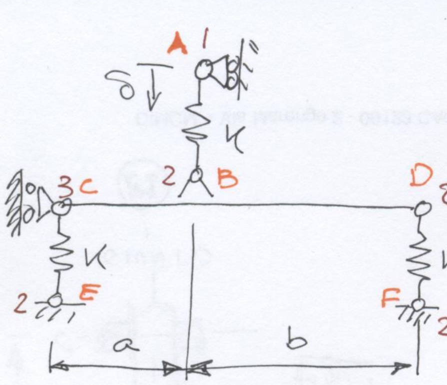
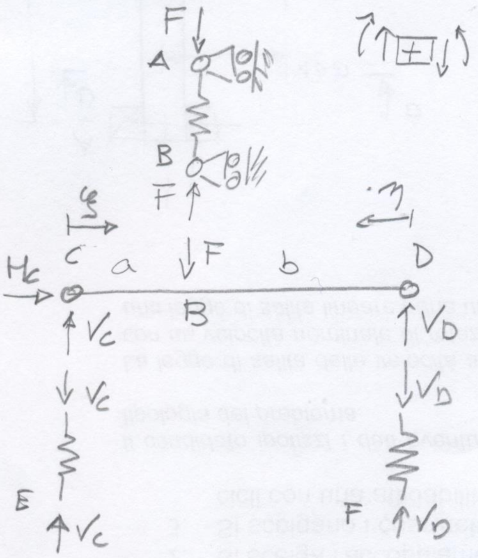


$a = l/3$

$b = \frac{2}{3} l$

$$\left.\begin{aligned} g.l. &= 3 \cdot 4 = 12 \\ g.v. &= 12 \end{aligned}\right\} \text{isostatica (o labile)}$$

Sollecitazioni nella struttura



$N_{AB} = -F$

$V_D = F\dfrac{a}{l} \quad \left(V_C = F\dfrac{b}{l}\right)$ (eq. rota. in C della trave)

$N_{CE} = -V_C = -\dfrac{Fb}{l}$

$N_{FD} = -V_D = -\dfrac{Fa}{l}$

$M_{CB} = V_C \cdot \xi = \dfrac{Fb}{l} \cdot \xi$

$M_{DB} = V_D \cdot \eta = \dfrac{Fa}{l} \cdot \eta$

Per calcolare δ_A utilizzo PLV (stessa struttura con forza unitaria in A).

Poiché siamo in teoria lineare, le azioni interne sono $\propto$, basta porre $F=1$

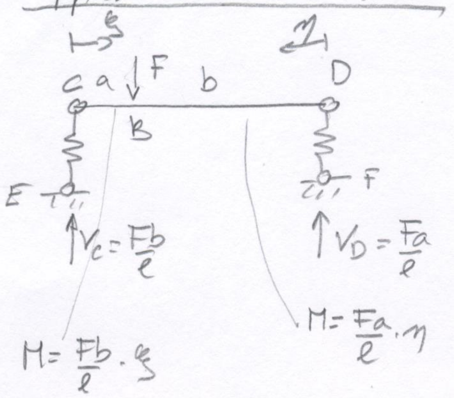
$L.V.e = 1 \cdot \delta$

$$LV_i = \int_A^B \frac{F}{EA_m} dx + \int_C^E \frac{V_C}{EA_m} \frac{b}{l} dx + \int_D^F \frac{V_D}{EA_m} \frac{a}{l} dx + \int_0^a F\left(\frac{b}{l}\xi\right)^2 \frac{1}{EJ} d\xi + \int_0^b F\left(\frac{a}{l}\eta\right)^2 \frac{1}{EJ} d\eta =$$

$$= \frac{F}{k} + \frac{F}{k}\frac{b^2}{l^2} + \frac{F}{k}\frac{a^2}{l^2} + \frac{Fb^2}{l^2}\frac{a^3}{3EJ} + \frac{Fa^2}{l^2}\frac{b^3}{3EJ} = F\left[\frac{1}{k}\left(1 + \frac{a^2}{l^2} + \frac{b^2}{l^2}\right) + \frac{b^2a^2\overbrace{(a+b)}^{l}}{3EJ\,l^2}\right]$$

$$F = \frac{\delta}{\dfrac{l^2+a^2+b^2}{kl^2} + \dfrac{b^2a^2}{3EJl}} = \frac{3EJkl^2}{3EJ(l^2+a^2+b^2) + kl\,b^2a^2} \cdot \delta$$

Approccio alternativo



Calcolo della freccia in B con il PLV

$$\delta_B = \int_C^E \frac{V_C}{EA} \cdot \frac{b}{l}\, dx + \int_D^F \frac{V_D}{EA} \frac{a}{l}\, dx + \int_0^a \frac{F}{EJ} \left(\frac{b}{l}\xi\right)^2 d\xi + \int_0^b \frac{F}{EJ} \left(\frac{a}{l}\eta\right)^2 d\eta .$$

$$\delta_B = \frac{F}{k}\frac{b^2}{l^2} + \frac{F}{k}\frac{a^2}{l^2} + \frac{Fb^2}{l^2}\frac{a^3}{3EJ} + \frac{Fa^2}{l^2}\frac{b^3}{3EJ}$$

$$\delta_B = \frac{F}{kl^2}(a^2+b^2) + \frac{Fa^2b^2}{3EJl}$$

Ma $F = k(\delta - \delta_B)$ ossia $\frac{F}{k} = \delta - \frac{F}{kl^2}(a^2+b^2) - F\frac{a^2b^2}{3EJl}$

$$F\left(\frac{l^2+a^2+b^2}{kl^2} + \frac{a^2b^2}{3EJl}\right) = \delta$$

$$\boxed{F = \frac{3EJkl^2}{3EJ(l^2+a^2+b^2) + kla^2b^2}}$$

— o —

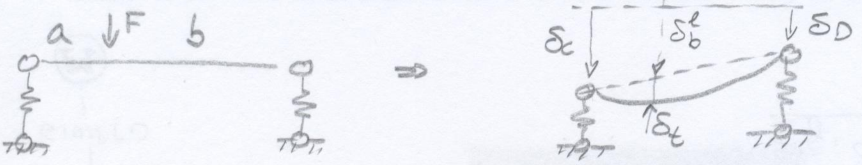
Nel nostro caso $a = \frac{l}{3}$ e $b = \frac{2}{3}l$, per cui

$$l^2+a^2+b^2 = l^2 + \frac{l^2}{9} + \frac{4}{9}l^2 = \frac{14}{9}l^2$$

$$l a^2 b^2 = l \cdot \frac{l^2}{9} \cdot \frac{4l^2}{9} = \frac{4}{81} l^5$$

$$F = \frac{243\, EJk\delta}{378EJ + 4kl^3}$$

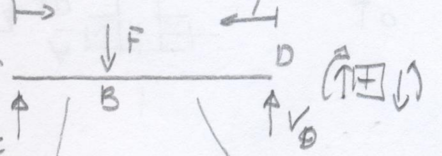
Approccio alternativo (per gli avventurosi)



Da $F = k\delta$ abbiamo $\delta_C = \dfrac{V_C}{k} = \dfrac{Fb}{lk}$ $\qquad \delta_D = \dfrac{V_D}{k} = \dfrac{Fa}{lk}$

Quindi $\delta_b^l = \delta_D + (\delta_C - \delta_D)\cdot\dfrac{b}{l} =$ $\qquad Fa(a+b) = Fa^2 + Fab$

$$= \frac{Fa}{lk} + \left(\frac{Fb}{lk} - \frac{Fa}{lk}\right)\frac{b}{l} = \frac{Fal + Fb^2 - Fab}{l^2k} = F\,\frac{a^2+b^2}{l^2k}$$



$M = V_C\cdot\xi = \dfrac{Fb\xi}{l}$ $\qquad M = V_D\,\eta = \dfrac{Fa}{l}\eta$

$$\delta_B = \delta_t = \int_0^a \frac{F}{ES}\left(\frac{b\xi}{l}\right)^2 d\xi + \int_0^b \frac{F}{ES}\left(\frac{a\eta}{l}\right)^2 d\eta =$$

$$= F\,\frac{b^2a^2l}{3ES\,l^2} = \frac{b^2a^2}{3ESl}\,F$$

$$F = k(\delta - \delta_B) = k\left[\delta - (\delta_b^l + \delta_t)\right] =$$

$$F = k\delta - F\,\frac{a^2+b^2}{l^2} - \frac{b^2a^2k}{3ESl}\,F$$

$$F\left(1 + \frac{a^2+b^2}{l^2} + \frac{a^2b^2k}{3ESl}\right) = k\delta$$

$$F\,\frac{3ESl^2 + 3ES(a^2+b^2) + a^2b^2kl}{3ESl^2} = k\delta$$

da cui $F = \dfrac{3ESkl^2}{3ES(l^2+a^2+b^2) + a^2b^2kl}\cdot\delta$

In realtà io l'ho fatto così!