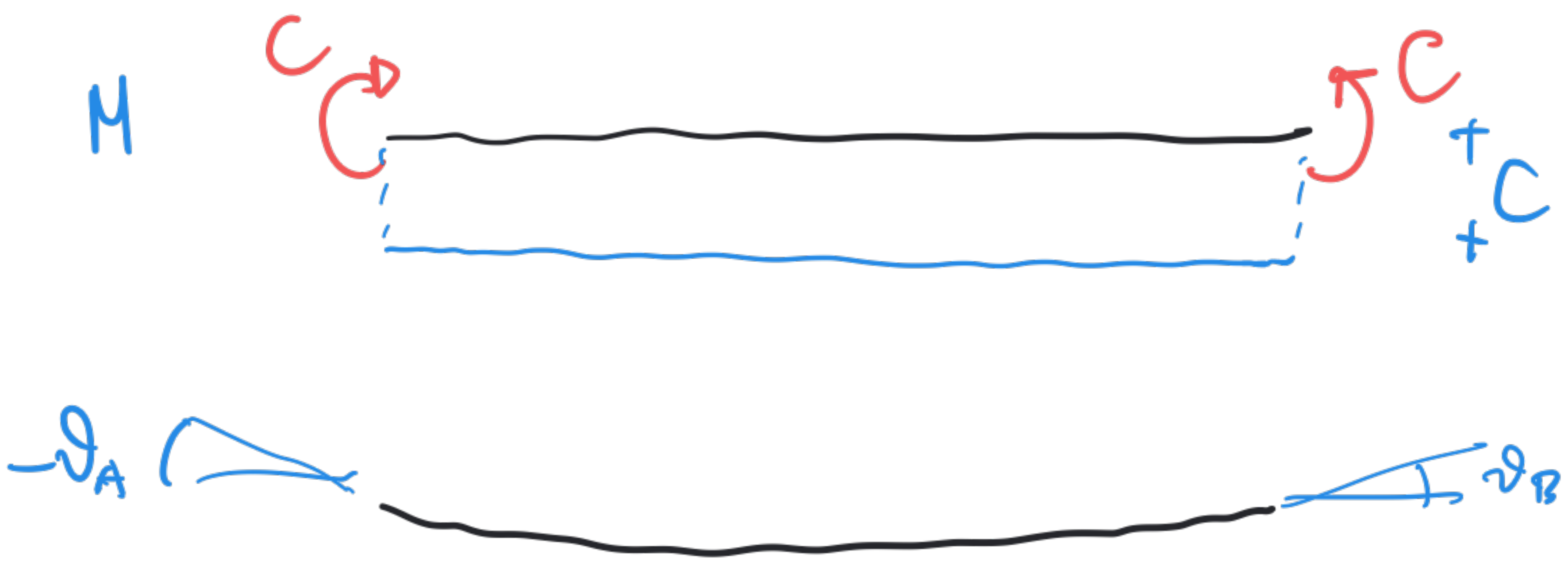
$$\frac{\mathcal{L}}{V} = \frac{\mathcal{L}}{AL} = \frac{1}{2} \frac{N}{A} \varepsilon = \frac{1}{2} \sigma \varepsilon = \frac{1}{2} \frac{\sigma^2}{E} = \frac{1}{2} E \varepsilon^2$$

RESILIENZA E TENACITA'





Hi 7.5



$$\vartheta_B - \vartheta_A = k L$$

$$k = 1/\rho = \frac{M}{EI} = \frac{C}{EI}$$

$$d\mathcal{L} = C\, d\vartheta_B - C\, d\vartheta_A$$

$$= C L\, dk$$

$$= EI L\, k\, dk$$

$$\mathcal{L} = \int_0^k EI L\, k\, dk$$

$$\mathcal{L}_{est}$$

$$\parallel$$

$$= \frac{1}{2} EI L\, k^2 = 1/2\, C(\vartheta_B - \vartheta_A)$$

$$\frac{\mathcal{L}}{L} = 1/2\, EI k^2 = 1/2\, M k = 1/2\, \frac{M^2}{EI} = \mathcal{L}_{int}$$

Energia flessionale per unità di lunghezza.

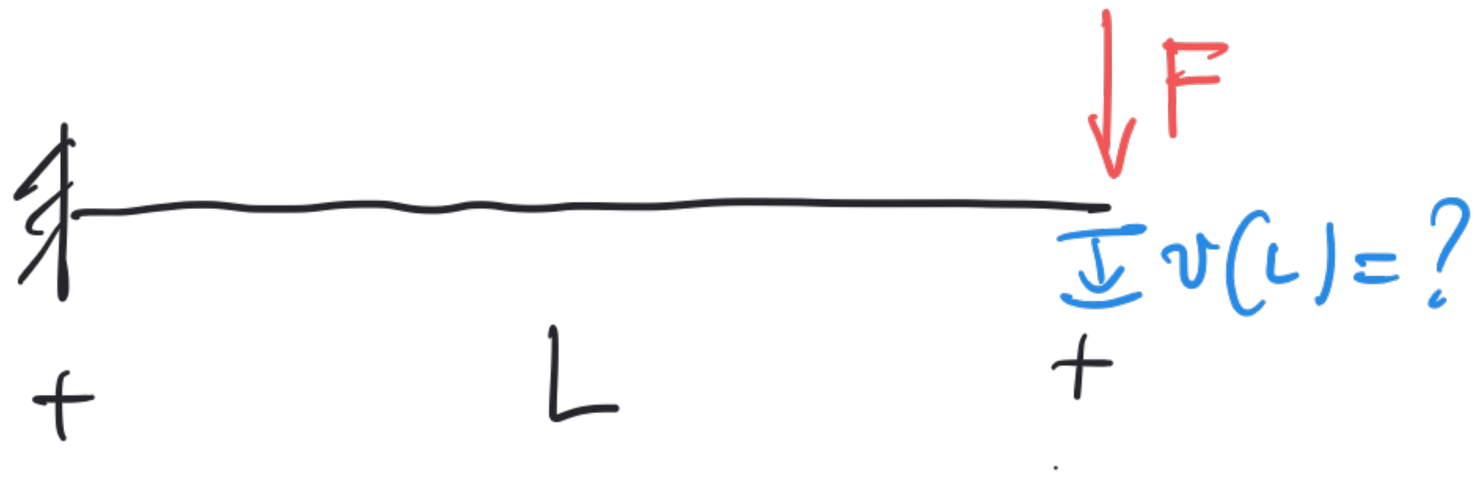
Nel caso generale

$$\mathcal{L}_{int} = \int_0^L \left(\frac{1}{2} N\varepsilon + \frac{1}{2} M k\right) dx = \int_0^L \left(\frac{1}{2} \frac{N^2}{EA} + \frac{1}{2} \frac{M^2}{EI}\right) dx$$

$$= \int_0^L \left(\frac{1}{2} EA\varepsilon^2 + \frac{1}{2} EIk^2\right) dx$$

Per un corpo tridimensionale $\mathcal{B}$

$$\mathcal{L}_{int} = \int_{\mathcal{B}} \frac{1}{2} \left(\sigma_x \varepsilon_x + \sigma_y \varepsilon_y + \sigma_z \varepsilon_z + \tau_{xy}\gamma_{xy} + \tau_{yz}\gamma_{yz} + \tau_{zx}\gamma_{zx}\right) dV$$



$$\mathcal{L}_{est} = \frac{1}{2} F\, v(L) = \underbrace{\frac{1}{2}\int_0^L \frac{M^2}{EI}\,dx}_{=\mathcal{L}_{int}} = \frac{1}{2EI} F^2 \int_0^L (L-x)^2\,dx = \frac{1}{3}\,\frac{FL^3}{EI}$$

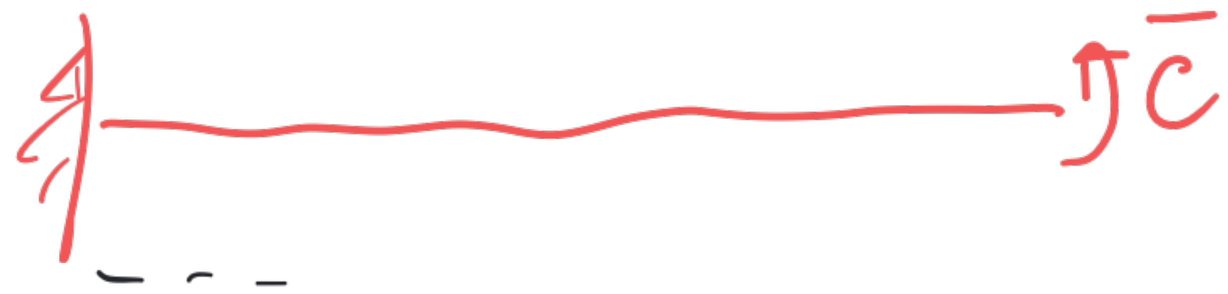
$$M(x) = -F(L-x)$$

$$\Rightarrow \quad v(L) = \frac{1}{3}\,\frac{FL^3}{EI}$$

$\vartheta(L) = ?$

$$\mathcal{L}_{est} = \frac{1}{2} C\,\vartheta(L) = \overset{\mathcal{L}_{int}}{\overset{\shortparallel}{\frac{1}{2}\int_0^L \frac{M^2}{EI}\,dx}} = \frac{1}{2}\frac{C^2}{EI}L$$

$$\Rightarrow \quad \vartheta(L) = \frac{CL}{EI}$$

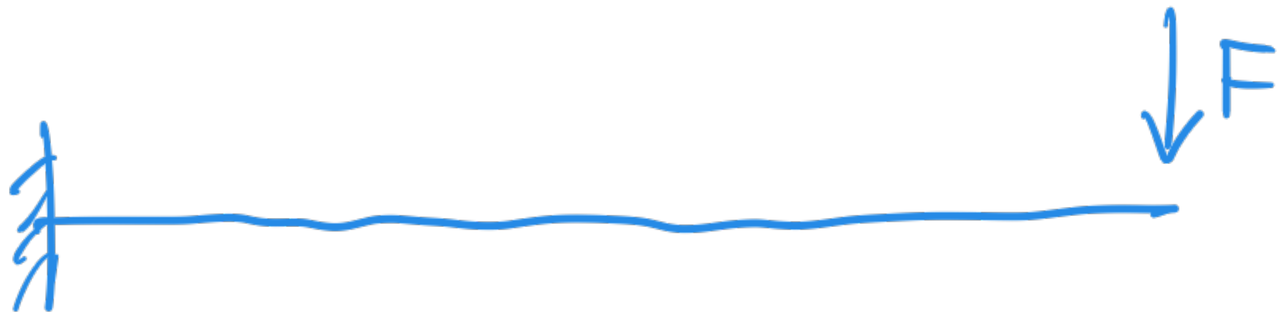


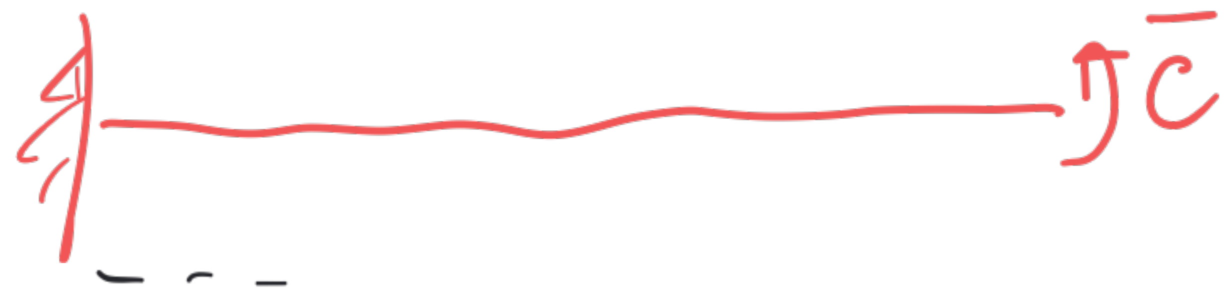
$$\vartheta(L) = ?$$

$$\mathcal{L}_{vest} = \bar{C}\,\vartheta(L)$$

$$\mathcal{L}_{virt} = \int_0^L \bar{M}\,k = \int_0^L \bar{C}\,\frac{M}{EI} = \int_0^L \bar{C}\,\frac{-F(L-x)}{EI}\,dx$$

$$= -\frac{\bar{C}F}{EI}\int_0^L (L-x)\,dx = -\bar{C}\,\frac{1}{2}\,\frac{FL^2}{EI}$$





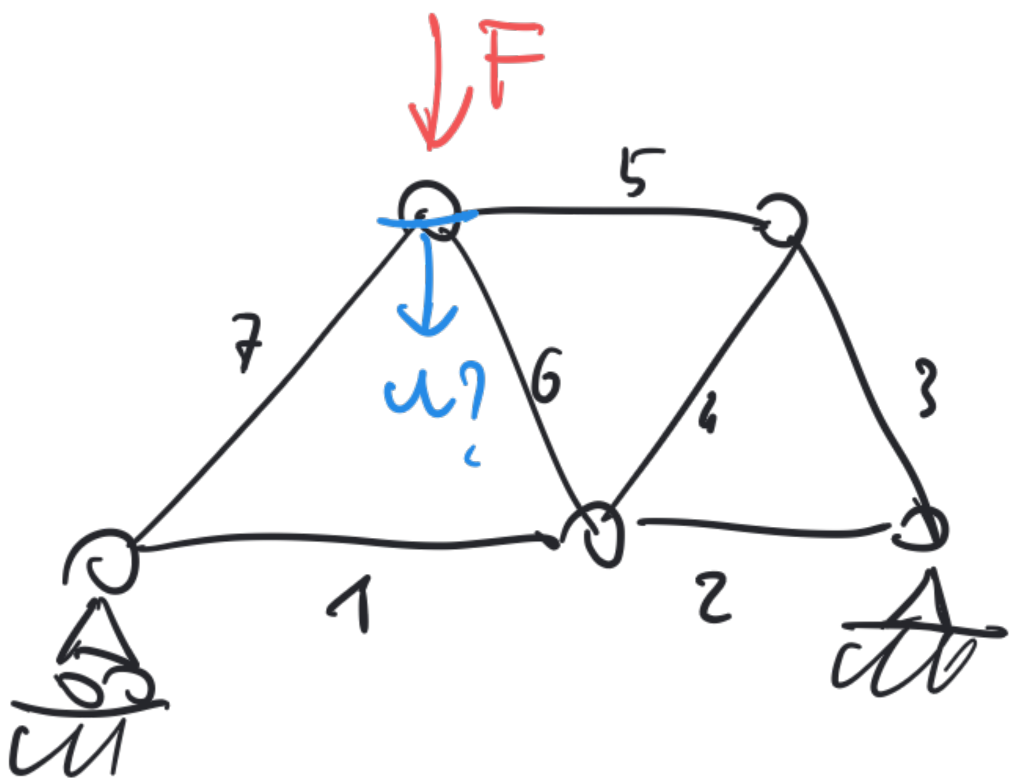
$$\vartheta(L) = \vartheta(0) + \int_0^L \frac{d\vartheta}{dx}\,dx = \int_0^L \frac{M}{EI}\,dx$$

$$= \frac{1}{EI}\int_0^L \left(-F(L-x)\right)dx = -\tfrac{1}{2}\,FL^2/EI$$

$$\mathcal{L}_{virt} = \int_0^L \bar{M}\,k = \int_0^L \bar{C}\,\frac{M}{EI} = \int_0^L \bar{C}\,\frac{-F(L-x)}{EI}\,dx$$

$$= -\frac{\bar{C}F}{EI}\int_0^L (L-x)\,dx = -\bar{C}\,\frac{1}{2}\,\frac{FL^2}{EI}$$

TRAVATURE RETICOLARI



$$\frac{1}{2}Fu = \sum_{i=1}^{7} \int_0^{L_i} \frac{1}{2}\varepsilon_i N_i \, dx = \sum_{i=1}^{7} \frac{1}{2}\varepsilon_i N_i L_i$$

$$= \sum_{i=1}^{7} \frac{1}{2} \frac{N_i^2 L_i}{EA}$$