21. Lezione 7 dicembre

lunedì 7 dicembre 2020 10:40

- SLIDE STATICA
  - legge ~~trasp~~
  - sist equiv.

$\underline{M}_A = \vec{AP} \wedge \underline{F}$

$- \underline{M}_B = \underline{M}_A + \vec{BA} \wedge \underline{R}$

- $\underline{M}_B = \underline{M}_A + \underline{R} \wedge \vec{AB}$

asse centrale

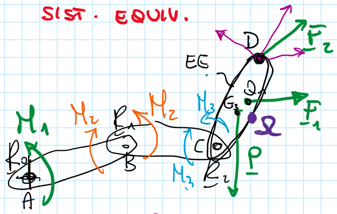
asse ~ Mozzi

$\underline{v}_B = \underline{v}_A + \underline{\omega} \wedge \vec{AB}$

$\longrightarrow \underline{v}_C = \underline{v}_A + \underline{\omega} \wedge \vec{AC}$

$\longrightarrow \underline{M}_C = \underline{M}_A + \underline{R} \wedge \vec{AC}$

ES. SIST. EQUIV.



$\underline{\tau} = -J^T \underline{\gamma}$

$\underline{\gamma} = \begin{bmatrix} \underline{R}^{EE} \\ \underline{M}_D^{EE} \end{bmatrix}_{6\times 1}$ $\qquad \underline{R}^{EE} = \underline{P} + \underline{F}_1 + \underline{F}_2$

$\underline{M}_D^{EE} = \vec{DG_3} \wedge \underline{P} + \vec{DQ_1} \wedge \underline{F}_1$

$D \equiv O_{EE}$

$J \rightleftharpoons \underline{v}_{O_{EE}}$

$J_g = \begin{bmatrix} \underline{k}_0 \wedge \vec{AD} & \underline{k}_1 \wedge \vec{BD} & \underline{k}_2 \wedge \vec{CD} \\ \underline{k}_0 & \underline{k}_1 & \underline{k}_2 \end{bmatrix}$ $\quad 6 \times 3$

$\boxed{O_{EE}}$

$T_{O_{EE}} = \begin{bmatrix} & [O_{EE}]_0 \\ \underline{0}^T & 1 \end{bmatrix}$

$\begin{bmatrix} M_1 \\ M_2 \\ M_3 \end{bmatrix} = \underline{\tau} = 3 \times 1 \quad - \quad$ 3 GIUNTI (1 GdL)

? J_Ω $\qquad \underline{v} = \begin{bmatrix} \underline{v}_\Omega \\ \underline{\omega}_{EE} \end{bmatrix} = J_\Omega \, \dot{\underline{q}}$; $\quad J_\Omega = \begin{bmatrix} \underline{k}_0 \wedge \vec{A\Omega} & \underline{k}_1 \wedge \vec{B\Omega} & \underline{k}_2 \wedge \vec{C\Omega} \\ \underline{k}_0 & \underline{k}_1 & \underline{k}_2 \end{bmatrix}$

? $[\Omega]_0$ mentre $[O_{EE}]_0$ sono già calcolate con la matrice $T_{O_{EE}}$, $[\Omega]_0$ non sono ancora note

$\left\{ \begin{matrix} [\Omega]_0 \\ 1 \end{matrix} \right\} = T_{O_{EE}} \left\{ \begin{matrix} [\Omega]_{EE} \\ 1 \end{matrix} \right\} \longleftarrow$ NOTE LE COORD $[\Omega]_0$ SI CALCOLA J_Ω

$\underline{\gamma}_\Omega = \begin{bmatrix} \underline{R}^{EE} \\ \underline{M}_\Omega^{EE} \end{bmatrix} \longrightarrow \underline{\tau} = -J_\Omega^T \underline{\gamma}_\Omega$

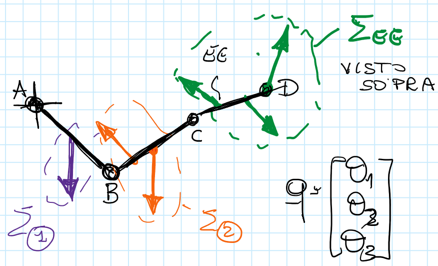
(non necess risp. O_{EE})

$\underline{k}_0 \odot)^{M_1} \quad (M_1 > 0)$ $\qquad \boxed{\underline{k}_0 \odot) |M_1|} \; (M_1 < 0)$

$) -3 \rightarrow \circlearrowright 3$

• forze su altri link

$\underline{v} = \begin{bmatrix} \underline{v}_{O_{EE}} \\ \underline{\omega} \end{bmatrix} = J_g \, \dot{\underline{q}}$



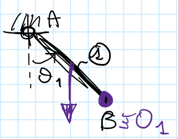
$\underline{q} = \begin{bmatrix} \theta_1 \\ \theta_2 \\ \theta_3 \end{bmatrix}$

$J_2 \qquad J_1$

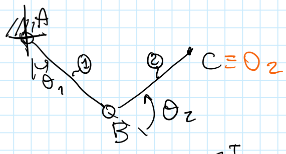
Jacob. geom. × ciascun link;

$\underline{v}_1 = \begin{bmatrix} \underline{v}_B \\ \underline{\omega}_1 \end{bmatrix} = J_1 \, \dot{\underline{q}}_1$

Jacob. geom. × ciascun link;



$q_1 = [\theta_1]$



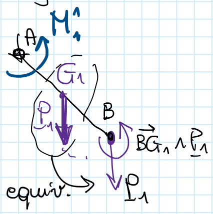
$q_2 = [\theta_1 \ \ \theta_2]^T$

$$\underline{v}_1 = \begin{bmatrix} \underline{v}_B \\ \underline{\omega}_1 \end{bmatrix} = \underbrace{J_1}_{6\times 1} \dot{\underline{q}}_1$$

$$\underline{v}_2 = \begin{bmatrix} \underline{v}_C \\ \underline{\omega}_2 \end{bmatrix} = \underbrace{J_2}_{6\times 2} \dot{\underline{q}}_2$$

$$J_1 = \begin{bmatrix} \underline{k}_0 \wedge \vec{AB} \\ \hline \underline{k}_0 \end{bmatrix} \qquad J_2 = \left[\begin{array}{c|c} \underline{k}_0 \wedge \vec{AC} & \underline{k}_1 \wedge \vec{BC} \\ \hline \underline{k}_0 & \underline{k}_1 \end{array}\right]$$

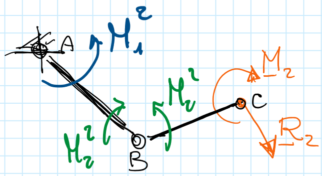
$\underline{\gamma}_1$



$$\underline{\gamma}_1 = \begin{bmatrix} \underline{P}_1 \\ \vec{BG_1} \wedge \underline{P}_1 \end{bmatrix} \rightarrow \underbrace{\overset{1\times 1}{\underline{\tau}_1}}_{M_1^1} = -J_1^T \underline{\gamma}_1$$

$\underline{P}_1$ non influenza M_2, M_3 !

$\underline{\gamma}_2$



M_2, R_2 sist. equiv. forze su link ② rispetto polo C

$$\underline{\gamma}_2 = \begin{bmatrix} \underline{R}_2 \\ \underline{M}_2 \end{bmatrix} \qquad \underbrace{\overset{2\times 1}{\underline{\tau}_2}}_{\begin{bmatrix} M_1^2 \\ M_2^2 \end{bmatrix}} = -J_2^T \underline{\gamma}_2$$

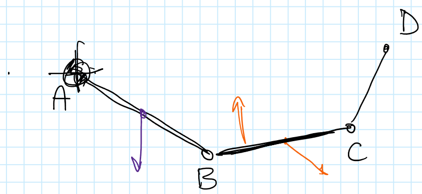
$\underbrace{\underline{\tau}, \ \underline{\tau}_1, \ \underline{\tau}_2}_{\text{PSE}}$

$$\begin{cases} \text{coppia giunto } 1 & \underline{\tau}(1) + \underline{\tau}_1(1) + \underline{\tau}_2(1) \\ \quad " \quad\quad " \quad 2 & \underline{\tau}(2) + \underline{\tau}_2(2) \\ \quad " \quad\quad " \quad 3 & \underline{\tau}(3) \end{cases}$$

Trucchi × avere $\underline{\tau}$ di uguali dimensione, es.

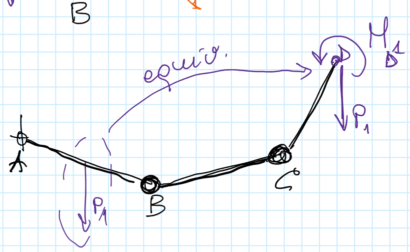
$$J_1^c = \left[\begin{array}{c|c|c} \overset{J_1}{\begin{matrix} \underline{k}_0 \wedge \vec{AB} \\ \underline{k}_0 \end{matrix}} & \underline{0} & \underline{0} \end{array}\right] \quad \underline{3\times 6}$$

$$\underline{\tau}_1^c = \begin{bmatrix} M_1^1 \\ 0 \\ 0 \end{bmatrix} = -J_1^c \ \underline{\gamma}_1$$



J POSSO CONTINUARE A USARE J_{g_e} RISP. EG

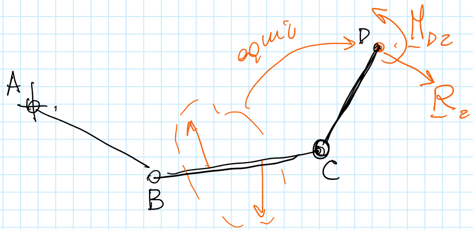
J_{EG} "CORRETTO" ×



$$\underline{\gamma}_1^* = \begin{bmatrix} \underline{P}_1 \\ \vec{DG_1} \wedge \underline{P}_1 \end{bmatrix}$$

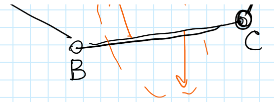
$$\underbrace{\underline{\tau}_1^*}_{3\times 1} = -J^T \underline{\gamma}_1^*$$

solo $\underline{\tau}_1^*(1) = M_1^1$



$$\underline{\gamma}_2^* = \begin{bmatrix} \underline{R}_2 \\ \underline{M}_{D2} \end{bmatrix} \qquad \underline{\tau}_2^* = -J^T \underline{\gamma}_2^*$$

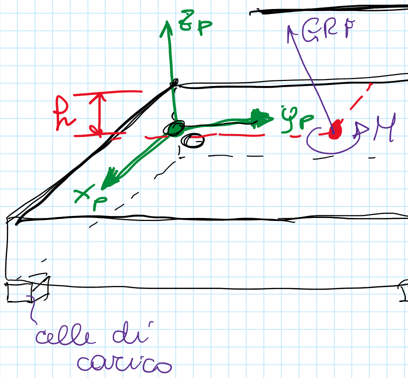
$\tau_2^*(1) = M^2$



$$\underline{y}_2^* = \begin{bmatrix} \vdots \\ \underline{M}_{D_2} \end{bmatrix}$$

$$\underline{\tau}_2 = -J\,\underline{y}_2$$

$$\begin{cases} \underline{\tau}_2^*(1) = M_1^2 \\ \underline{\tau}_2^*(2) = M_2^2 \end{cases}$$



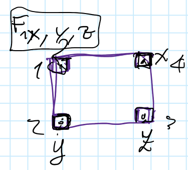
SIST. EQUIV. PEDANE

- RISULTANTE = $\underline{R}$
- MOM. RIS. $\underline{M}_O$

$\rightarrow$ GRF $\equiv \underline{R}$

COP, M_z free mom.

x_{cop}, y_{cop}, h



6 MISURE IN PUNTI NOTI

$R = F_{1x} + F_{4x} \ldots$

$\boxed{x_{cop},\ y_{cop},\ M_f}$