

## 14. Lezione 12 novembre

giovedì 12 novembre 2020

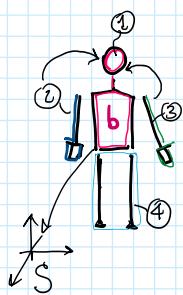
08:42

### IMPOSTAZIONE MODELLO

- CORPI RIGIDI (link)
- GIUNTI (articoli)

1° STEP

### I POTESI SEMPLIFIC.



- base (b) → posiziona rispetto terra  
altri corpi rispetto a b

2° base  
GDL ext. int

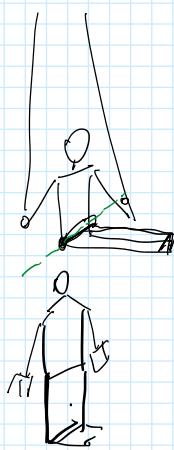
$$T_{sb}(\theta_{ext}) \text{ al max } G \text{ (gdl } G)$$

$$T_{b_2}(\theta_{FE}^{sd}, \theta_{AA}^{sd}, \theta_{RIE}^{sd})$$

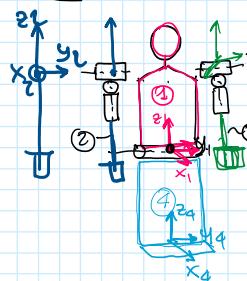
gde di 2 rispetto al base  
spalla come giunto sfuroso

$$T_{b_4}(\theta_{FE}^A)$$

$$\left. \begin{array}{l} 6 \text{ gdl ext} \\ 3+3 \text{ spalle} \\ 1 \text{ anchi} \end{array} \right\} 4 \text{ int} \quad \left. \begin{array}{l} \\ \\ \end{array} \right\} 13 \text{ GDL}$$



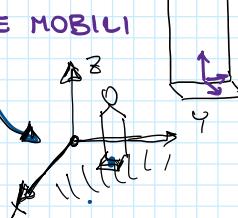
### 3° STEP: schema cinematico



GIUNTO SFEROICO → 3 ROTATORIALI  
(FE → AA → RIE)

### 4° STEP: SDR FISSI E MOBILI

$$S (\text{z auto}, x, \psi) \text{ come vortù scorsa}$$



ES. OTTORNI  
100 RPO

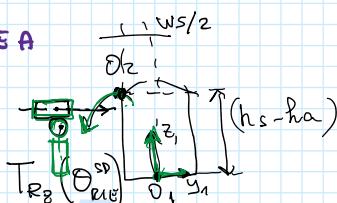
\* ATT. RIVEDERE.  
COORD. PUNTI  
TERNE LO CALI  
IN MATLAB!

- Terne assi // im PAR, x in avanti ↗ vs alto

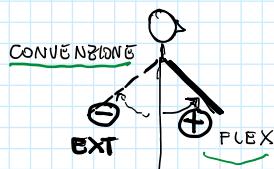
### 5° STEP: MATRICI DI TRASF. OMogenea

$$T_{12}(\theta_{FE}^{sd}, \theta_{AA}^{sd}, \theta_{RIE}^{sd}) = T_{tr}\left(0, -\frac{ws}{2}, h_s \cdot ha\right).$$

$$T_{Ry}(\theta_{FE}^{sd}) T_{Rx}(\theta_{AA}^{sd}) T_{Rz}(\theta_{RIE}^{sd})$$



- ATTENZIONE Segni angoli e CONVENZIONI



$$T_{Ry}(\theta_{FE}^{sd}) \rightarrow T_{Ry}(-\theta_{FE}^{sd})$$

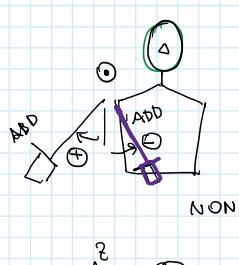
max 45° (D)

NON COER.

| FLEX > 0  
EXT < 0

$$\theta_{FE}^{sd} = 45^\circ$$

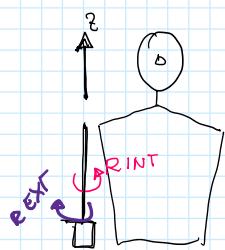
COER.



$$T_{Rx}(-\theta_{AA}^{sd})$$

NON COER.

NON COGR.

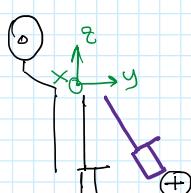


$$\Theta_{\text{RLE}}^{\text{SD}} > 0$$

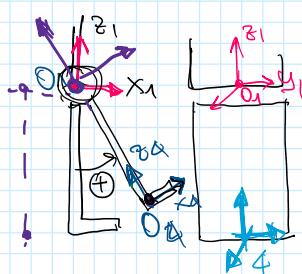
ROT. INT  $\oplus$

$$\bullet T_{12}(\Theta_{\text{FE}}^{\text{SD}}, \Theta_{\text{AA}}^{\text{SD}}, \Theta_{\text{RLE}}^{\text{SD}}) = T_{\text{tr}}([0, -\frac{ws}{2}, h_s - ha]) \cdot T_{\text{Ry}}(-\Theta_{\text{FE}}^{\text{SD}}) \cdot T_{\text{Rx}}(-\Theta_{\text{AA}}^{\text{SD}}) \cdot T_{\text{Rz}}(\Theta_{\text{RLE}}^{\text{SD}})$$

$$\bullet T_{13}(\Theta_{\text{FE}}^{\text{SS}}, \Theta_{\text{AA}}^{\text{SS}}, \Theta_{\text{RLE}}^{\text{SS}}) = T_{\text{tr}}([0, +\frac{ws}{2}, h_s - ha]) \cdot T_{\text{Ry}}(-\Theta_{\text{FE}}^{\text{SS}}) \cdot T_{\text{Rx}}(\Theta_{\text{AA}}^{\text{SS}}) \cdot T_{\text{Rz}}(-\Theta_{\text{RLE}}^{\text{SS}})$$

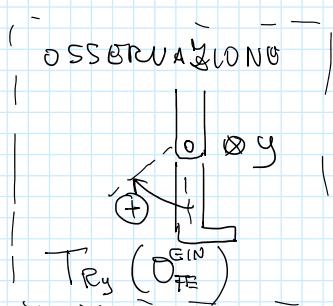
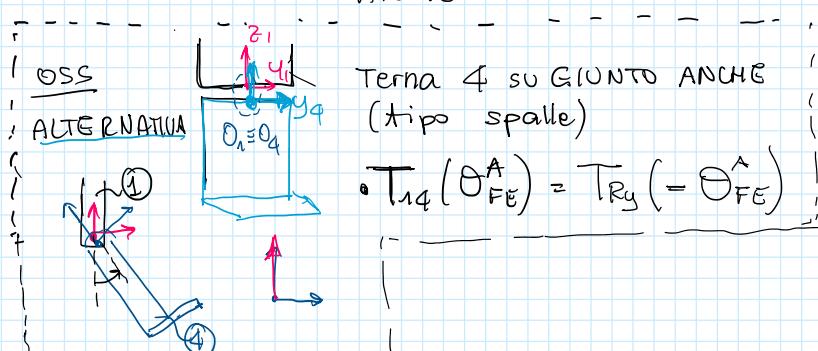


R INT  $\oplus$



$$\bullet T_{14}(\Theta_{\text{FE}}^A) = T_{\text{Ry}}(-\Theta_{\text{FE}}^A) T_{\text{tr}}([0, 0, -ha])$$

ATTIC. GIUNTO ANCHE TRASLA LUNGO GAMBO



$$\bullet T_{S1}(x_{01}, y_{01}, z_{01}, \alpha, \beta, \gamma) = T_{01} = T_{\text{tr}}([x_{01}, y_{01}, z_{01}]) \cdot T_{\text{Ry}}(\alpha) T_{\text{Ry}}(\beta) T_{\text{Ry}}(\gamma)$$

ANG. EUL.  $z'y'x'$

$$T_{02}(\quad) = T_{01}(q_{\text{ext}}) T_{12}(q^{\text{SD}})$$

$$T_{03}(\quad) = T_{01}(q_{\text{ext}}) T_{13}(q^{\text{SS}})$$

$$T_{04}(\quad) = T_{01}(q_{\text{ext}}) T_{14}(q^A)$$

$$q = \begin{bmatrix} q_{\text{ext}} \\ q^{\text{SD}} \\ q^{\text{SS}} \\ q^A \end{bmatrix}_{13 \times 1}$$

• 6° STEP: ASSEGNAME  $q(t)$  PER I FRAME IN ESAME

• 6° STEP: ASSEGNAME  $\dot{q}(t)$  PER I FRAME IN ESAME

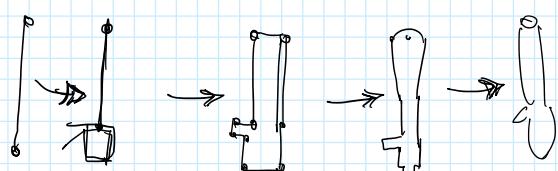
$$\underline{t} = [t_1, t_2 \dots, t_m] \quad m \text{ FRAME}$$

$$\begin{aligned} \bullet M\dot{q} &= 13 \times m & \text{matrice con i valori} \\ &\Downarrow & \text{delle } q \text{ ai vari istanti} \end{aligned}$$

NOSTRO  
MOVIMENTO

• 7° STEP: VISUALIZZAZIONE MOVIMENTO

- schema x visualizzazione



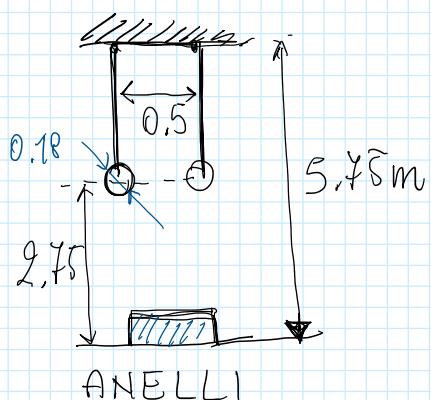
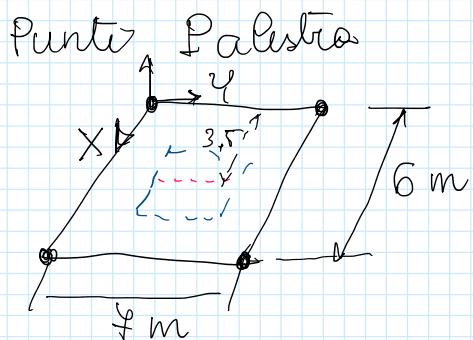
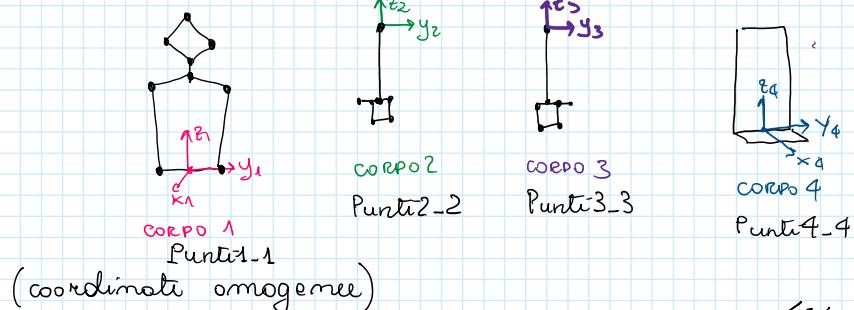
- coord. punti in terna locale
- Tog coord. in terna fisse

animazione plot3

---- pro seguire con analisi F Muscol Rec Gruenti

• Completare esercitazione Matlab

- scrivere coordinate punti in terna locale  
adoattando quanto già fatto (vd. eser gire e braccio)



VISUALIZZ. MOVIMENTO

figure

figure

```
for i = 1 : M ~frame da visualizzare  
qi = MQ(i,:);  
Punti1_S = T01(qi) * Punti1_1  
Punti2_S = T01(qi) T12(qi) Punti2_2
```

3-S  
4-S  
plot 3(palestra, anelli)

hold on

```
plot 3( )  
; view  
; axis equal  
axis  
pause  
getframe hold off  
end  
movie
```