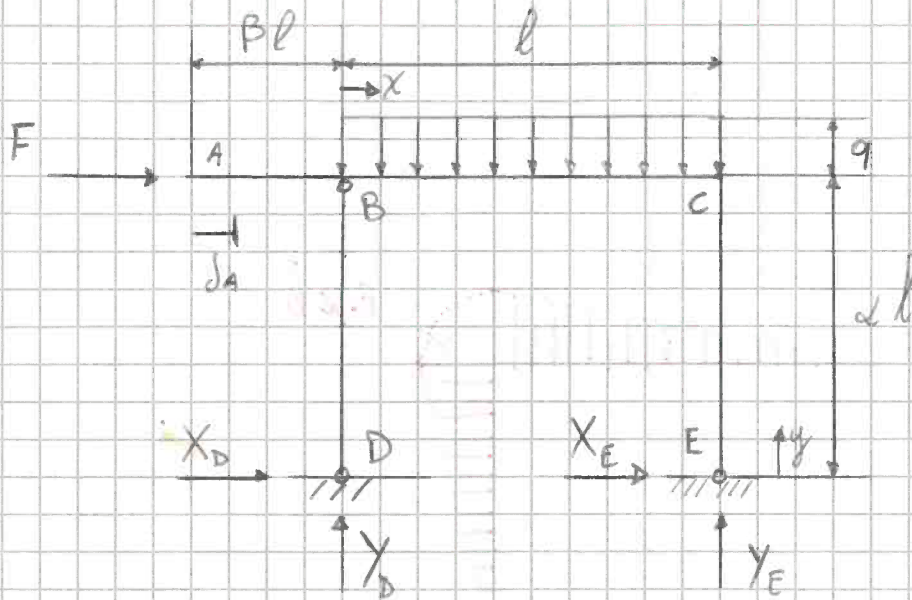


Traccia del 26/01/2023. <sup>19</sup> esercizio 1.



- Calcolo delle reazioni vincolari, la struttura è isostatica.

$$\rightarrow + ] F + X_D + X_E = 0 \rightarrow X_E = -F$$

$$\uparrow + ] -q \cdot l + Y_D + Y_E = 0 \rightarrow Y_E = F \cdot d + q \frac{l}{2}$$

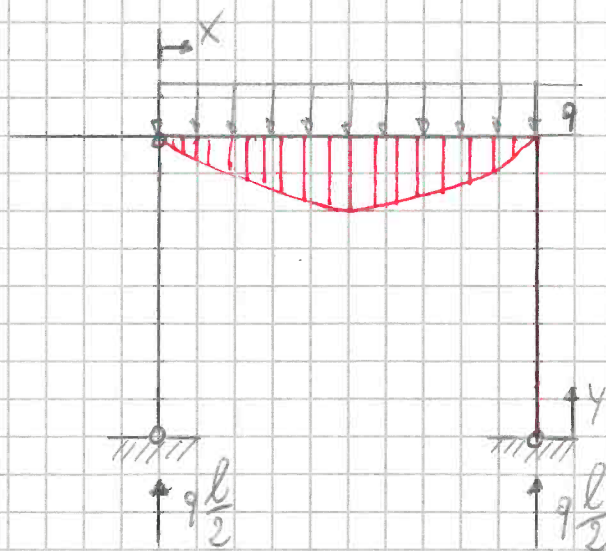
$$\curvearrowright + ] q \cdot l \cdot \frac{l}{2} - F \cdot d \cdot l - Y_D \cdot l = 0 \rightarrow Y_D = q \frac{l}{2} - F \cdot d$$

DB è una biella ]  $X_D = 0$

$$\{r_{01}\} = 0 ; \{r_{02}\} = \frac{1}{2} ; \{r_{03}\} = 0 ; \{r_{04}\} = \frac{1}{2}$$

$$\{r_{05}\} = 0 ; \{r_{06}\} = -d ; \{r_{07}\} = -1 ; \{r_{08}\} = +d$$

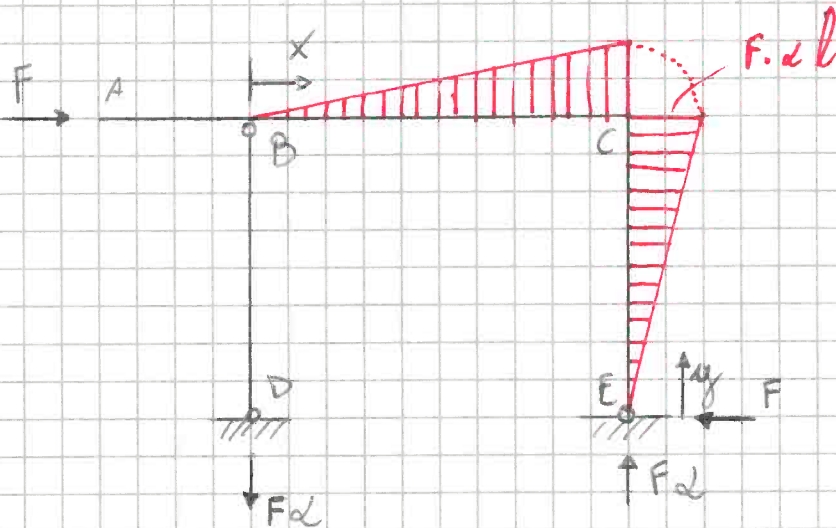
- Calcolo del momento flettente considerando solo q.



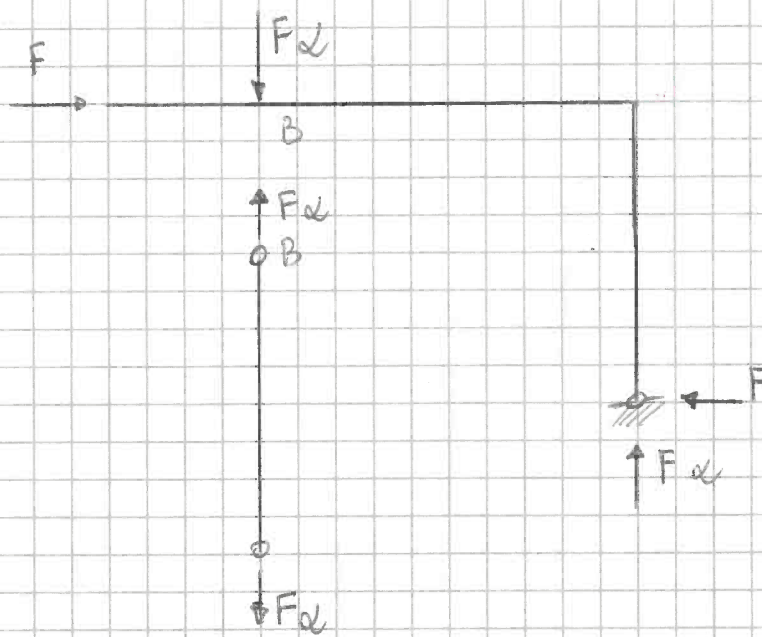
$$M_{BCq}(x) = \cancel{\dots} = -q \frac{x^2}{2} + \frac{q \cdot l}{2}$$

$$M_{ECq}(y) = 0$$

• Calcolo del momento flettente considerando solo F.



Per capire meglio cosa succede in B:



$$M_{BCF}(x) = -F_d \cdot x$$

$$M_{ECF}(y) = -F \cdot y$$

$$\{r_{09}\} = \frac{1}{2}; \{r_{10}\} = 0; \{r_{11}\} = 0; \{r_{12}\} = 0; \{r_{13}\} = 0; \{r_{14}\} = 0;$$

$$\{r_{15}\} = -\alpha; \{r_{16}\} = 0; \{r_{17}\} = -1; \{r_{18}\} = 0$$

# CALCOLO LO SPOSTAMENTO IN A CON CASTIGLIANO

$$U = \frac{1}{2EI} \int M_p^2 dx$$

$$= \frac{1}{2EI} \left[ \int_0^L M_{F, B}^2 dx + \int_0^{uL} M_{F, EC}^2 dy \right]$$

$$= \frac{1}{2EI} \left[ \int_0^L \left( F_d x^2 - 2F_d l p x^2 + F_d p x^3 + \frac{p^2 x^4}{4} - p l x^3 + p^2 l^2 x^2 \right) dx + \int_0^{uL} F^2 y^2 dy \right]$$

$$= \frac{1}{2EI} \left( \frac{1}{120} p^2 l^5 - \frac{F_d l^4}{12} p + \frac{F^2 u^3 l^3}{3} + \frac{F^2 u^3 l^3}{3} \right)$$

$$\Delta = \frac{\partial U}{\partial F} = - \frac{u l^4 p}{24 EI} + \frac{F l^3 (u^2 + l^3)}{3 EI}$$