

g : n° GDL DEL SISTEMA ($g=3N$)

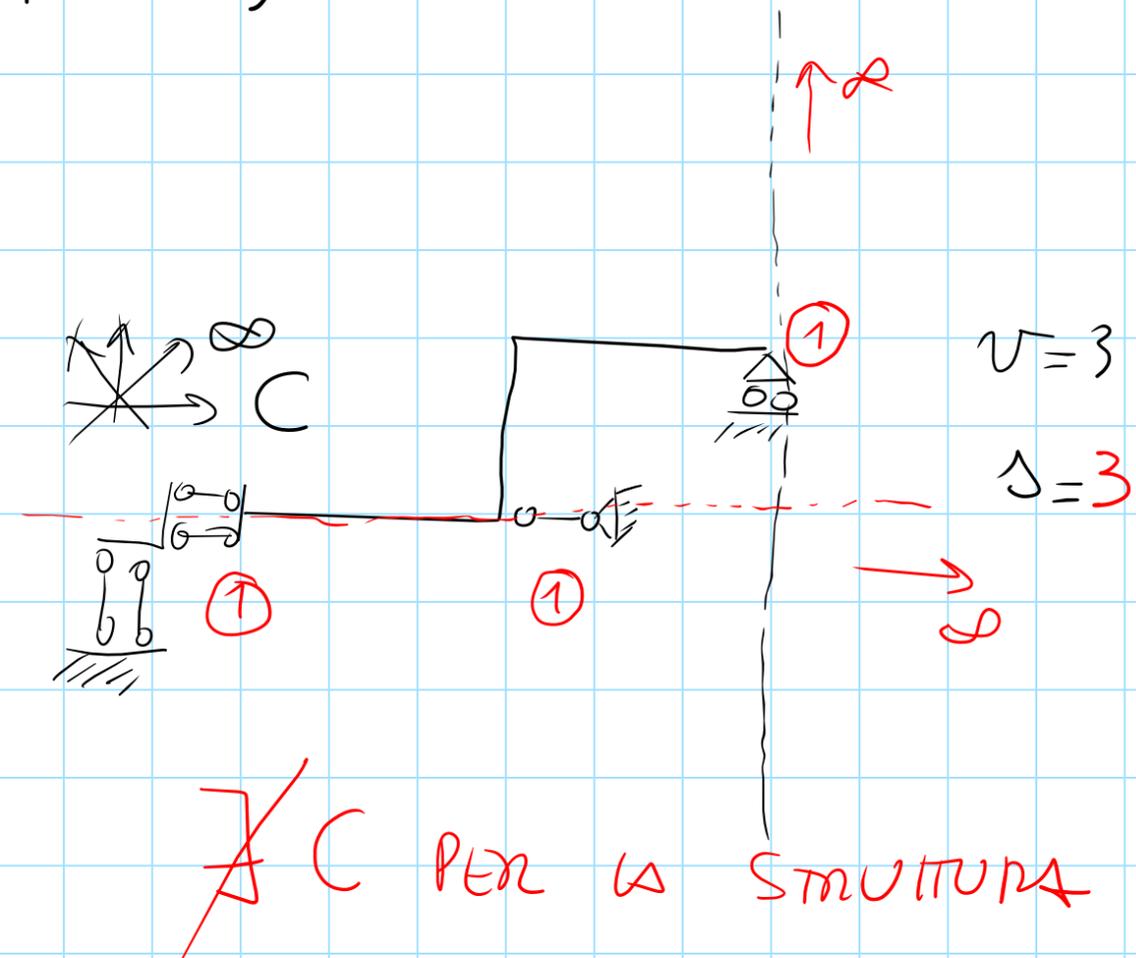
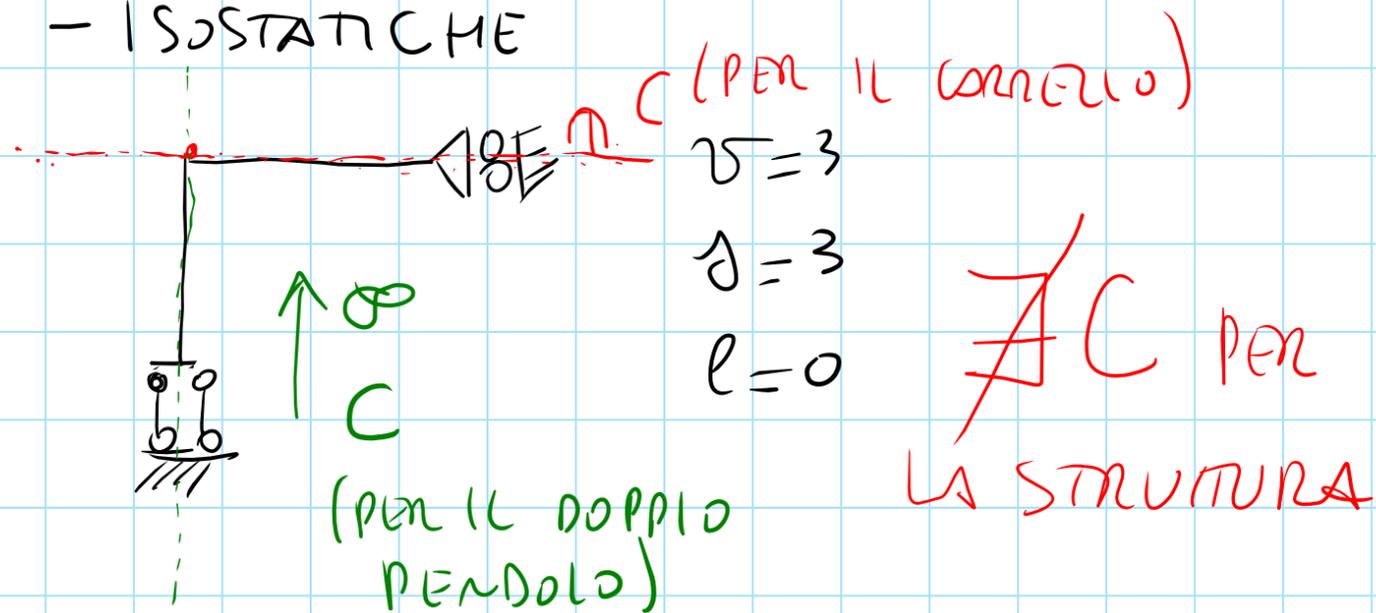
30/10/25

v : MOLTEPLICITA' TOTALE DI VINCOLO

δ : GDL "EFFETTIVAMENTE" SOTTRATTI ($\delta \leq v$)

l : GRADO DI LIBERTÀ ($l = g - \delta$)

- ISOSTATICHE



POSTULATO DELLE REAZ. VINCOLE

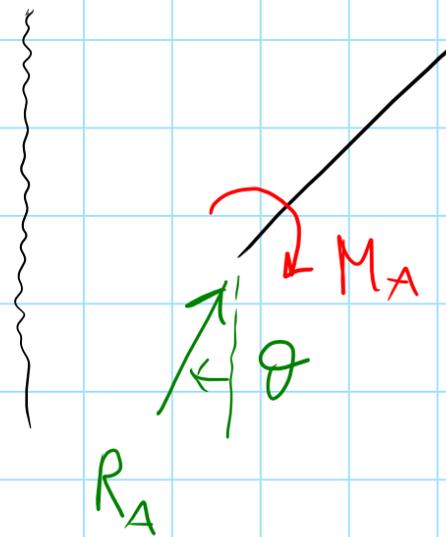
Ad ogni "movimento" impedito da un vincolo CORRISPONDE una FORZA (o un momento se il "movimento" è una rotazione) esercitata dal vincolo sul sistema. Questa forza è la REAZIONE VINCOLE

PRESTAZIONI STATICHE DEI VINCOLI

— INCASTRO ($n=3$)



3 COMPONENTI DI REAZIONE VINCOLE INCOGNITE



$$V_A = R_A \cos \theta$$

$$H_A = R_A \sin \theta$$

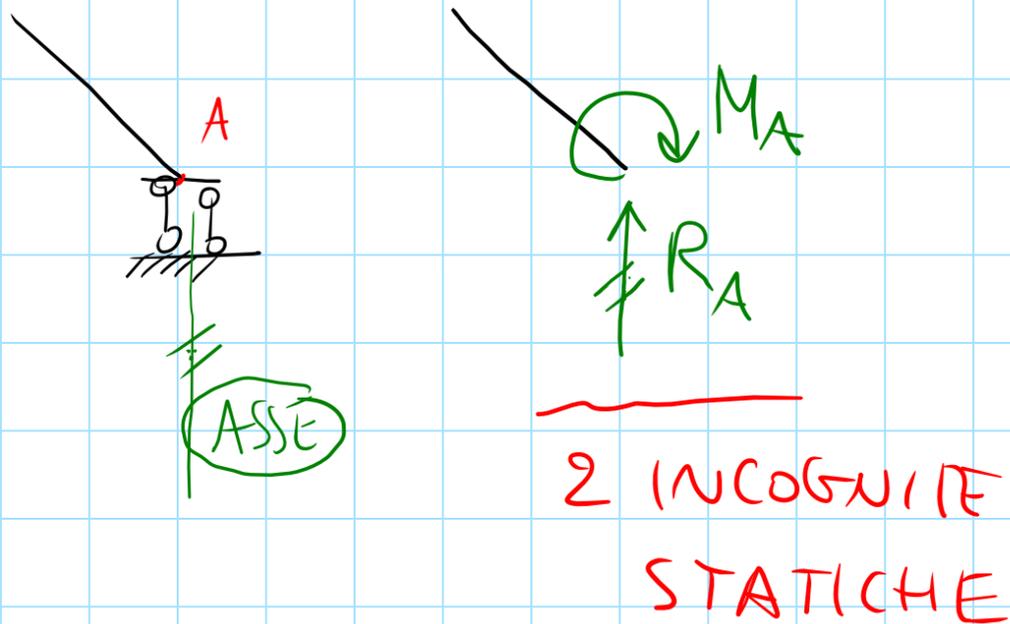
$$H_A, V_A, M_A \iff$$

$$R_A, M_A, \theta$$

- CERNIERA ($n=2$)



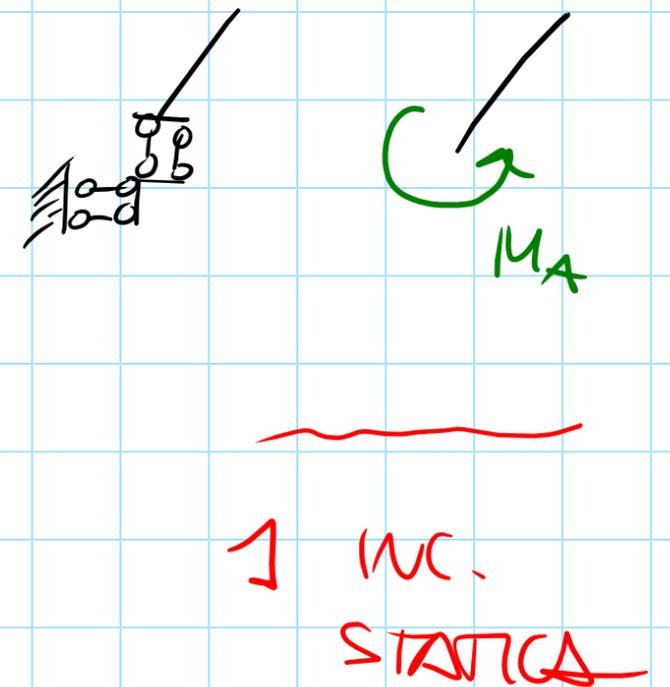
- DOPPIO PENDOLO ($n=2$)



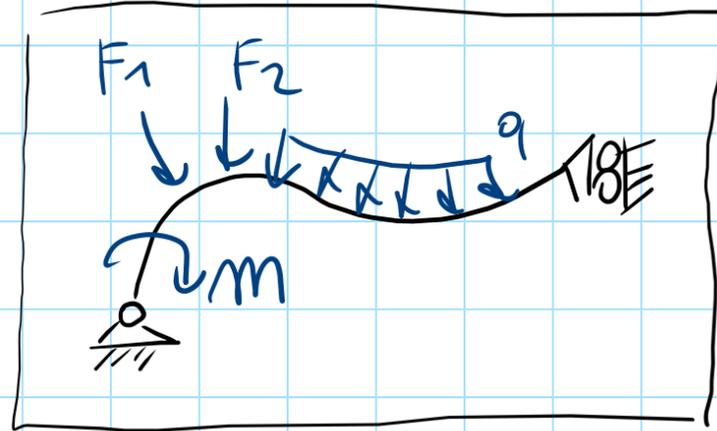
- CARROLLIO / PENDOLO / BIELLA ($n=1$)



DOPPIO-DOPPIO PENDOLO ($n=1$)

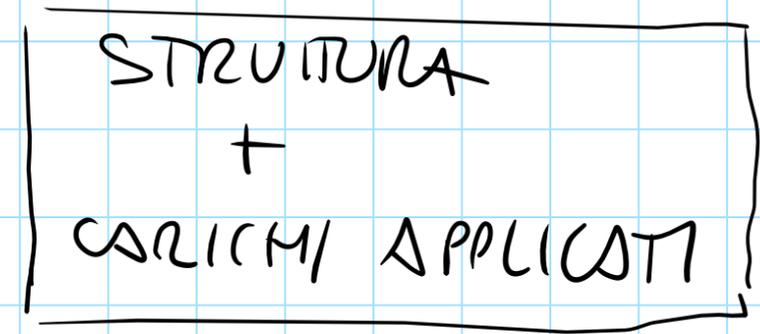


PROBLEMI STATICI E ANALISI STATICA DELLE TRAVI PIANE



STRUTTURA PIANA + CONDIZ. DI CARICO CHE PERMETTONO DI IMPOSTARE UN PROBLEMA STATICO NEL PIANO

PROBLEMA STATICO:

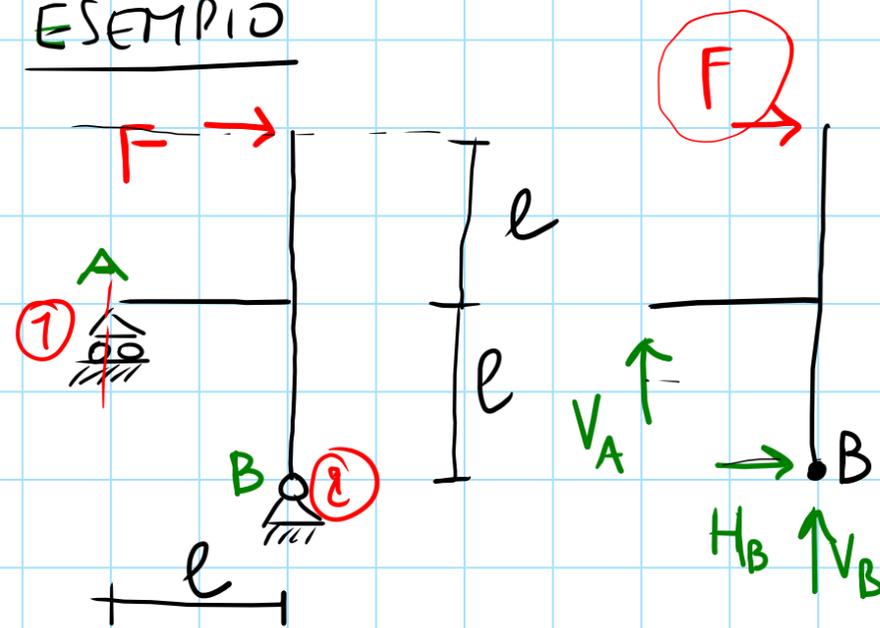


INCOGNITE: REAZIONI VINCOLI

SIAMO IN GRADO DI DETERMINARLE CON LE SOLE

E.C.S.?

ESEMPIO



E.C.S. (3 EQUAZ.)

$$\left. \begin{aligned} \rightarrow : +F + \underline{H_B} &= 0 \\ \uparrow : +V_A + \underline{V_B} &= 0 \\ \curvearrowright_B : -\underline{V_A}l - F2l &= 0 \end{aligned} \right\}$$

SIST. LIN. DI 3 EQUAZ. IN 3 INCOGNITE (V_A, H_B, V_B)

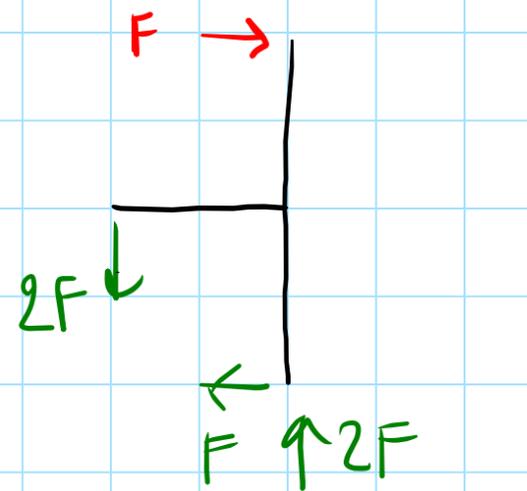
⇒ DISCUSSIONE DEL SISTEMA

$$H_B = -F, \quad V_A = -2F, \quad V_B = +2F$$

(SOLUZ. UNICA)

$$\left. \begin{aligned} q &= 3 \\ v &= 3 \\ \delta &= 3 \end{aligned} \right\} \text{SIST}$$

SCHEMA DI CORPO LIBERO (S.C.L.)



S.C.L. EQUIL.

STRUMENTO DI
VERIFICA DEL
CALCO DELLE
REAZ. VINCOLI

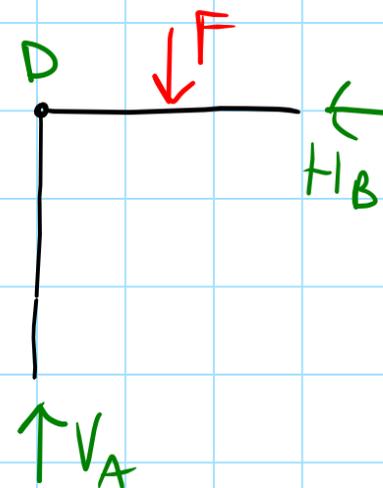
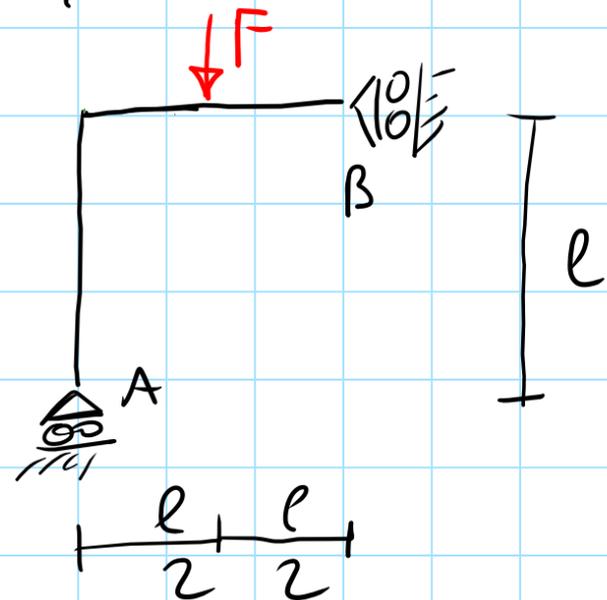
ESEMPIO DI
PROBLEMA STATICO
STATICAMENTE
DETERMINATO

CLASSIFICAZIONE DEI PROBLEMI STATICI

- STATICAMENTE IMPOSSIBILE : IL SIST. DELLE E.C.S. NON HA SOLUZIONE

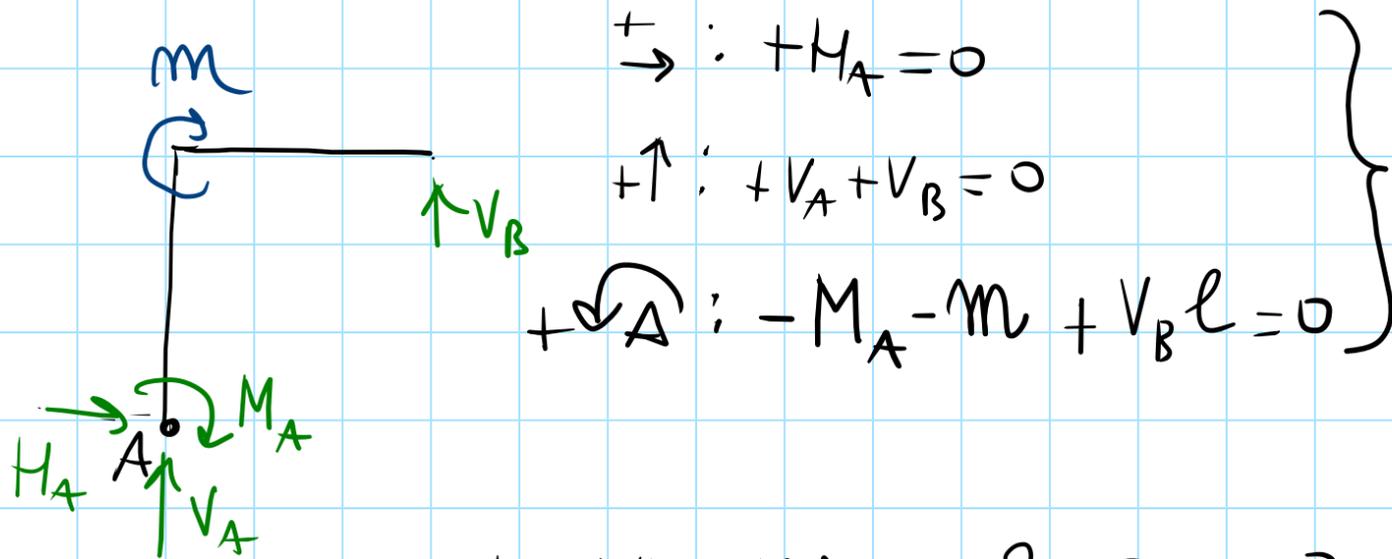
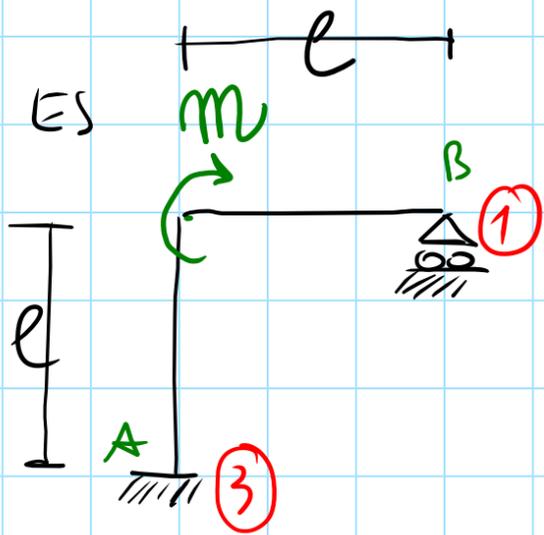
- " DETERMINATO : IL SIST. DELLE E.C.S. HA SOLUZ. UNICA

- " INDETERMINATO : IL SIST. DELLE E.C.S. HA INFINITE SOLUZ.



$$\left. \begin{array}{l} \rightarrow : -H_B = 0 \\ \uparrow : +V_A - F = 0 \\ \curvearrowright : -F \frac{l}{2} = 0 \end{array} \right\} \text{EQUAZ. SODDISF. SOLO PER } F=0 \text{ (MAI SODDISFATTA)}$$

PROBLEMA STATICO STAT. IMPOSSIBILE



$$\begin{aligned} \rightarrow : +H_A &= 0 \\ \uparrow : +V_A + V_B &= 0 \\ +\curvearrowleft : -M_A - m + V_B e &= 0 \end{aligned}$$

3 EQ. IN 4 INCOGNITE

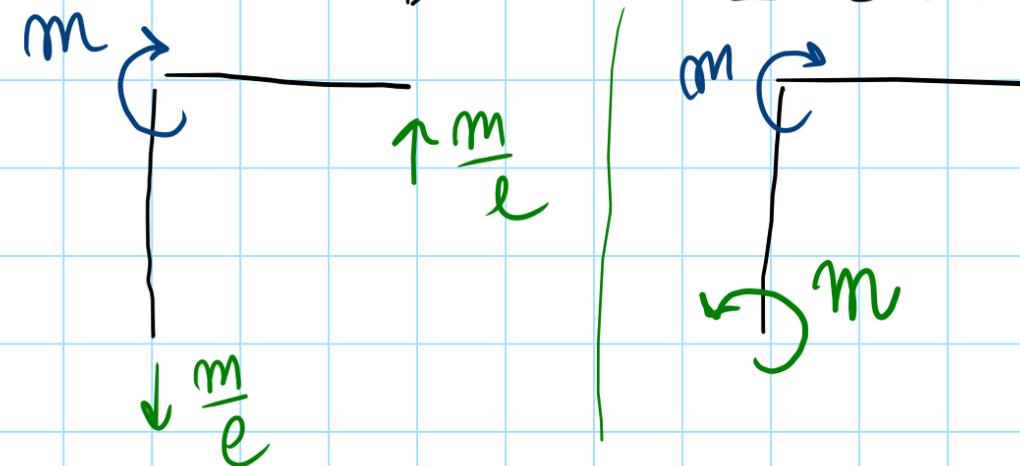


STATIC. INDETERMINATO

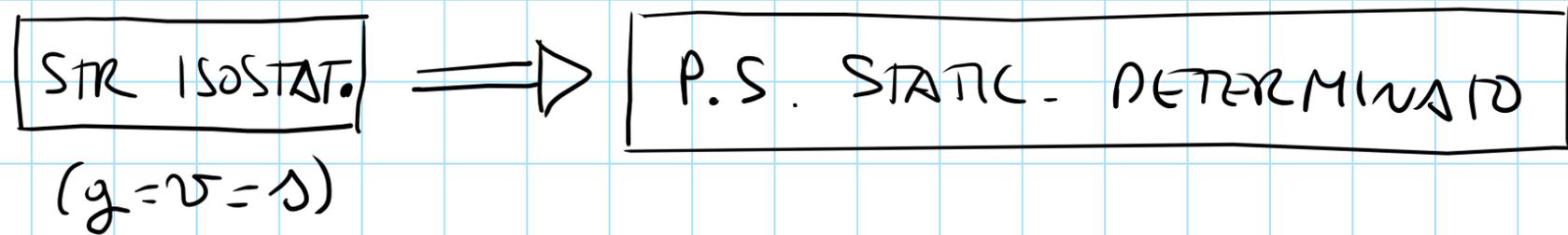
$$\infty^{4-3} = \infty^1 \text{ SOLUZIONI}$$

$$\begin{aligned} v &= 4 \\ \delta &= 3 \\ i &= 1 \end{aligned}$$

INDIVIDUIAMO 2 SOLUZIONI MA LE INFINITE:



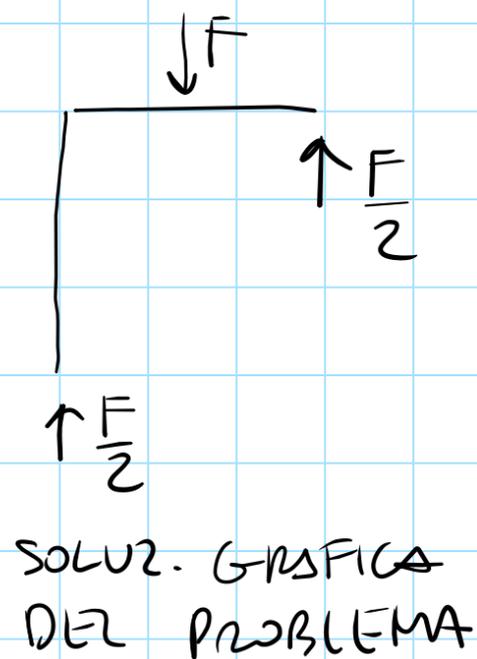
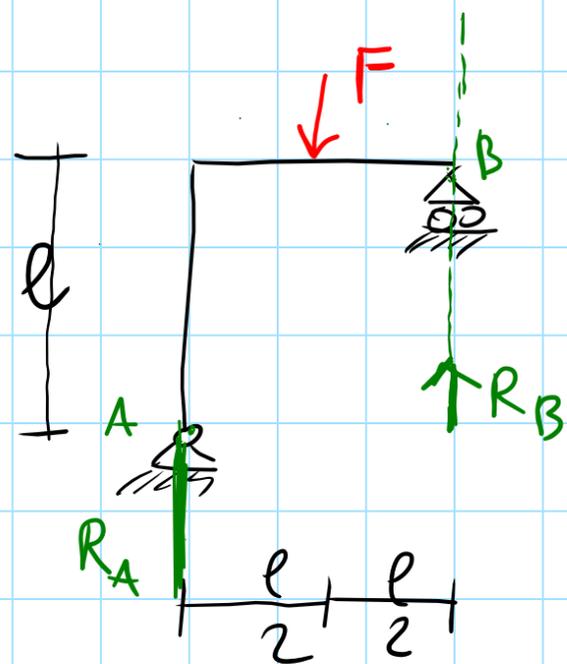
RELAZIONI TRA PROBLEMI STATICI E TIPI DI STRUTTURE



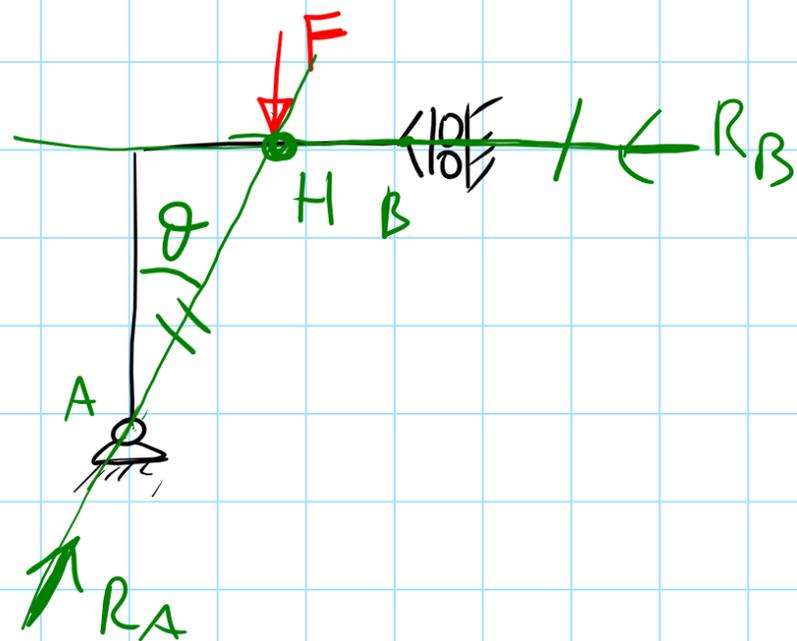
g : N° DI EQUAZIONI SCALARI

v : N° DI INCOGNITE

SOLUZ. GRAFICA DELLE STR ISOSTATICHE



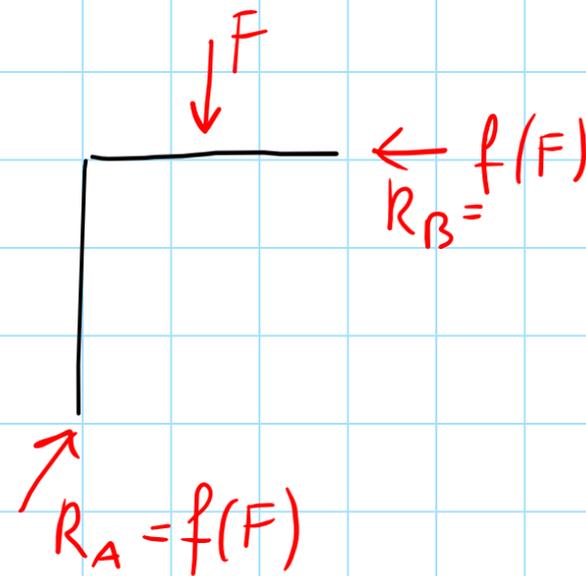
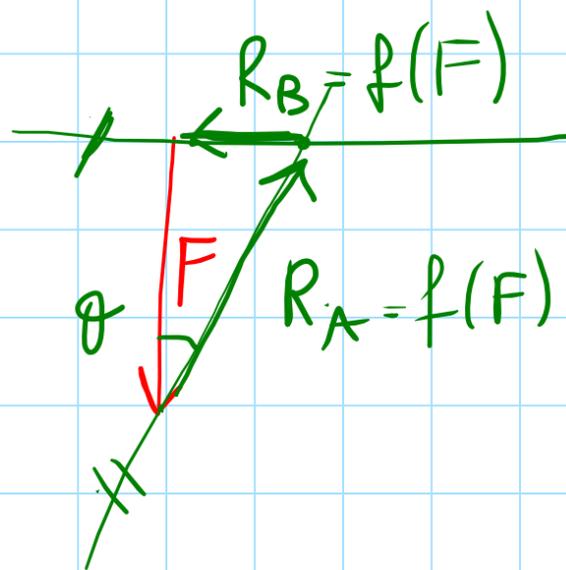
SOLUZ. GRAFICA DEL PROBLEMA

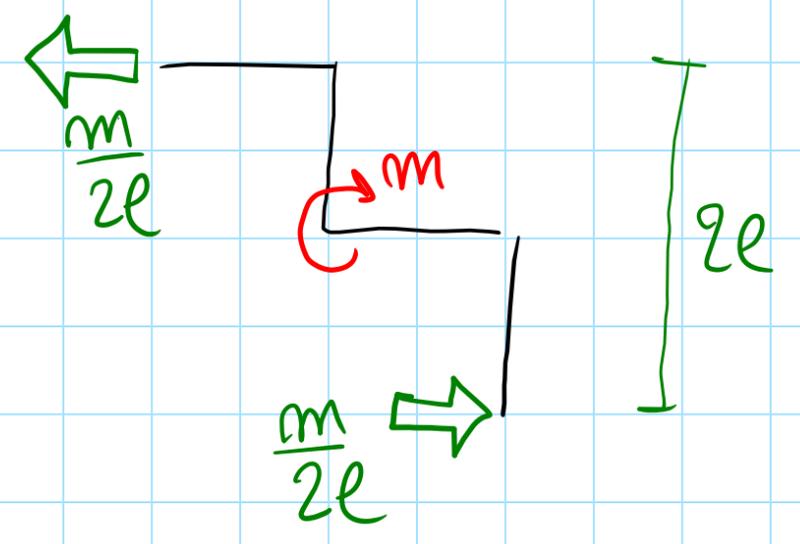
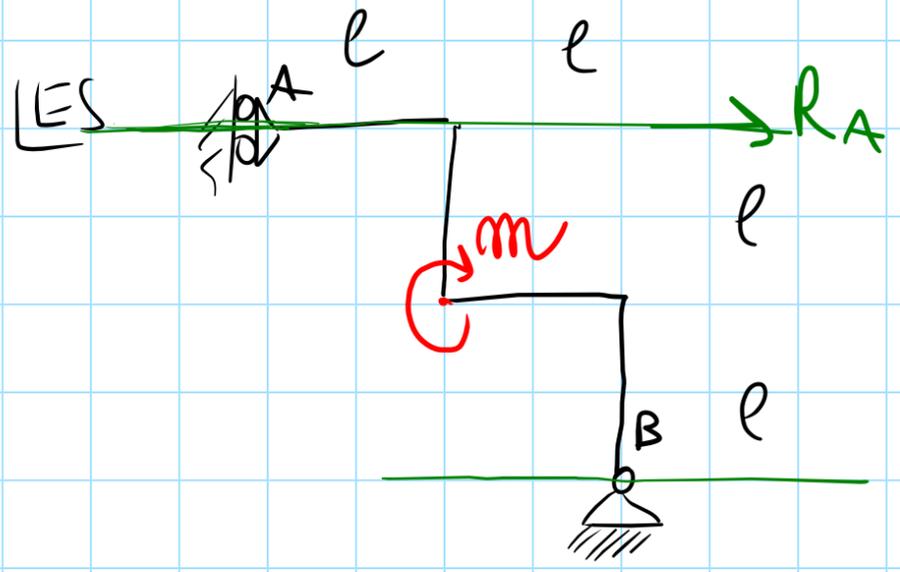


TRIANGOLO DELLE FORZE (CHIUSO) \Rightarrow

$$R_A = f(F)$$

$$R_B = f(F)$$



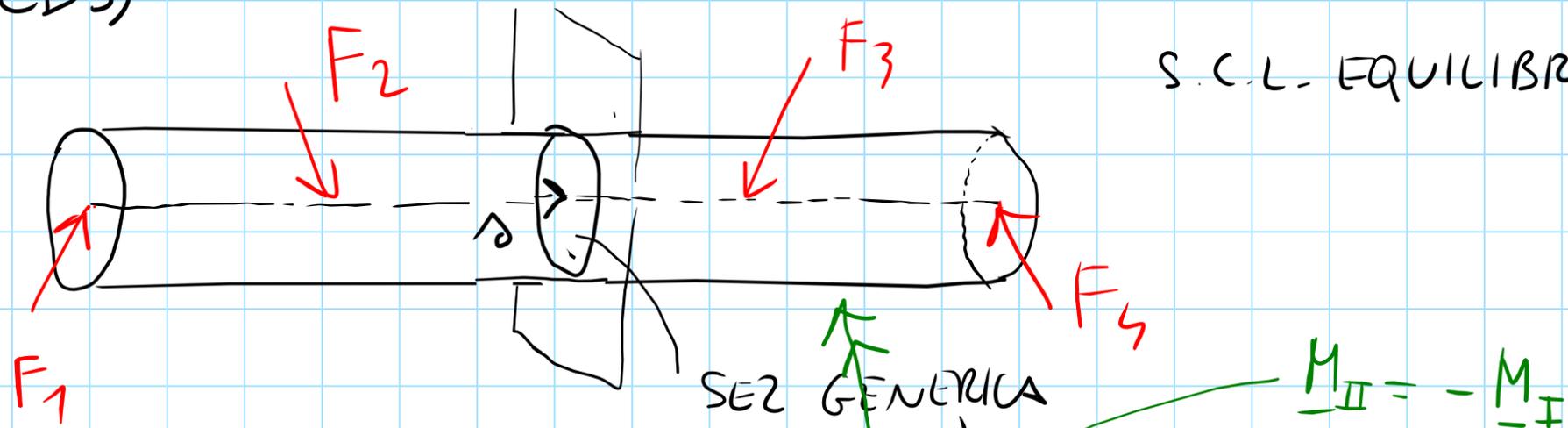


S.C.L. - EQUIL.

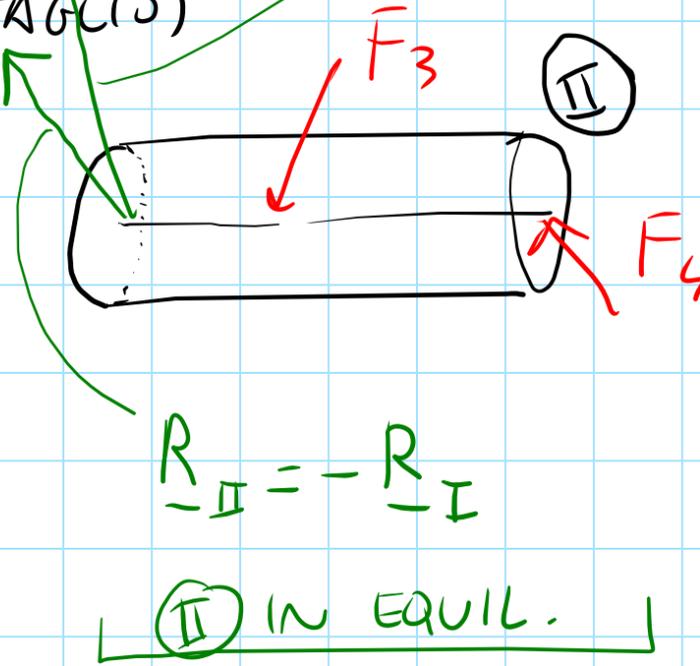
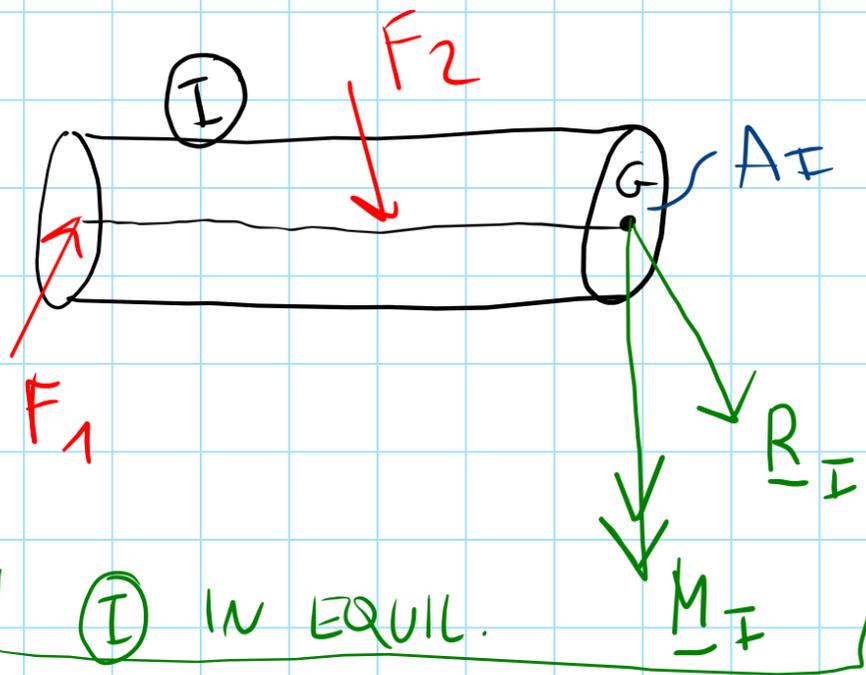
INT. DELLA COPPIA EQUIL.
 $\left(\frac{m}{2l}, 2l\right) = m$

CARATTERISTICHE DELLA SOLLECITAZIONE (INTERNA DELLE TRAVI) [AZIONI INTERNE] (CDS)

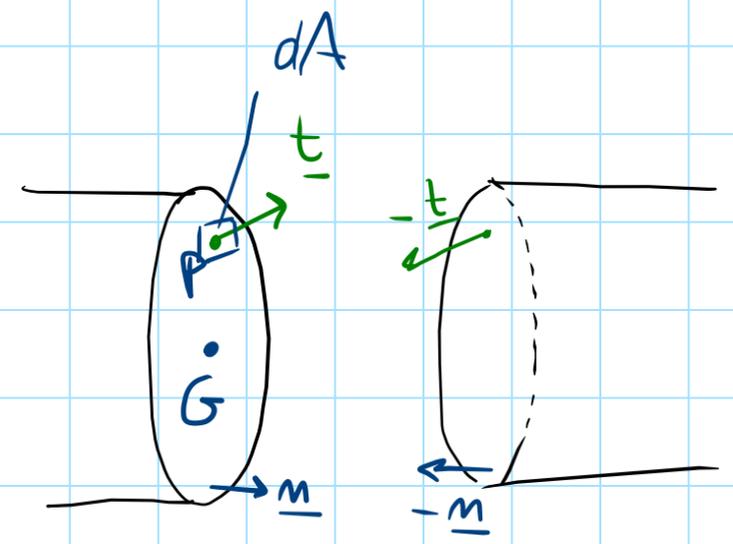
S.C.L. EQUILIBRATO



$$\underline{M}_{II} = -\underline{M}_I$$



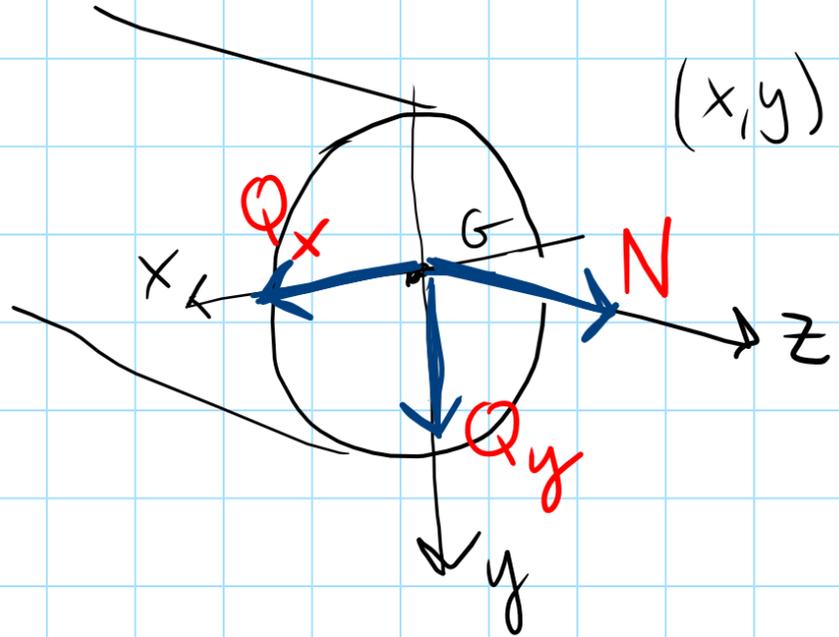
$$\underline{R}_{II} = -\underline{R}_I$$



$$\underline{R}_I = \int_{A_I} \underline{t} dA$$

$$\underline{M}_I = \int_{A_I} GP \times \underline{t} dA$$

$\{ \underline{F}_1, \underline{F}_2, \underline{R}_I, \underline{M}_I \}$ SIST. EQUILIBRATO



(x, y) : ASSI PRINCIPALI DI INERZIA

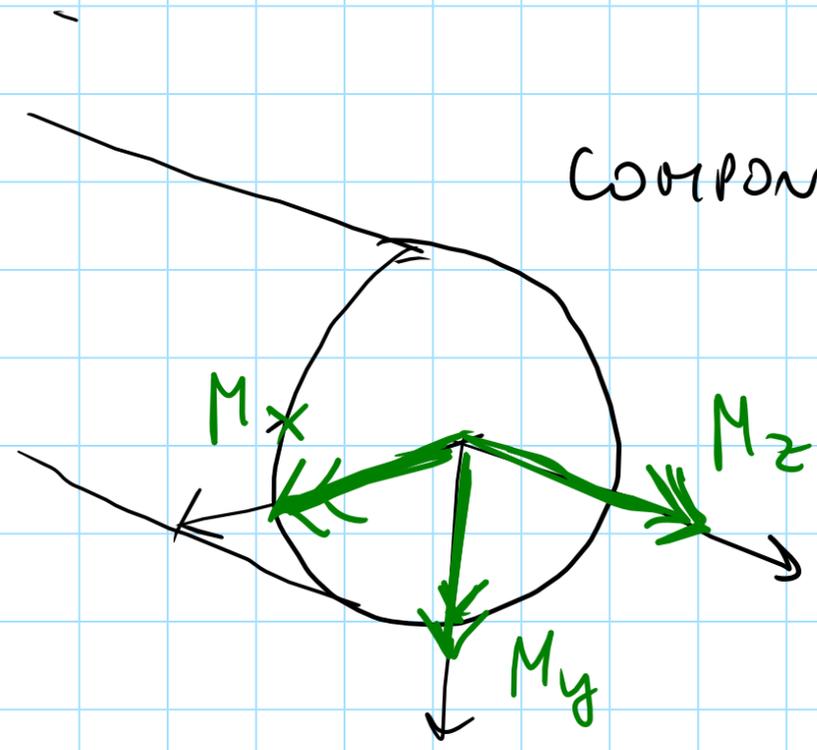
COMPONENTI DI \underline{R}_I : $\underline{R}_I = N \underline{e}_z + Q_x \underline{e}_x + Q_y \underline{e}_y$

3 C.D.S.

N : FORZA NORMALE (σ ASSIALE), SFORZO NORMALE

Q_x : FORZA TAGLIANTE (LUNGO x), TAGLIO LUNGO x

Q_y : " " (" y), TAGLIO LUNGO y



COMPONENTI DI \underline{M}_I : $\underline{M}_I = M_z \underline{e}_z + M_x \underline{e}_x + M_y \underline{e}_y$

3 C.D.S.

M_z : MOMENTO TORCENTE

M_x : " FLETTENTE RESISTIVO A x

M_y : " " " " y