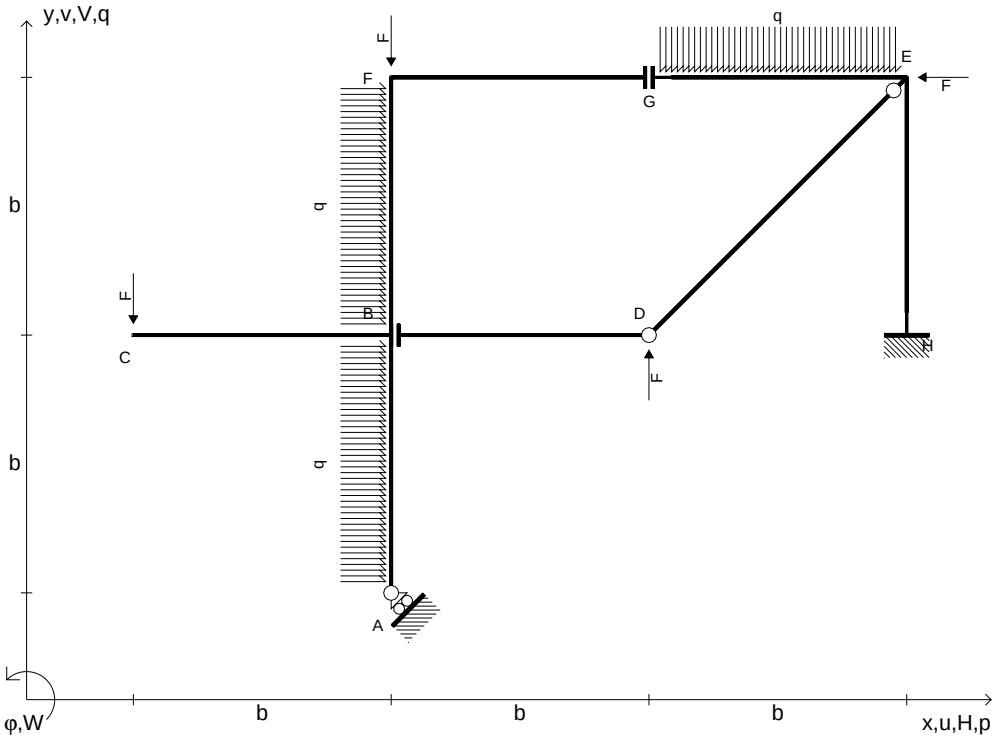

$V_C = -F$
$V_F = -F$
$H_E = -F$
$V_D = F$
$p_{AB} = q = F/b$
$p_{BF} = q = F/b$

$q_{GE} = -q = -F/b$
$EJ_{AB} = EJ$
$EJ_{BC} = EJ$
$EJ_{BD} = EJ$
$EJ_{DE} = EJ$
$EJ_{BF} = EJ$

$EJ_{FG} = EJ$
$EJ_{GE} = EJ$
$EJ_{EH} = EJ$

1
1
Piano A

Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.
Piano di scorrimento del vincolo con inclinazione assegnata.

Struttura Isostatica.001

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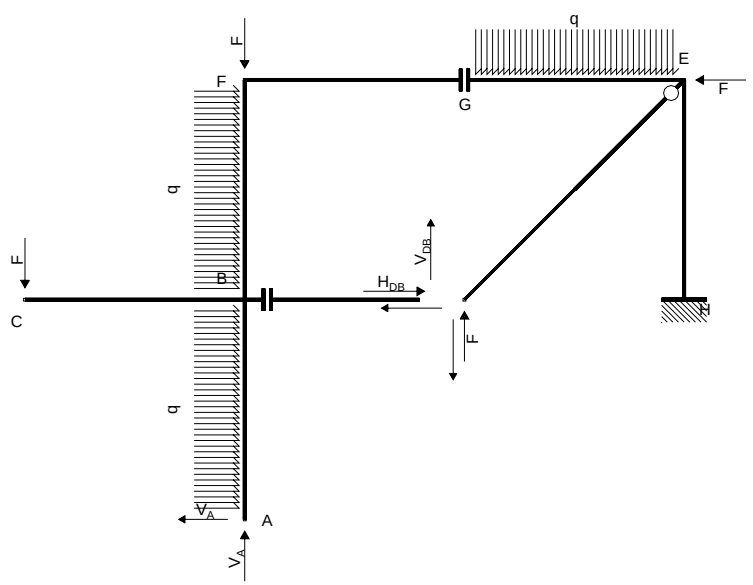


EQUAZIONI DI EQUILIBRIO

Rotazione intorno a E: aste ED

$-H_{DB}b + V_{DB}b = Fb$

Traslazione verticale: aste GF FB BA BC BD

$V_A + V_{DB} = 2F$

Traslazione verticale: aste BD

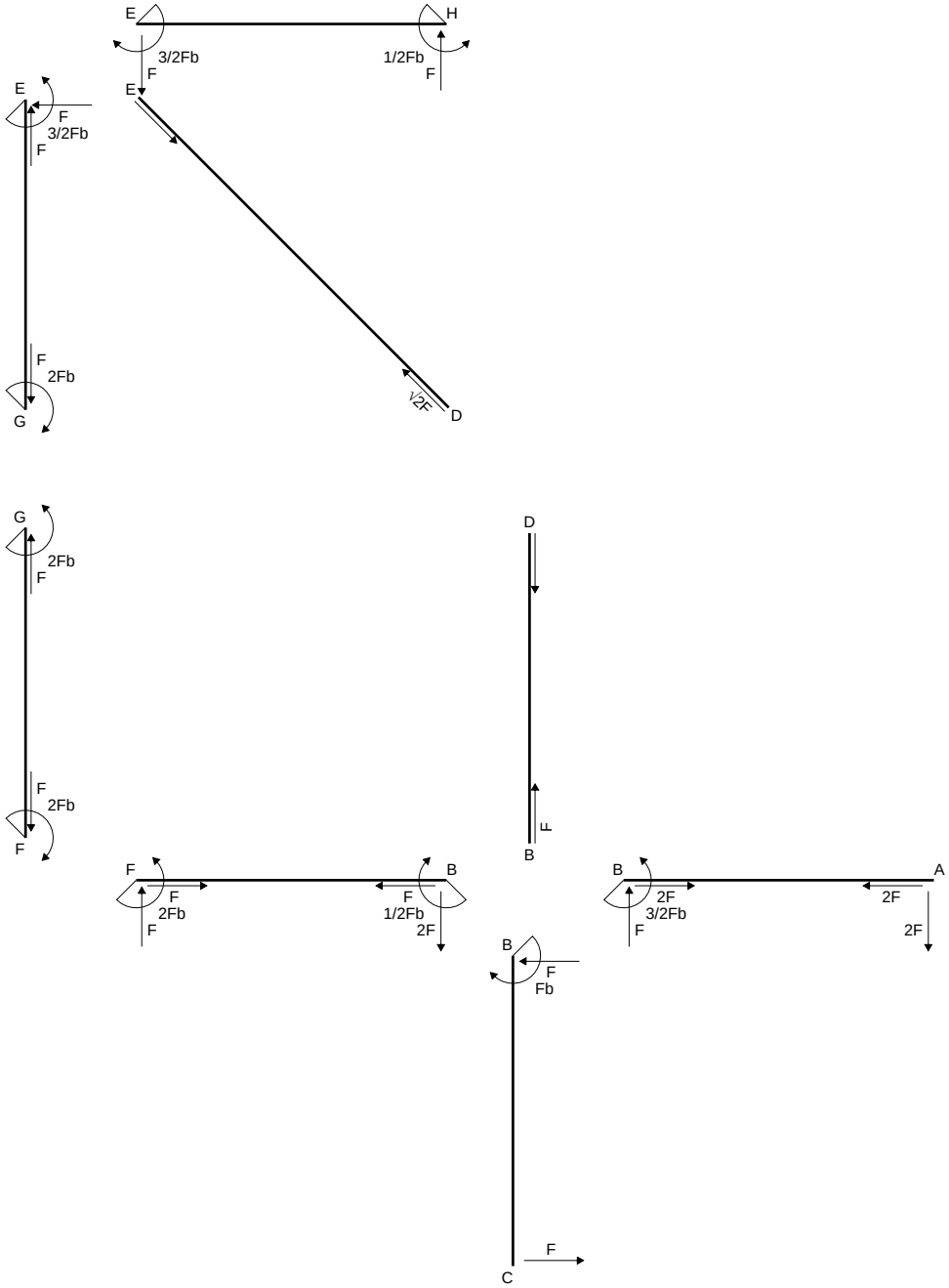
$V_{DB} = 0$

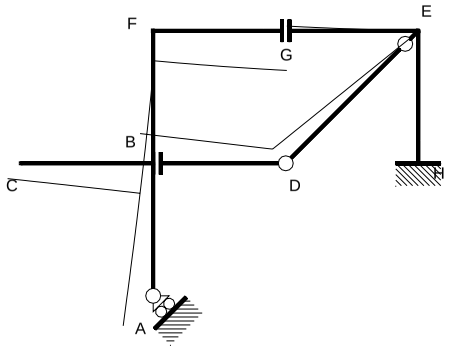
Matrice di equilibrio

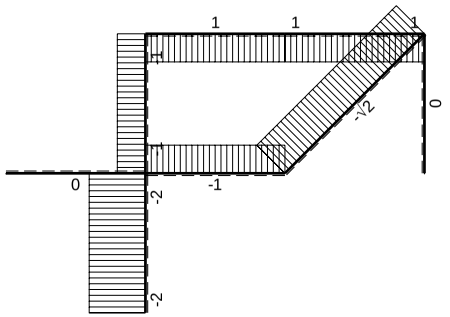
$$\begin{array}{c} \\ \varphi_{ED} \\ v_{GF} \\ v_{BD} \end{array} \begin{bmatrix} V_A b & H_{DB} b & V_{DB} b \\ 0 & -1 & 1 \\ 1 & 0 & 1 \\ 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 1 & 0 \\ 2 & 0 \\ 0 & 0 \end{bmatrix}$$

Soluzione del sistema

$$\begin{bmatrix} H_{DB} b \\ V_A b \\ V_{DB} b \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ -1 & 0 \\ 2 & 0 \\ 0 & 0 \end{bmatrix}$$

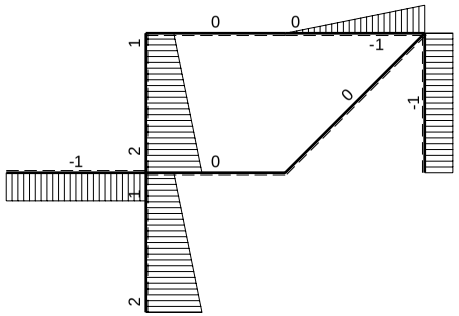


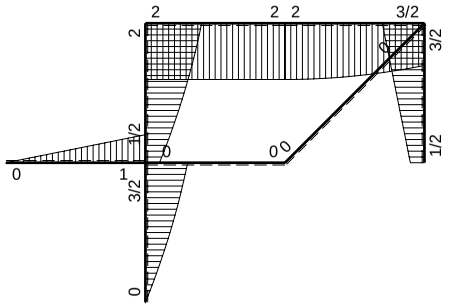




$\vdash\!\!\dashv$ 30 Fb^3/EJ

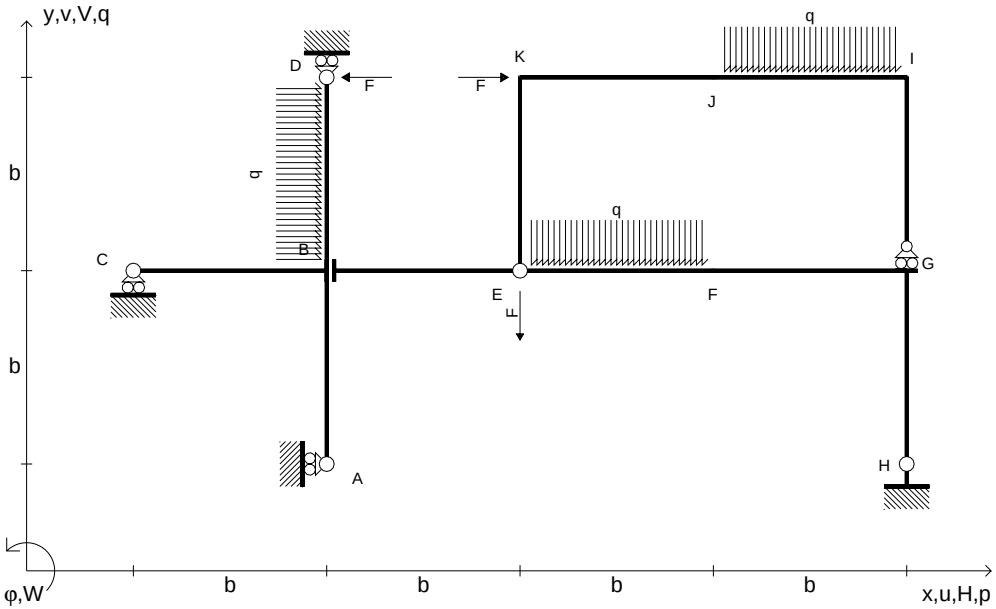
$\leftarrow$ F $\rightarrow$





F

Fb



$V_E = -F$	$p_{BD} = q = F/b$	$EJ_{AB} = EJ$	$EJ_{BE} = EJ$	$EJ_{GH} = EJ$	$EJ_{JK} = EJ$
$H_D = -F$	$q_{EF} = -q = -F/b$	$EJ_{BC} = EJ$	$EJ_{EF} = EJ$	$EJ_{GI} = EJ$	$EJ_{KE} = EJ$
$H_K = F$	$q_{IJ} = -q = -F/b$	$EJ_{BD} = EJ$	$EJ_{FG} = EJ$	$EJ_{IJ} = EJ$	

Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.

Struttura Isostatica.001

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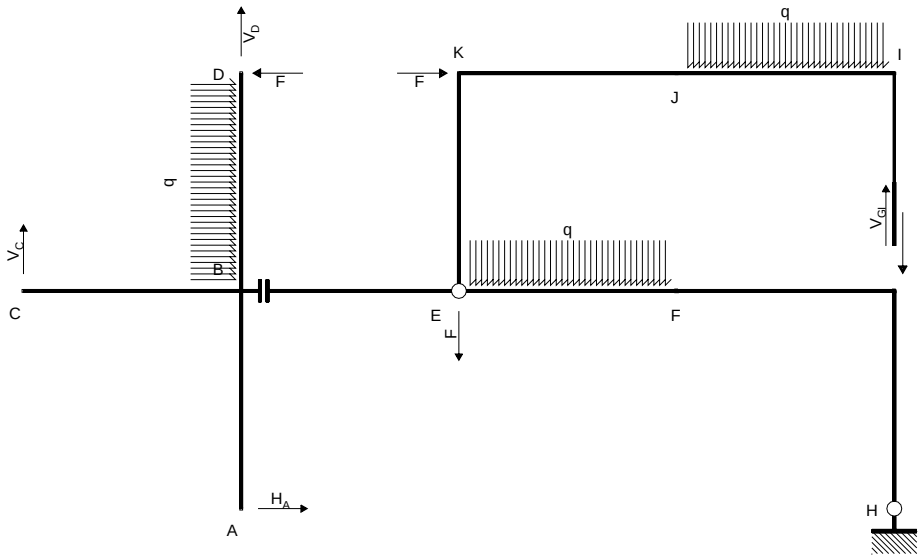


EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a H

$-4V_Cb -3V_Db = -2Fb -1/2qb^2$

Rotazione intorno a E: aste EB EK BA BC BD KJ JI IG

$H_Ab -2V_Cb -V_Db +2V_{GI}b = 2qb^2$

Traslazione verticale: aste BA BC BD

$V_C +V_D = 0$

Rotazione intorno a E: aste EK KJ JI IG

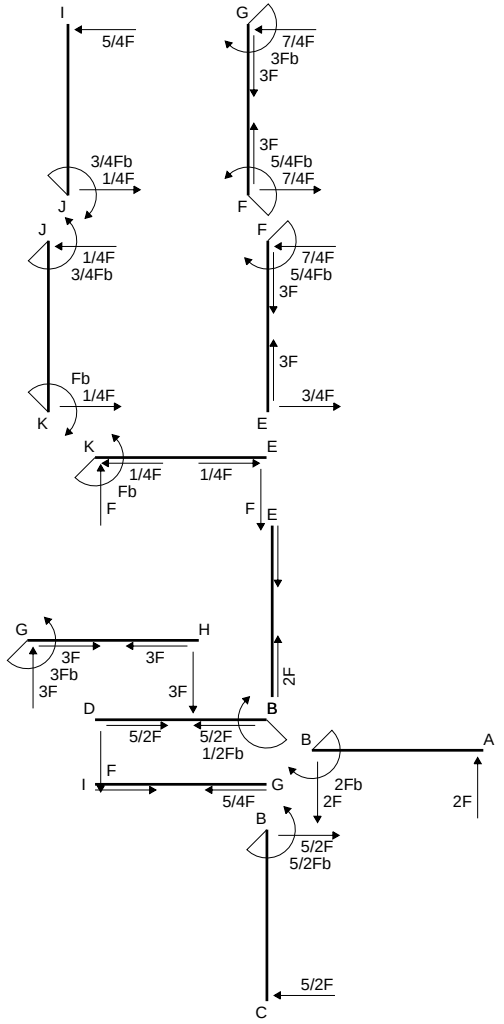
$2V_{GI}b = Fb +3/2qb^2$

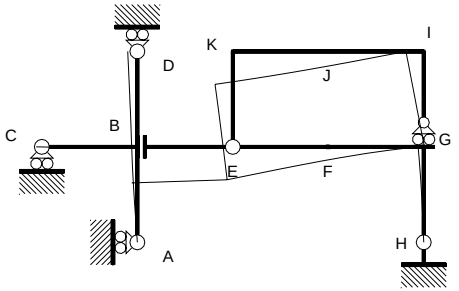
Matrice di equilibrio

$$\begin{array}{c} \\ \varphi_H \\ \varphi_{EF} \\ v_{BE} \\ \varphi_{EK} \end{array} \begin{array}{c} \begin{bmatrix} H_Ab & V_Cb & V_Db & V_{GI}b \end{bmatrix} \\ \begin{bmatrix} 0 & -4 & -3 & 0 \\ 1 & -2 & -1 & 2 \\ 0 & 1 & 1 & 0 \\ 0 & 0 & 0 & 2 \end{bmatrix} \end{array} = \begin{bmatrix} Fb & qb^2 \end{bmatrix} \begin{bmatrix} -2 & -1/2 \\ 0 & 2 \\ 0 & 0 \\ 1 & 3/2 \end{bmatrix}$$

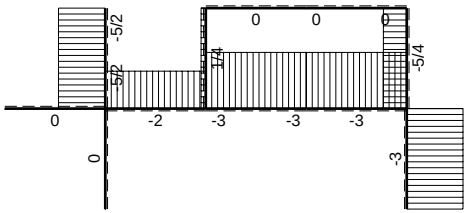
Soluzione del sistema

$$\begin{bmatrix} V_Cb \\ H_Ab \\ V_Db \\ V_{GI}b \end{bmatrix} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 2 & 1/2 \\ 1 & 1 \\ -2 & -1/2 \\ 1/2 & 3/4 \end{bmatrix} \end{array}$$

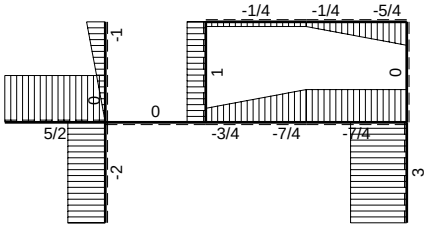




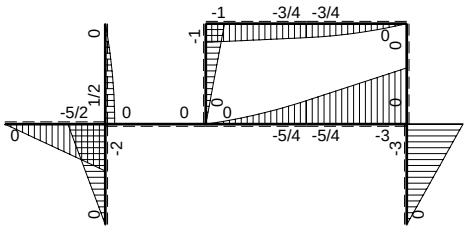
20 Fb^3/EJ



F



F



Fb

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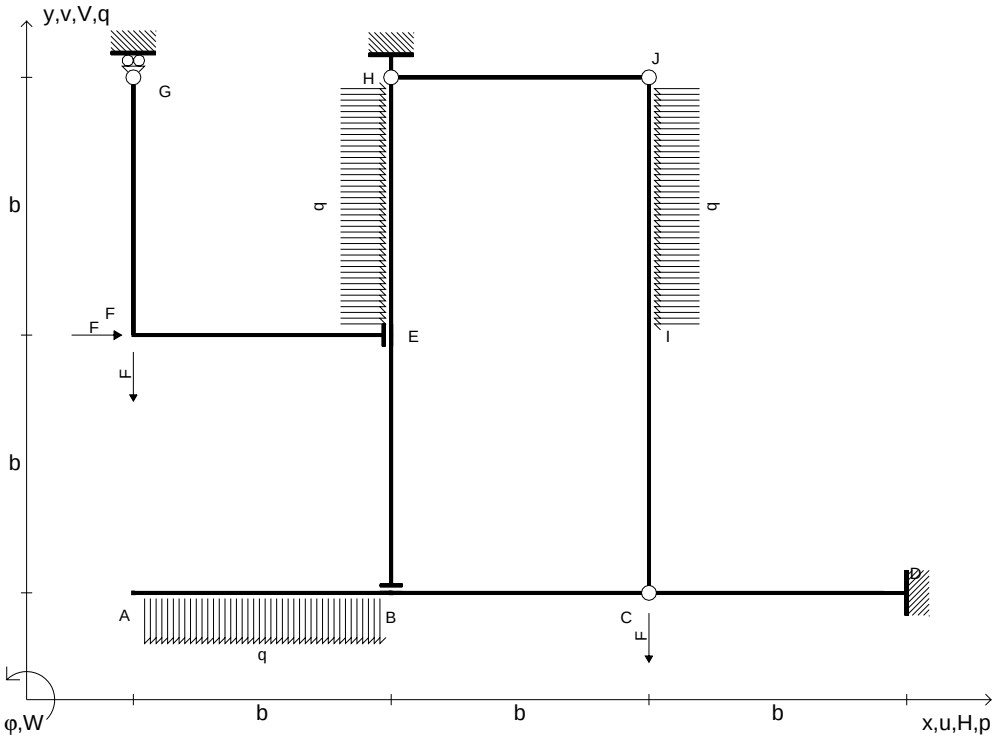

$V_F = -F$ $q_{AB} = -q = -F/b$ $EJ_{AB} = EJ$ $EJ_{BE} = EJ$ $EJ_{EH} = EJ$ $EJ_{JH} = EJ$

$V_C = -F$ $p_{EH} = q = F/b$ $EJ_{BC} = EJ$ $EJ_{EF} = EJ$ $EJ_{CI} = EJ$

$H_F = F$ $p_{IJ} = -q = -F/b$ $EJ_{CD} = EJ$ $EJ_{FG} = EJ$ $EJ_{IJ} = EJ$

Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.

Struttura Isostatica.001

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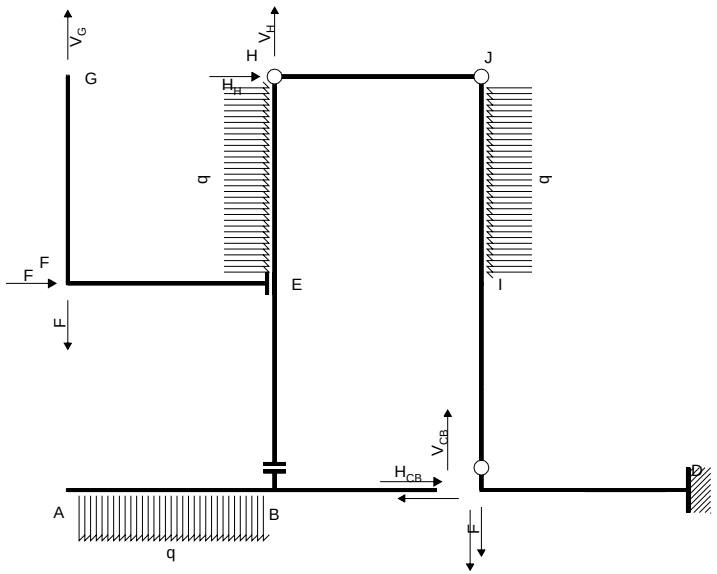


EQUAZIONI DI EQUILIBRIO

Rotazione intorno a C: aste CI IJ JH HE EB EF BA BC FG

$-2V_G b -2H_H b -V_H b = -Fb -3/2qb^2$

Rotazione intorno a J: aste JH HE EB EF BA BC FG

$-2V_G b -V_H b +2H_{CB} b = -3Fb -2qb^2$

Rotazione intorno a H: aste HE EB EF BA BC FG

$-V_G b +2H_{CB} b +V_{CB} b = -2Fb -qb^2$

Traslazione orizzontale: aste BA BC

$H_{CB} = 0$

Traslazione verticale: aste EF FG

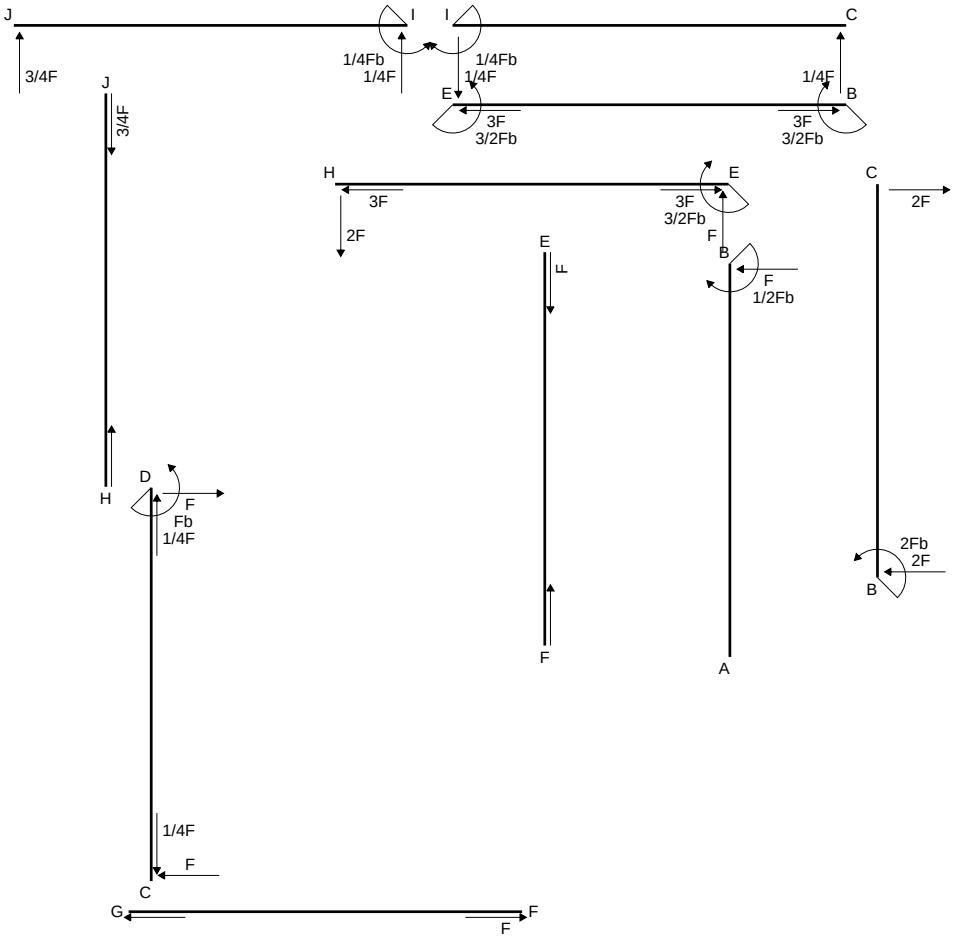
$V_G = F$

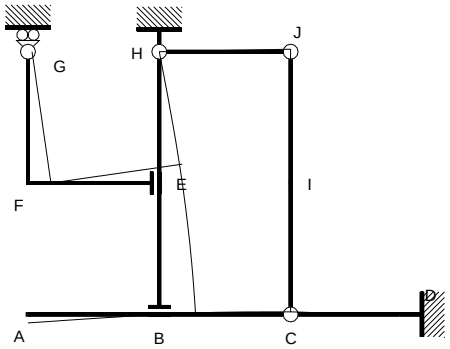
Matrice di equilibrio

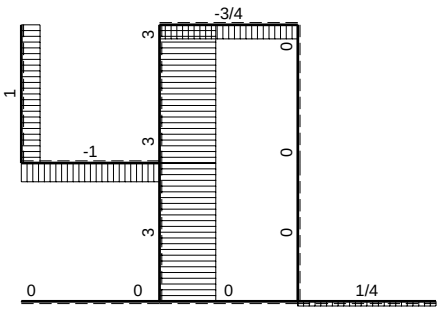
$$\begin{array}{c} \\ \varphi_{CI} \\ \varphi_{JI} \\ \varphi_{HJ} \\ u_{BE} \\ v_{EF} \end{array} \begin{bmatrix} V_G b & H_H b & V_H b & H_{CB} b & V_{CB} b \\ -2 & -2 & -1 & 0 & 0 \\ -2 & 0 & -1 & 2 & 0 \\ -1 & 0 & 0 & 2 & 1 \\ 0 & 0 & 0 & 1 & 0 \\ 1 & 0 & 0 & 0 & 0 \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ -1 & -3/2 \\ -3 & -2 \\ -2 & -1 \\ 0 & 0 \\ 1 & 0 \end{bmatrix}$$

Soluzione del sistema

$$\begin{bmatrix} V_G b \\ H_H b \\ V_H b \\ H_{CB} b \\ V_{CB} b \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 1 & 0 \\ -1 & -1/4 \\ 1 & 2 \\ 0 & 0 \\ -1 & -1 \end{bmatrix}$$

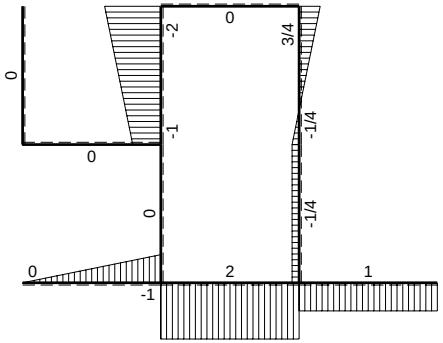


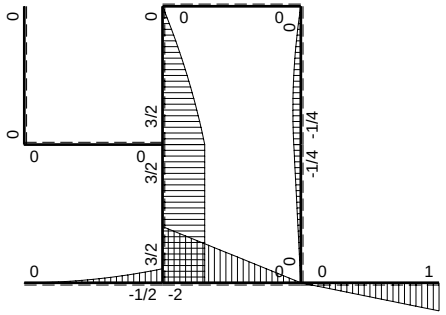




$\vdash\!\!\!\dashv$ 10 Fb^3/EJ

$\leftarrow$ F $\rightarrow$





F

Fb

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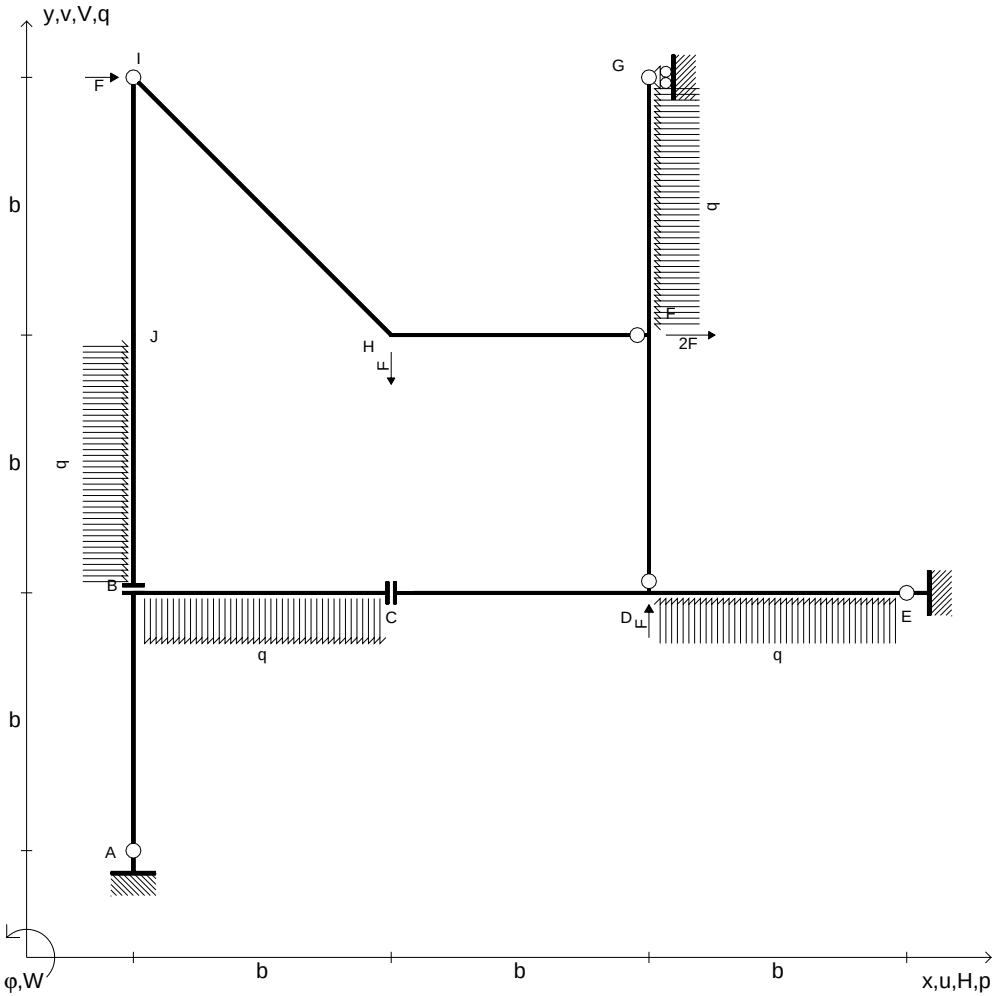

$V_H = -F$	$H_I = F$	$p_{FG} = -q = -F/b$	$EJ_{BC} = EJ$	$EJ_{DF} = EJ$	$EJ_{HI} = EJ$
$H_F = 2F$	$q_{BC} = -q = -F/b$	$p_{JB} = q = F/b$	$EJ_{CD} = EJ$	$EJ_{FG} = EJ$	$EJ_{IJ} = EJ$
$V_D = F$	$q_{DE} = q = F/b$	$EJ_{AB} = EJ$	$EJ_{DE} = EJ$	$EJ_{FH} = EJ$	$EJ_{JB} = EJ$

Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.

Struttura Isostatica.001

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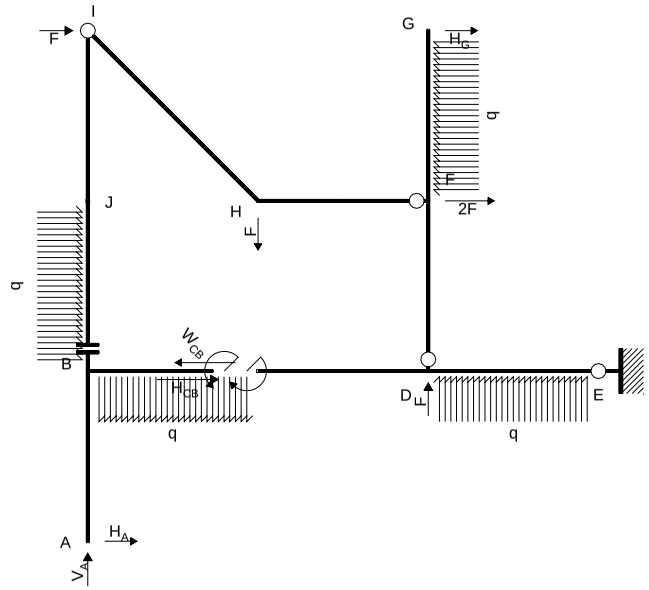


EQUAZIONI DI EQUILIBRIO

Rotazione globale intorno a E

$H_A b - 3V_A b - 2H_G b = 3Fb - 3qb^2$

Rotazione intorno a D: aste DF FG FH HI IJ JB BA BC

$H_A b - 2V_A b - 2H_G b + W_{CB} = 3Fb - 5/2qb^2$

Rotazione intorno a F: aste FH HI IJ JB BA BC

$2H_A b - 2V_A b + H_{CB} b + W_{CB} = -2qb^2$

Rotazione intorno a I: aste IJ JB BA BC

$3H_A b + 2H_{CB} b + W_{CB} = -qb^2$

Traslazione orizzontale: aste BA BC

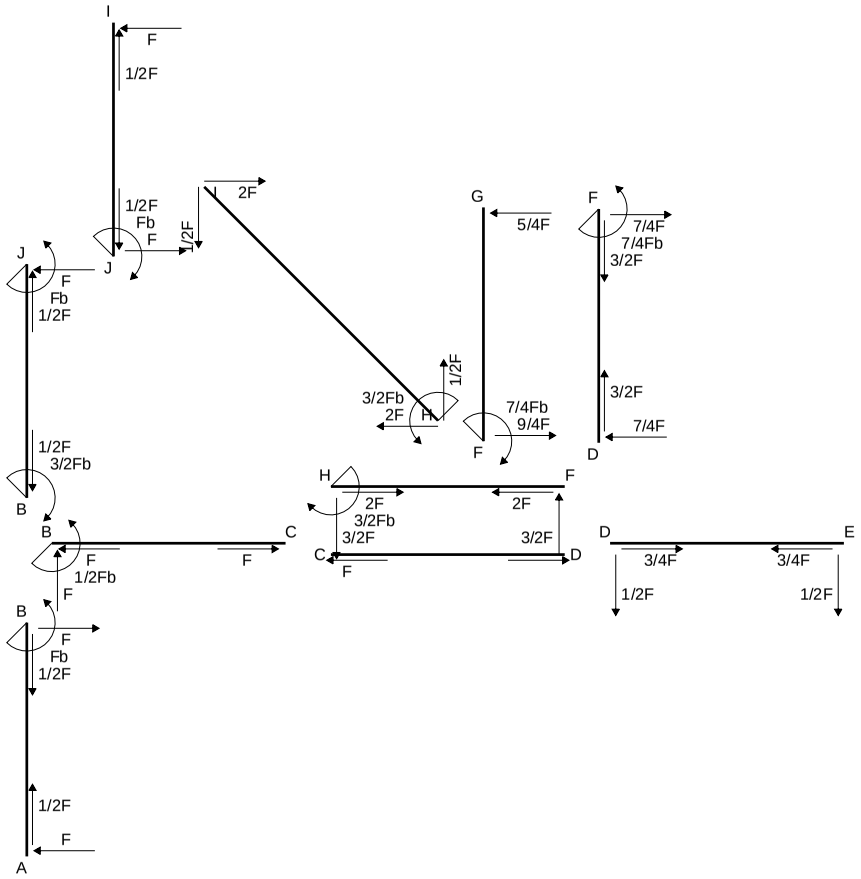
$H_A + H_{CB} = 0$

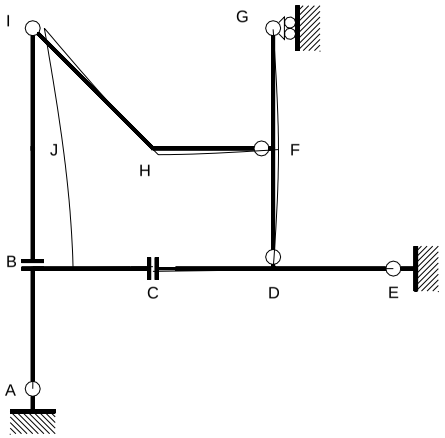
Matrice di equilibrio

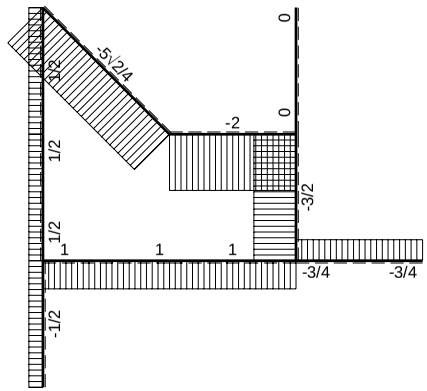
$$\begin{array}{c} \\ \varphi_E \\ \varphi_{DF} \\ \varphi_{FH} \\ \varphi_{IJ} \\ u_{BJ} \end{array} \begin{bmatrix} H_A b & V_A b & H_G b & H_{CB} b & W_{CB} \\ 1 & -3 & -2 & 0 & 0 \\ 1 & -2 & -2 & 0 & 1 \\ 2 & -2 & 0 & 1 & 1 \\ 3 & 0 & 0 & 2 & 1 \\ 1 & 0 & 0 & 1 & 0 \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 3 & -3 \\ 3 & -5/2 \\ 0 & -2 \\ 0 & -1 \\ 0 & 0 \end{bmatrix}$$

Soluzione del sistema

$$\begin{bmatrix} H_A b \\ V_A b \\ H_G b \\ H_{CB} b \\ W_{CB} \end{bmatrix} = \begin{array}{c} \begin{bmatrix} Fb & qb^2 \end{bmatrix} \\ \begin{bmatrix} 0 & -1 \\ 0 & 1/2 \\ -3/2 & 1/4 \\ 0 & 1 \\ 0 & 0 \end{bmatrix} \end{array}$$

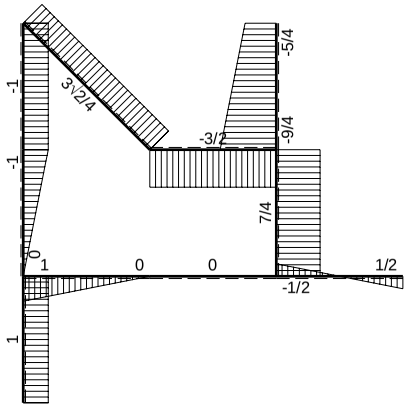


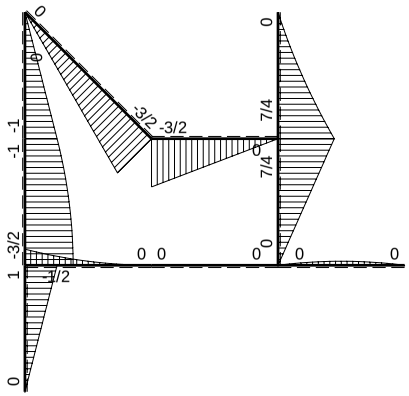

I
G
J
H
F
B
C
D
E
A


-5√2/4
1/2
-2
-3/2
-3/4
-1/2
1
1
1

8 Fb^3/EJ

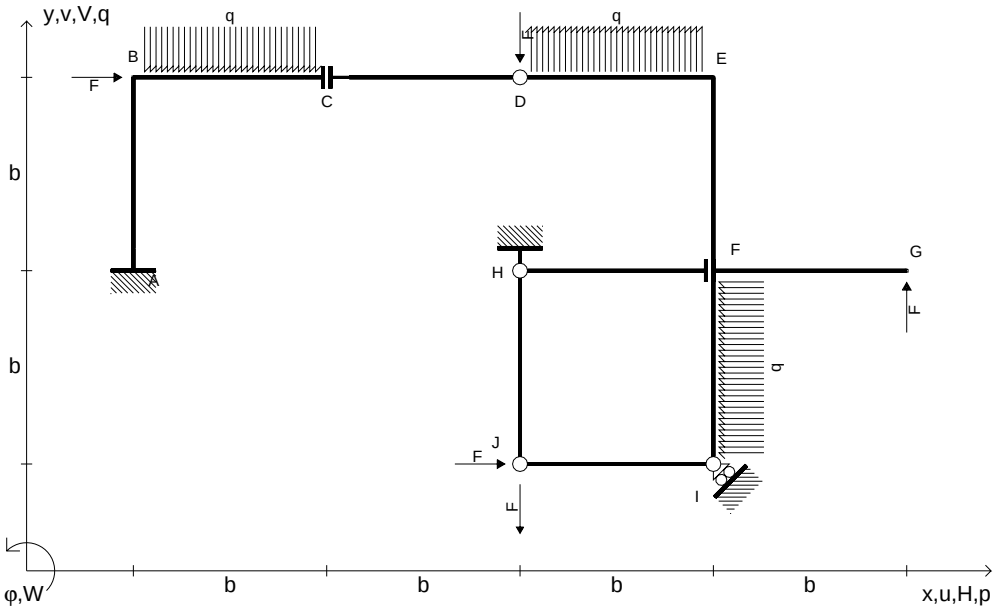
F


3√2/4
-5/4
-3/2
-9/4
7/4
-1/2
1
0
0
1/2


-3/2
-3/2
7/4
7/4
-3/2
0 0
0
0
0

F

Fb



$V_D = -F$
$H_B = F$
$V_G = F$
$H_J = F$
$V_J = -F$
$q_{BC} = -q = -F/b$

$q_{DE} = q = F/b$
$p_{FI} = -q = -F/b$
$EJ_{AB} = EJ$
$EJ_{BC} = EJ$
$EJ_{CD} = EJ$
$EJ_{DE} = EJ$

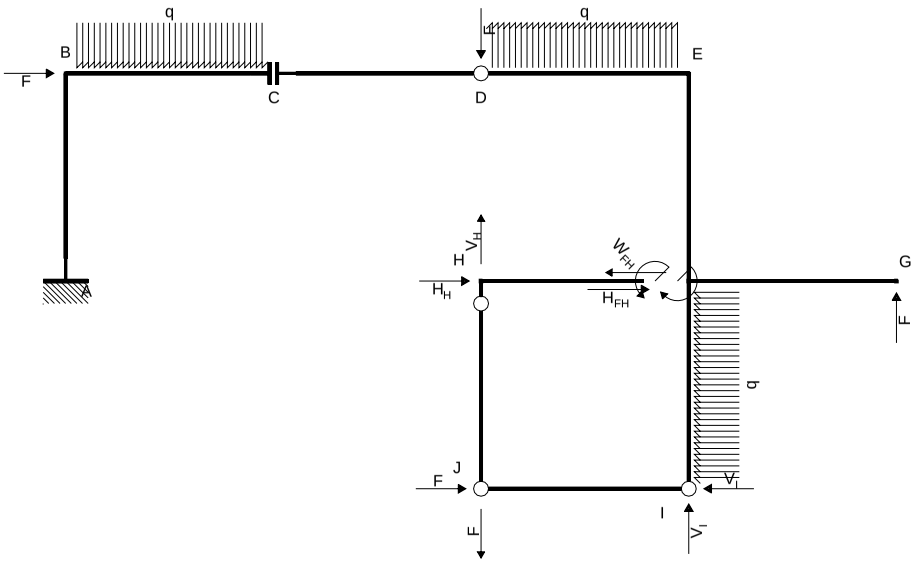
$EJ_{EF} = EJ$
$EJ_{FG} = EJ$
$EJ_{FH} = EJ$
$EJ_{FI} = EJ$
$EJ_{HJ} = EJ$
$EJ_{JI} = EJ$

1
1
Piano I

Carichi e deformazioni date hanno verso efficace in disegno.
Calcolare reazioni vincolari della struttura e delle aste.
Tracciare i diagrammi quotati delle azioni interne nelle aste.
J_{YZ} - x_{YZ} - θ_{YZ} riferimento locale asta YZ con origine in Y.
Piano di scorrimento del vincolo con inclinazione assegnata.

Struttura Isostatica.001

@ Adolfo Zavelani Rossi, Politecnico di Milano, vers.27.03.13 02.11.15



EQUAZIONI DI EQUILIBRIO

Traslazione verticale: aste CD DE EF FG FI IJ JH HF

$V_H + V_I = F - qb$

Rotazione intorno a D: aste DE EF FG FI IJ JH HF

$H_H b - V_I b = -4Fb + qb^2$

Rotazione intorno a J: aste JH HF

$-H_H b - H_{FH} b + W_{FH} = 0$

Rotazione intorno a I: aste IJ JH HF

$-H_H b - V_H b - H_{FH} b + W_{FH} = -Fb$

Rotazione intorno a H: aste HF

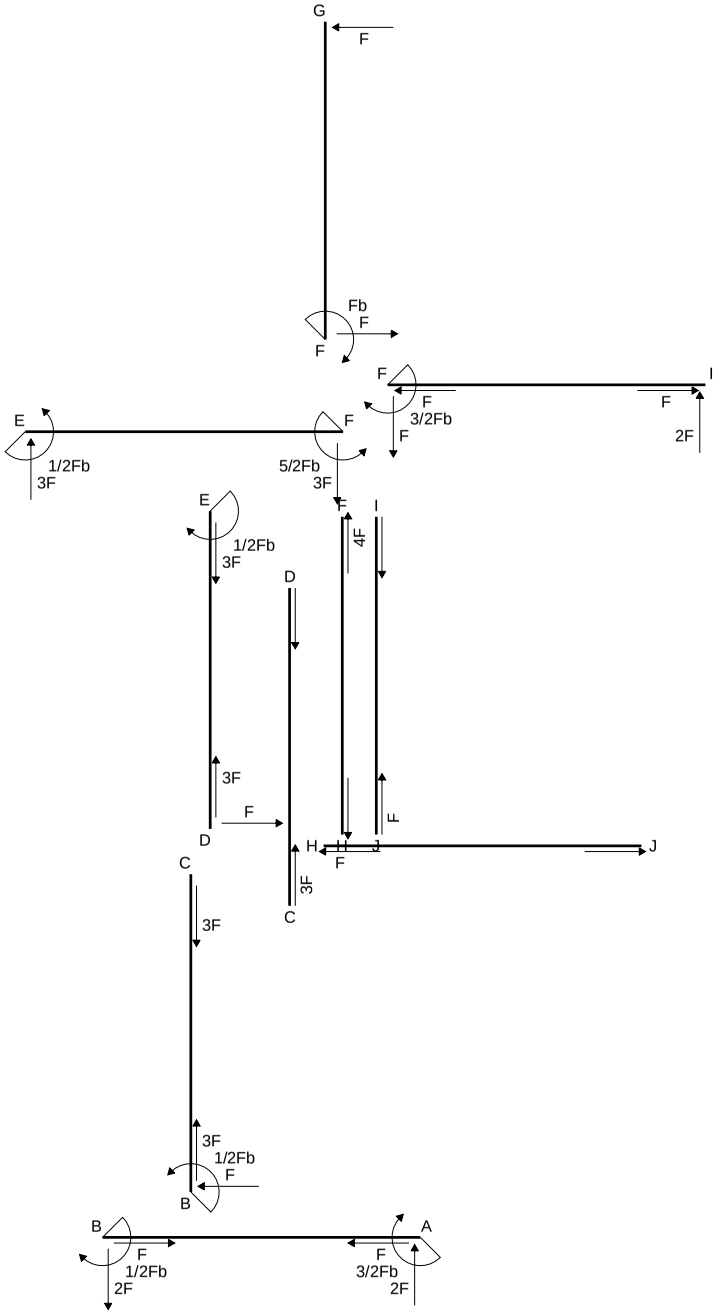
$W_{FH} = 0$

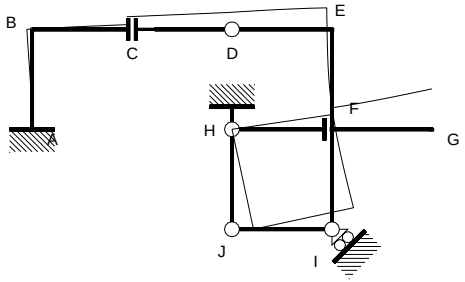
Matrice di equilibrio

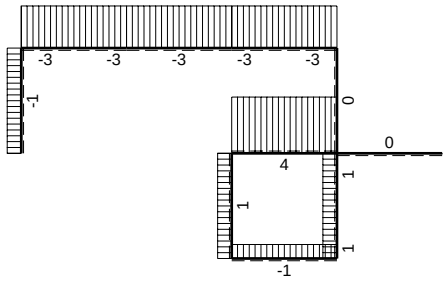
$$\begin{array}{c} \\ v_{CB} \\ \varphi_{DC} \\ \varphi_{JI} \\ \varphi_{IJ} \\ \varphi_{HJ} \end{array} \begin{bmatrix} H_H b & V_H b & V_I b & H_{FH} b & W_{FH} \\ 0 & 1 & 1 & 0 & 0 \\ 1 & 0 & -1 & 0 & 0 \\ -1 & 0 & 0 & -1 & 1 \\ -1 & -1 & 0 & -1 & 1 \\ 0 & 0 & 0 & 0 & 1 \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 1 & -1 \\ -4 & 1 \\ 0 & 0 \\ -1 & 0 \\ 0 & 0 \end{bmatrix}$$

Soluzione del sistema

$$\begin{bmatrix} V_H b \\ H_H b \\ V_I b \\ H_{FH} b \\ W_{FH} \end{bmatrix} = \begin{bmatrix} Fb & qb^2 \\ 1 & 0 \\ -4 & 0 \\ 0 & -1 \\ 4 & 0 \\ 0 & 0 \end{bmatrix}$$

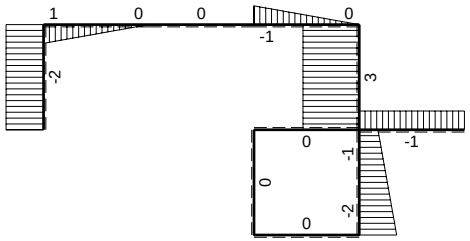


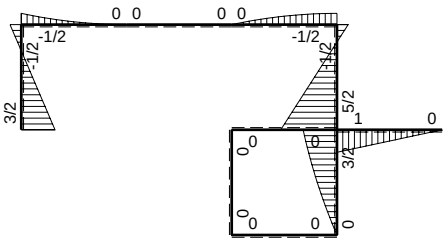




$\vdash\!\!\!\!\dashv$ 6 Fb^3/EJ

$\leftarrow$ F $\rightarrow$





$\uparrow$ F $\downarrow$

Fb