Es

$$\left.\begin{array}{l} N = F \\ N = EA\varepsilon \end{array}\right\} \Rightarrow \varepsilon = \frac{F}{EA}$$

sistema congruente

sistema reale

$$\underset{\displaystyle \frac{F}{EA}}{\underset{\shortparallel}{\varepsilon}},\ \gamma = 0,\ \chi = 0$$

$$w,\ \varphi,\ v$$

PLV:

$$L_{ve} = 1 \cdot w_B + (-1)\cancel{w_A}$$

$$L_{vi} = \int_0^{\ell} \bar{N}\varepsilon \, dz = \underset{\displaystyle 1}{\underset{\shortparallel}{\bar{N}}} \frac{F}{EA} \ell$$

$$w_B = \frac{F\ell}{EA}$$

sistema virtuale

$$\bar{N} = 1,\ \bar{T} = 0,\ \bar{M} = 0$$

Es

$$\left.\begin{aligned} N &= F \\ N &= EA\varepsilon \end{aligned}\right\} \Rightarrow \varepsilon = \frac{F}{EA}$$

$$\varepsilon = w'$$

$$w_B - \underset{\substack{\parallel \\ 0}}{\cancel{w_A}} = \int_0^{\ell} w'\,dz = \int_0^{\ell} \varepsilon\,dz$$

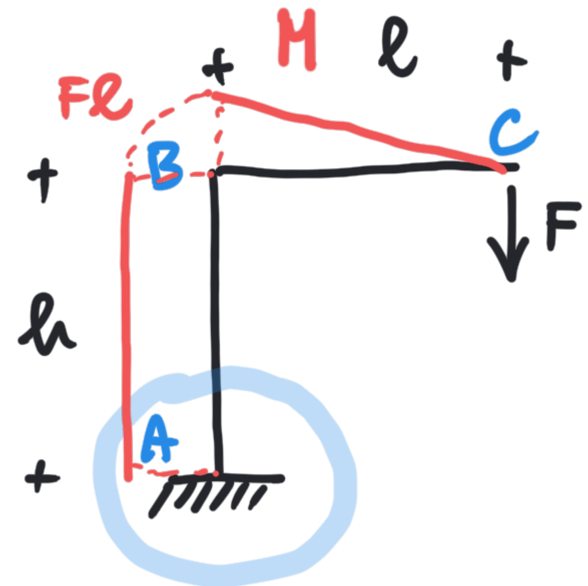
$$\boxed{w_B = \frac{F\ell}{EA}}$$

PLV:

$$L_{ve} = 1 \cdot w_B + (-1)\cancel{w_A}$$

$$L_{vi} = \int_0^{\ell} \bar{N}\varepsilon\,dz = \underset{\substack{\parallel \\ 1}}{\bar{N}}\frac{F}{EA}\ell$$

$$w_B = \frac{F\ell}{EA}$$



$v_C = ?$

$L_{ve} = 1 \cdot v_C$

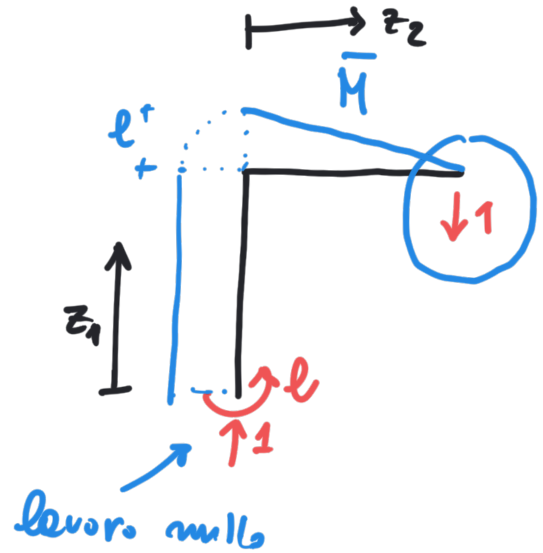
$$L_{vi} = \int_{\text{strutt.}} \bar{M}(z)\,\chi(z)\,dz = \int \bar{M}(z)\,\frac{M(z)}{EI}\,dz$$

$\gamma = 0$

$EA \to +\infty \Rightarrow \varepsilon = 0$

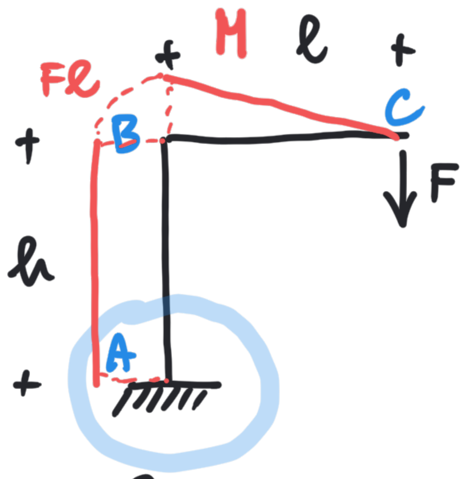
$$= \frac{F}{EI} \int \bar{M}^2(z)\,dz$$

$$\chi = \frac{M}{EI} = \frac{F\bar{M}}{EI}$$



$$\bar{M}(z_1) = -\ell$$

$$\bar{M}(z_2) = z - \ell$$



$\gamma = 0$

$EA \to +\infty \Rightarrow \varepsilon = 0$

$v_c = ?$

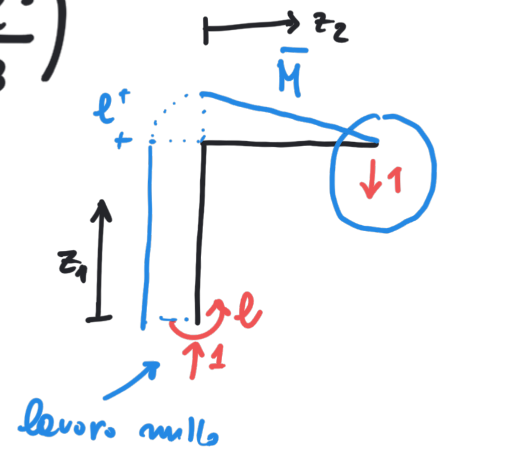
$L_{ve} = 1 \cdot v_c$

$$L_{vi} = \frac{F}{EI}\left(\underbrace{\int_A^B \bar{M}^2}_{= h\ell^2} + \underbrace{\int_B^C \bar{M}^2}_{\ell^3/3}\right)$$

$$\int_0^\ell (z-\ell)^2 dz = \int_0^\ell z^2 + \ell^2 - 2\ell z = \frac{\ell^3}{3} + \cancel{\ell^3} \cancel{- \ell^3}$$

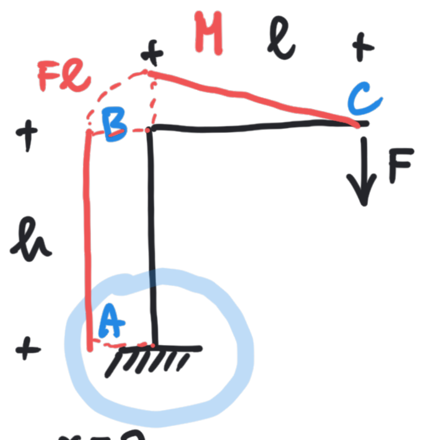
$$\chi = \frac{M}{EI} = \frac{F\bar{M}}{EI}$$

$$v_c = \frac{F}{EI}\left(h\ell^2 + \frac{\ell^2}{3}\right)$$



$\bar{M}(z_1) = -\ell$

$\bar{M}(z_2) = z - \ell$

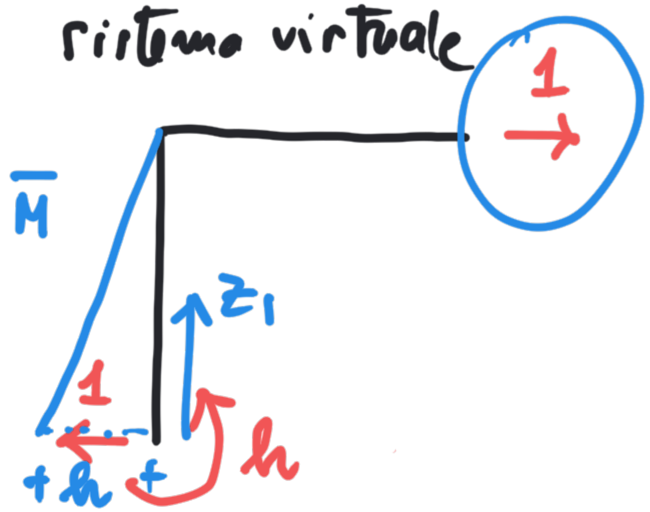


$w_c = ?$

$\gamma = 0$

$EA \to +\infty \Rightarrow \varepsilon = 0$

sistema virtuale



$L_{ve} = 1 \cdot w_c$

$$\chi = \frac{M}{EI}$$

$$L_{vi} = \int_{\text{str.}} \bar{M} \frac{M}{EI} = \int_0^h (z_1 - h)(-\ell) F \frac{1}{EI}\, dz_1$$

virtual

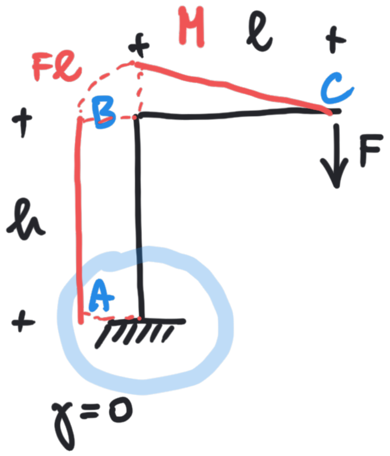
$$= -\frac{F\ell}{EI} \int_0^h (z_1 - h)\, dz_1$$

$$M(z_1) = (-\ell)F$$

$$M(z_2) = (z - \ell)F$$

$$\bar{M}(z_1) = z_1 - h$$

$$= -\frac{F\ell}{EI}\left(\frac{h^2}{2} - h^2\right) = \frac{1}{2}\frac{F\ell h^2}{EI}$$

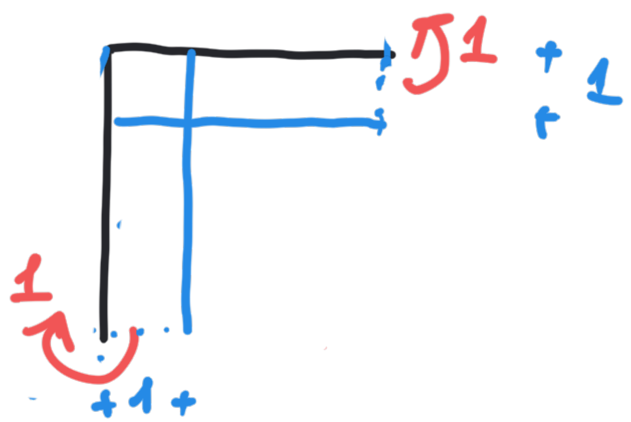


$\gamma = 0$

$EA \to +\infty \Rightarrow \varepsilon = 0$

$\varphi_C = ?$

sistema virtuale



$L_{ve} = 1 \cdot w_c$

$$L_{vi} = \int_{\text{str.}} \underset{\text{virtual}}{\bar{M}} \frac{M}{EI} = \frac{1}{EI}\int_0^h M(z_1)\,dz_1 + \frac{1}{EI}\int_0^{\ell} M(z_2)\,dz_2$$

$$\chi = \frac{M}{EI}$$

$M(z_1) = (-\ell)F$

$M(z_2) = (z-\ell)F$

$\bar{M} = 1$

$$= \frac{1}{EI}(-\ell F)h + \frac{1}{EI}\left(\frac{\ell^2}{2} - \ell^2\right)F$$

$$= -\frac{F}{EI}\left(\ell h + \frac{\ell^2}{2}\right)$$