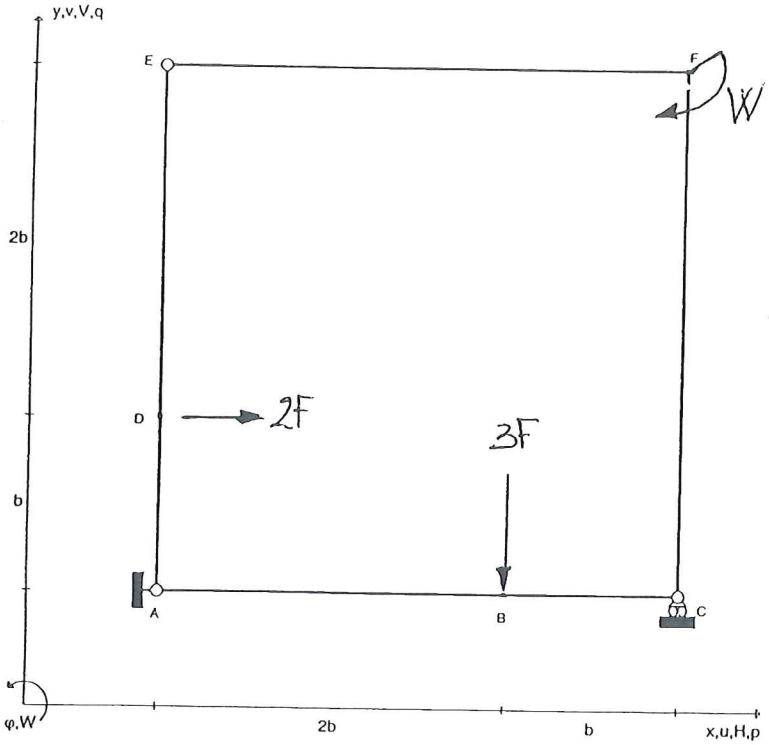
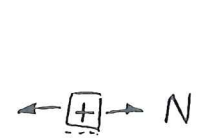
Esercizio n.3 (7 punti)

Risolvere la struttura riportata in Figura e tracciare i grafici delle azioni interne sul tratto EFC.





$W = Fb$

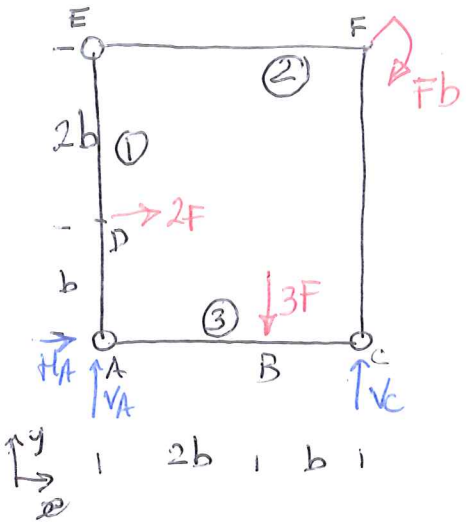
V_A = ...; H_A = ...; V_C = ...;

N_{FC} = ...; N_{EF} = ...;

T_{FC} = ...; T_{EF} = ...;

M_{FC} = ...; M_{EF} = ...;

1/3



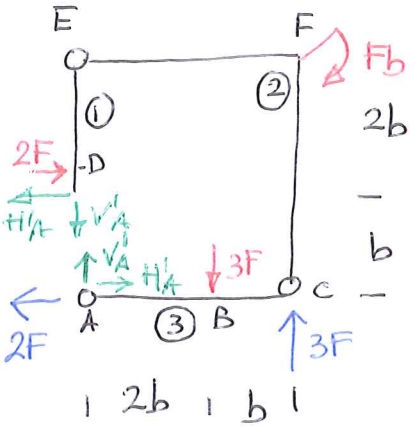
$GDL = 3 \times 3 = 9$

$GDV = 4(A) + 3(C) + 2(E) = 9$

$GDL = GDV \Rightarrow$ STRUTTURA ISOSTATICA

$$\begin{cases} \rightarrow R_x = 0 & H_A + 2F = 0 \\ \uparrow R_y = 0 & V_A - 3F + V_C = 0 \\ \circlearrowleft M_{z(A)} = 0 & -2Fb - 3F \cdot 2b + V_C \cdot 3b - Fb = 0 \end{cases}$$

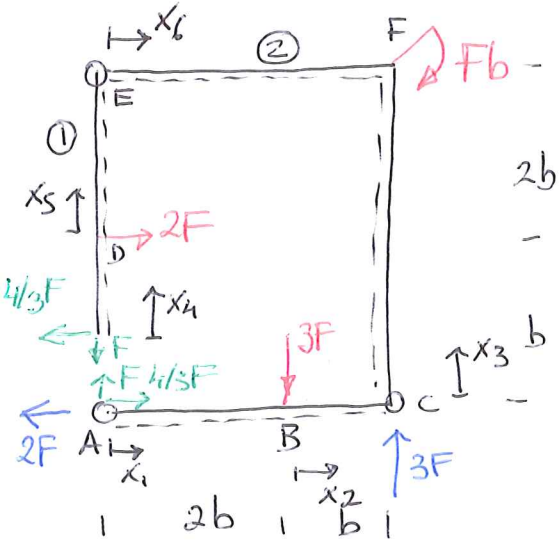
$$\begin{cases} H_A = -2F \\ V_A + V_C = 3F \\ V_C \cdot 3b = 9Fb \end{cases} \Rightarrow \begin{cases} H_A = -2F \\ V_C = 3F \\ V_A = 0 \end{cases}$$



CALCOLO REAZIONI VINCOLO INTERNO A (SULLA TRAVE ①):

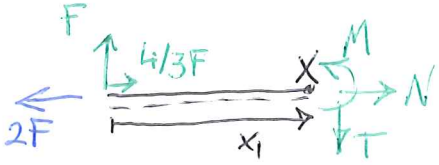
$$\begin{cases} \circlearrowleft M^{①}_{z(E)} = 0 & 2F \cdot 2b - H'_A \cdot 3b = 0 \\ \circlearrowleft M^{③}_{z(C)} = 0 & -V'_A \cdot 3b + 3Fb = 0 \end{cases} \Rightarrow \begin{cases} H'_A = \frac{4}{3}F \\ V'_A = F \end{cases}$$

LA STRUTTURA APERTA IN CONDIZIONI DI EQUILIBRIO È QUINDI:



Ⅰ $A \rightarrow B$

$0 < x_1 < 2b$



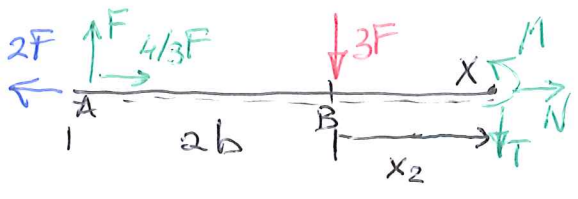
$$\begin{cases} N(x_1) = +\frac{2}{3}F \\ T(x_1) = +F \\ M(x_1) = Fx_1 \end{cases}$$

$M(x_1 = 0) = 0$

$M(x_1 = 2b) = 2Fb$

Ⅱ $B \rightarrow C$

$0 < x_2 < b$



$$\begin{cases} N(x_2) = +\frac{2}{3}F \\ T(x_2) = -2F \\ M(x_2) = 2F[b - x_2] \end{cases}$$

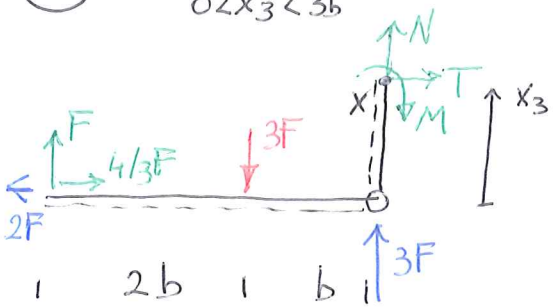
$M(x_2 = 0) = 2Fb$

$M(x_2 = b) = 0$

III

$C \to F$

$0 < x_3 < 3b$



$$N(x_3) = -F$$
$$T(x_3) = \frac{2}{3}F$$
$$M(x_3) = -\frac{2}{3}Fx_3$$

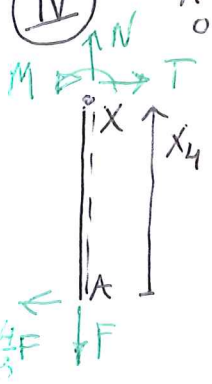
$M(x_3=0) = 0$

$M(x_3=3b) = -2Fb$

IV

$A \to D$

$0 < x_4 < b$



$$N(x_4) = +F$$
$$T(x_4) = \frac{4}{3}F$$
$$M(x_4) = \frac{4}{3}Fx_4$$

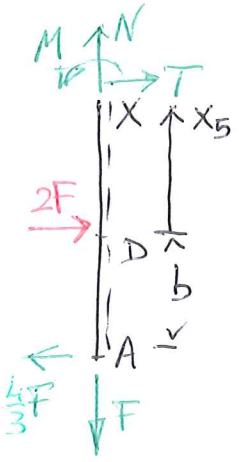
$M(x_4=0) = 0$

$M(x_4=b) = \frac{4}{3}Fb$

V

$D \to E$

$0 < x_5 < 2b$



$$N(x_5) = +F$$
$$T(x_5) = -\frac{2}{3}F$$
$$M(x_5) = \frac{2}{3}F[2b - x_5]$$

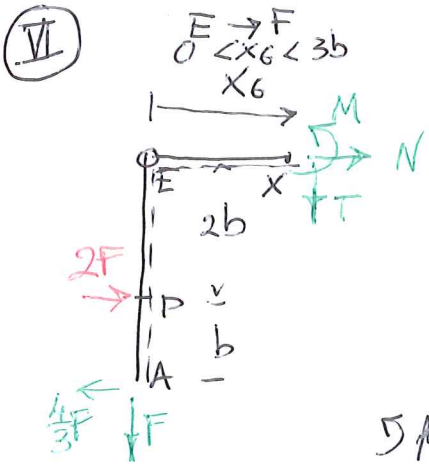
$M(x_5=0) = \frac{4}{3}Fb$

$M(x_5=2b) = 0$

VI

$E \to F$

$0 < x_6 < 3b$

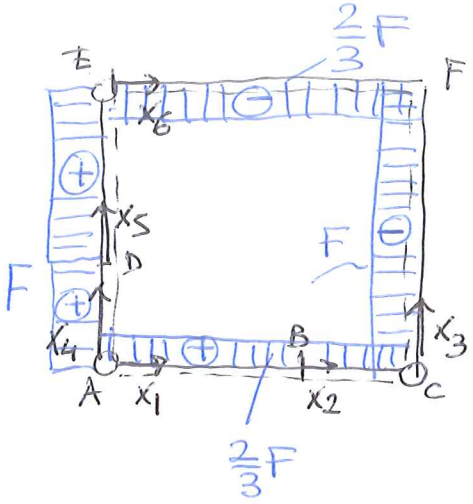


$$N(x_6) = -\frac{2}{3}F$$
$$T(x_6) = -F$$
$$M(x_6) = -Fx_6$$

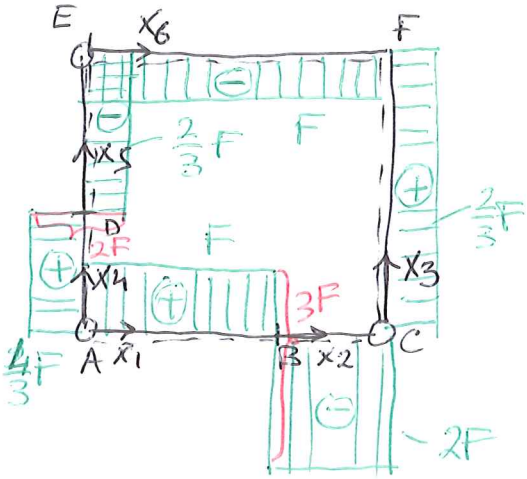
$M(x_6=0) = 0$

$M(x_6=3b) = -3Fb$

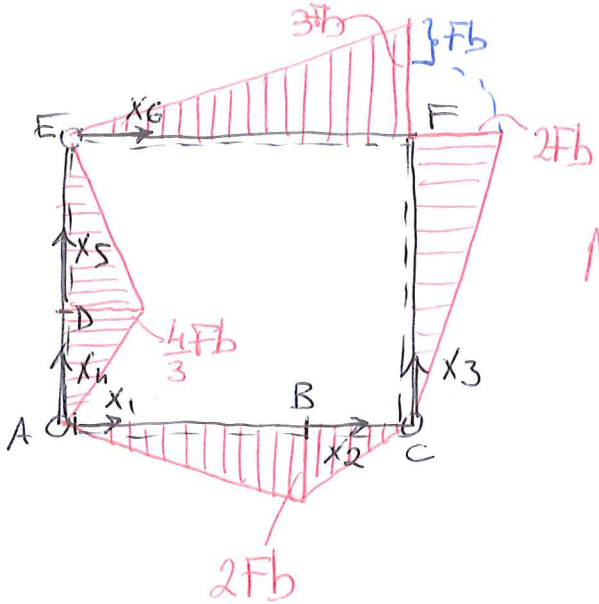
$\sum M_{E(x)} = 0 \quad -\frac{4F}{3} \cdot 3b + 2F \cdot 2b + Fx_6 + M(x_6) = 0$



N ← [+] →

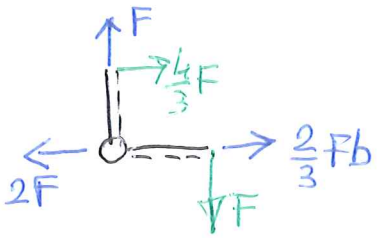


T [+]

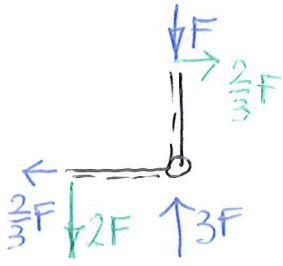


M (□)

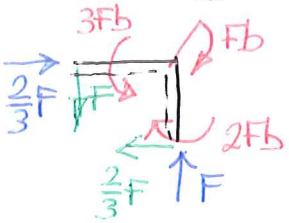
NODO (A)



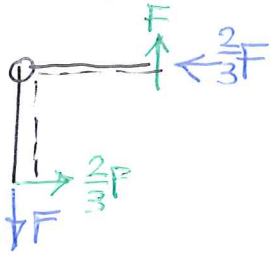
NODO (C)

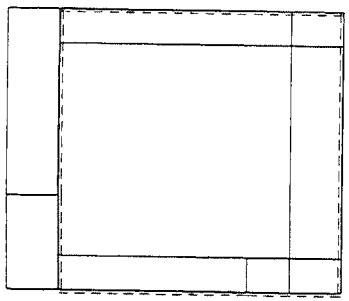


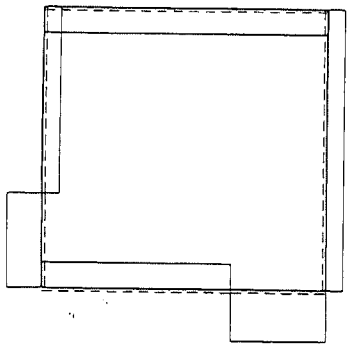
NODO (F)

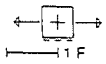


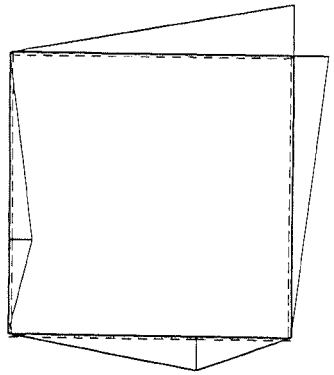
NODO (E)











AZIONI INTERNE (coordinate locali)

$N_{AB} = 2/3F$
$T_{AB} = F$
$M_{AB} = Fx$

$N_{BC} = 2/3F$
$T_{BC} = -2F$
$M_{BC} = 2Fb - 2Fx$

$N_{AD} = F$
$T_{AD} = 4/3F$
$M_{AD} = 4/3Fx$

$N_{DE} = F$
$T_{DE} = -2/3F$
$M_{DE} = 4/3Fb - 2/3Fx$

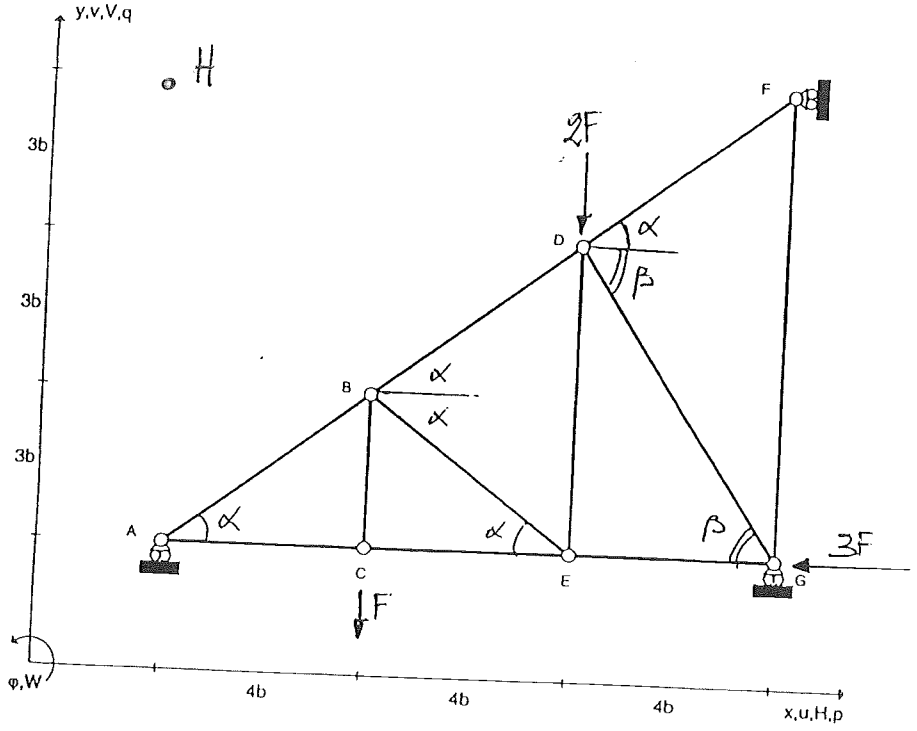
$N_{EF} = -2/3F$
$T_{EF} = -F$
$M_{EF} = -Fx$

$N_{FC} = -F$
$T_{FC} = 2/3F$
$M_{FC} = -2Fb + 2/3Fx$

Esercizio n.2 (8 punti)

Risolvere la struttura reticolare indicata in Figura; calcolare i valori delle azioni assiali nelle singole aste e indicare, ingrossandole nel disegno, quali si comportano come puntoni.

Si ricorda che $\text{sen}\alpha=3/5$, $\cos\alpha=4/5$, $\text{sen}\beta=6/\sqrt{52}$ e $\cos\beta=4/\sqrt{52}$.



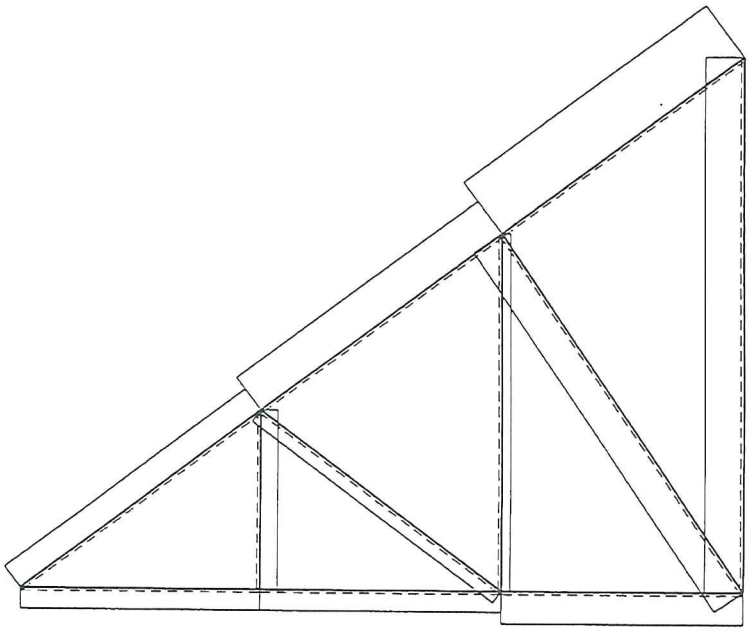
$V_A = -\frac{11}{12}F(\uparrow) = \frac{11}{12}F(\downarrow)$; $V_G = \frac{47}{12}F\ (\uparrow)$; $H_F = 3F\ (\rightarrow)$;

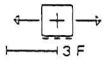
N_{AB} = ...; N_{AC} = ...; N_{BC} = ...; N_{CE} = ...;

N_{BE} = ...; N_{BD} = ...; N_{EG} = ...;

N_{DG} = ...; N_{DF} = ...; N_{FG} = ...

1/2





AZIONI INTERNE (coordinate locali)

$N_{AB} = 55/36F$ $T_{AB} = 0$ $M_{AB} = 0$	$N_{AC} = -11/9F$ $T_{AC} = 0$ $M_{AC} = 0$	$N_{BC} = F$ $T_{BC} = 0$ $M_{BC} = 0$	$N_{BE} = -5/6F$ $T_{BE} = 0$ $M_{BE} = 0$
$N_{CE} = -11/9F$ $T_{CE} = 0$ $M_{CE} = 0$	$N_{BD} = 85/36F$ $T_{BD} = 0$ $M_{BD} = 0$	$N_{DE} = 1/2F$ $T_{DE} = 0$ $M_{DE} = 0$	$N_{EG} = -17/9F$ $T_{EG} = 0$ $M_{EG} = 0$
$N_{DG} = -5\sqrt{13}/9F$ $T_{DG} = 0$ $M_{DG} = 0$	$N_{DF} = 15/4F$ $T_{DF} = 0$ $M_{DF} = 0$	$N_{FG} = -9/4F$ $T_{FG} = 0$ $M_{FG} = 0$	