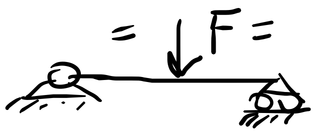
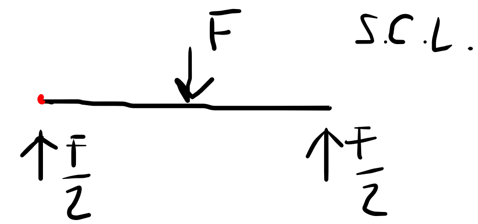
UTILIZZO DEL PRINCIPIO DEI LAVORI VIRTUALI PER IL CALCOLO DI REAZ. VINCOLARI IN STRUTTURE ISOSTATICHE

PUNTO DI PARTENZA: STR. ISOST. IN EQUILIBRIO

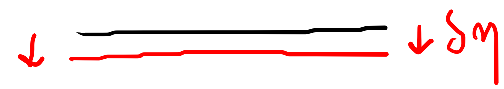


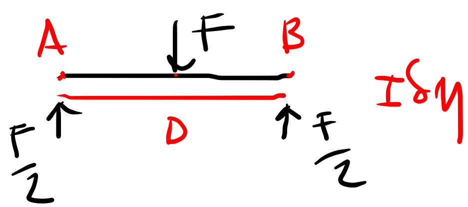


ADESSO APPLICO AL CORPO RIGIDO UNA ROTOTRASLAZ. A PIACERE

$\delta\eta$: SPOST. VIRTUALE

TRASLAZIONE



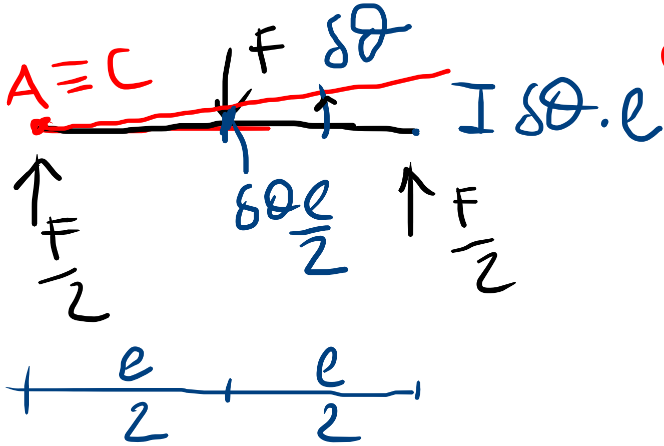


SCRIVO UNA ESPRESSIONE DEL LAVORO VIRTUALE

$$\delta L = -\frac{F}{2}\delta\eta + F\,\delta\eta - \frac{F}{2}\delta\eta =$$

$$= \underbrace{\left(-\frac{F}{2} + F - \frac{F}{2}\right)}_{0}\delta\eta = 0 \quad ; \quad \forall\,\delta\eta$$

PER UNA STRUTTURA EQUILIBRATA, IL LAVORO VIRTUALE È NULLO QUALSIASI SIA L'ENTITÀ DELLO SPOST. VIRTUALE.

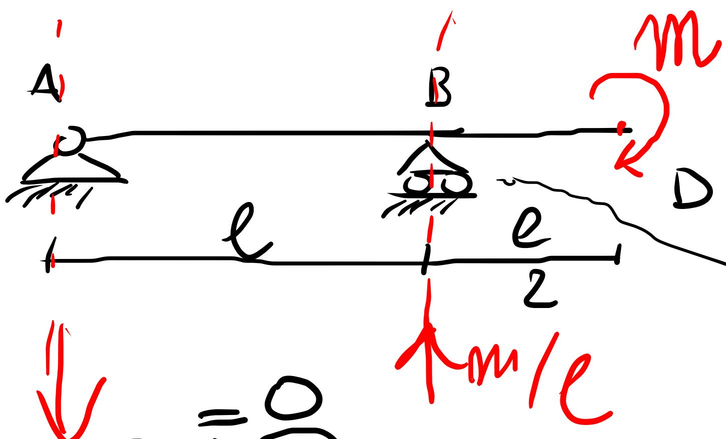


C ≡ C. DI IST. ROTAZ. DELLA ROTOTRASL. (A PIACERE)

$$\delta L = \frac{F}{2}\cdot 0 - F\cdot\frac{\delta\theta\,\ell}{2} + \frac{F}{2}\,\delta\theta\cdot\ell =$$

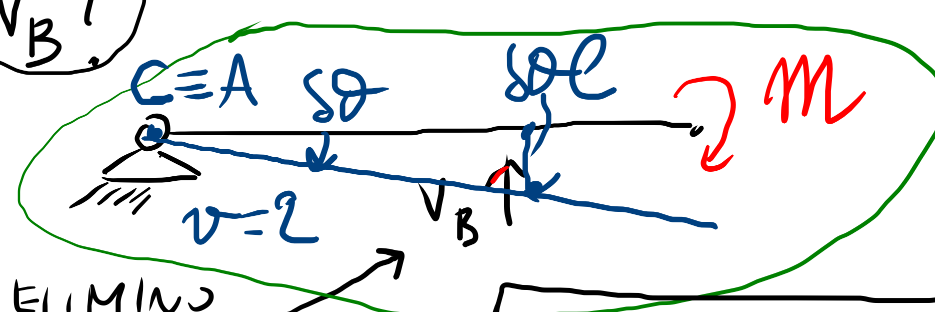
$$= \underbrace{\left(-\frac{F\ell}{2} + \frac{F\ell}{2}\right)}_{0}\delta\theta = 0 \quad \forall\,\delta\theta$$

ES: IMPONIAMO $\delta L = 0$ PER DETERMINARE UNA REAZ. VINCOLARE ALLA VOLTA.



V_B?

CATENA CINEMATICA (1 V. LABILE)



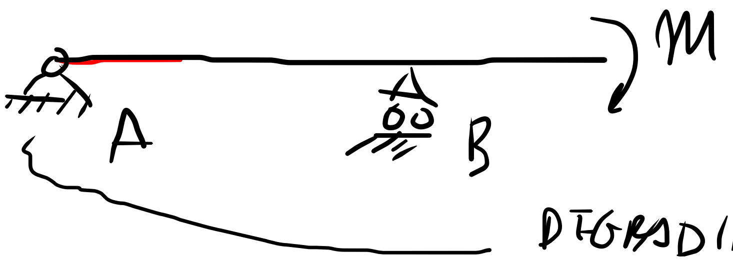
ELIMINO IL CARRELLO

V_B !!

$$\boxed{\delta L = -V_B\,\delta\theta\,\ell + M\,\delta\theta = 0}$$

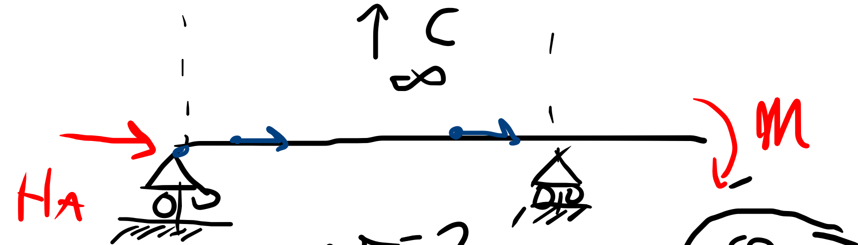
$$\overbrace{\left(-V_B\,\ell + M\right)}^{=0}\delta\theta = 0 \Rightarrow \boxed{V_B = +\frac{M}{\ell}}$$

$V_B \uparrow \frac{M}{\ell}$



H_A?

DEGRADIAMO IL VINCOLO



$v = 2$

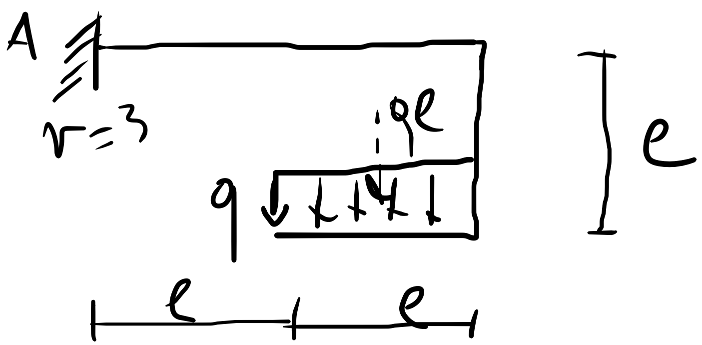
$\ell = 1$

$\delta\theta = 0$

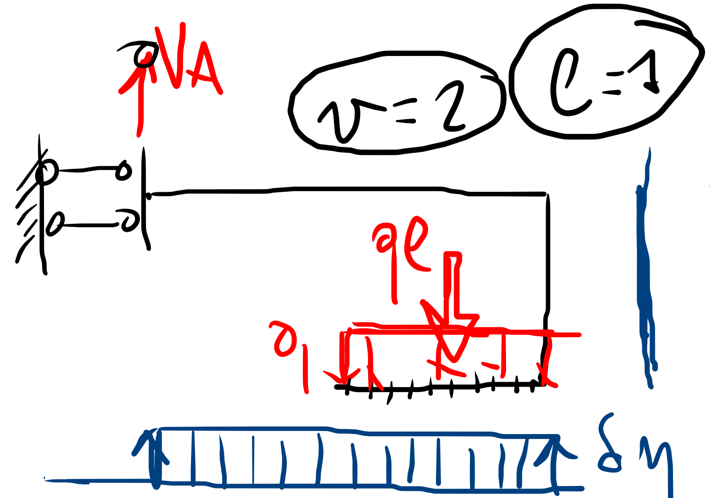
$\longmapsto \delta\eta$ (PER TUTTI PUNTI)

$$\underbrace{\delta L = H_A\,\delta\eta + M \cdot 0 = 0}_{H_A\,!!} \longrightarrow H_A\,\delta\eta = 0 \Rightarrow \underline{H_A = 0} \quad (\forall \delta\eta)$$

ES.



V_A?



$v = 2$ $\ell = 1$

$\overset{\infty}{\rightarrow} C$

$\delta\eta$ (TRASLAZ. VERTICALE)

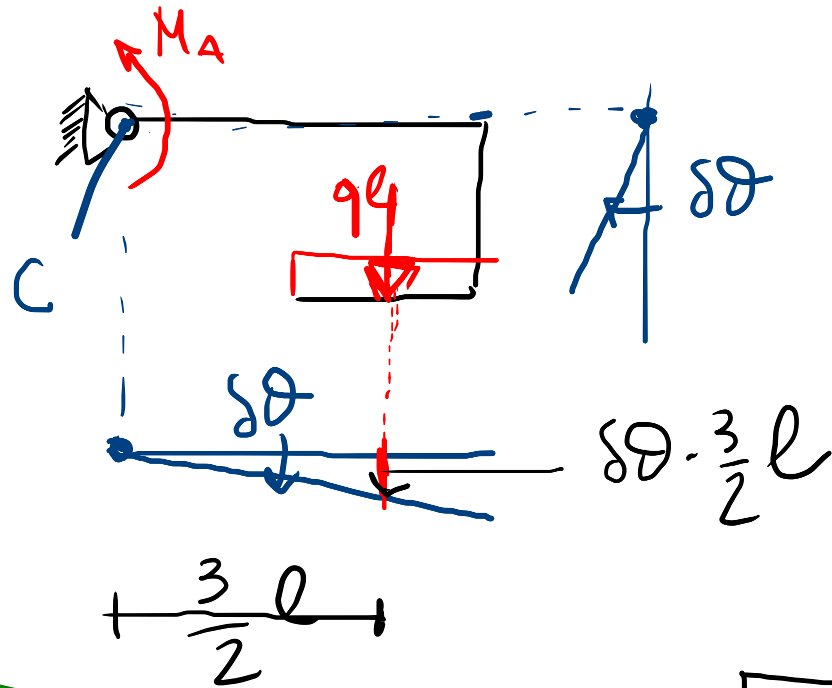
$$\delta L = 0 : \; V_A\,\delta\eta - q\ell\,\delta\eta = 0 \Rightarrow (V_A - q\ell)\,\delta\eta = 0$$

$$\boxed{V_A = q\ell} \;\; (+)$$

VERSO L'ALTO

EQUAZ. DEI LAVORI VIRTUALI

M_A ?

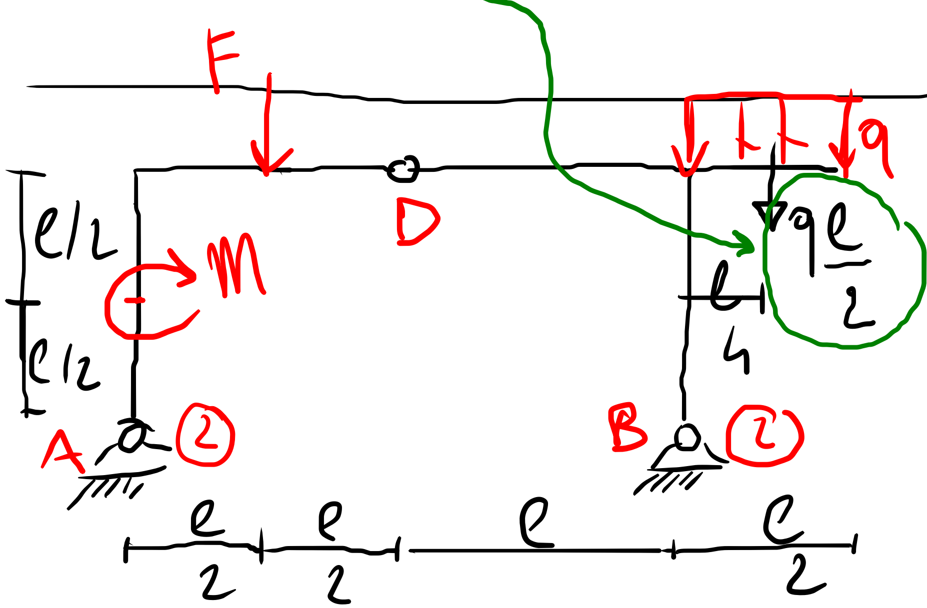


$$\delta L = -M_A\delta\theta + ql\,\delta\theta\cdot\frac{3}{2}l$$

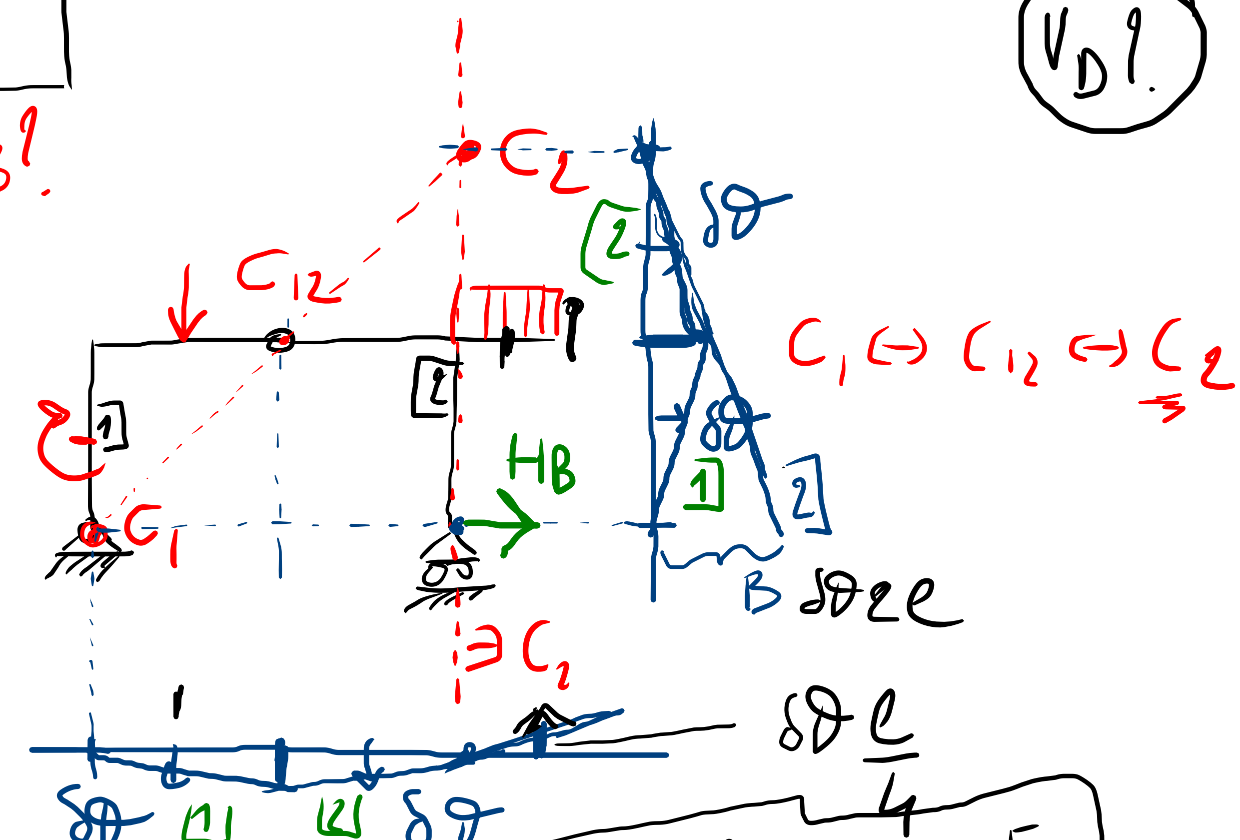
$$= \underbrace{\left(-M_A + \frac{3}{2}ql^2\right)}_{=0}\delta\theta = 0$$

$$M_A = \frac{3}{2}ql^2 \quad \circlearrowleft (+)$$

CORRETTO!



V_D ?



$$\delta L = M\delta\theta + F\delta\theta\frac{l}{2} - q\frac{l}{2}\cdot\delta\theta\frac{l}{4}$$

$$+ H_B\delta\theta 2l = 0 \rightarrow \frac{M}{l} + F\frac{\cancel{l}}{2} - q\frac{l^{\cancel{2}}}{8} + 2H_B\cancel{l} = 0 \rightarrow \boxed{H_B = q\frac{l}{16} - \frac{M}{2l} - \frac{F}{4}}$$