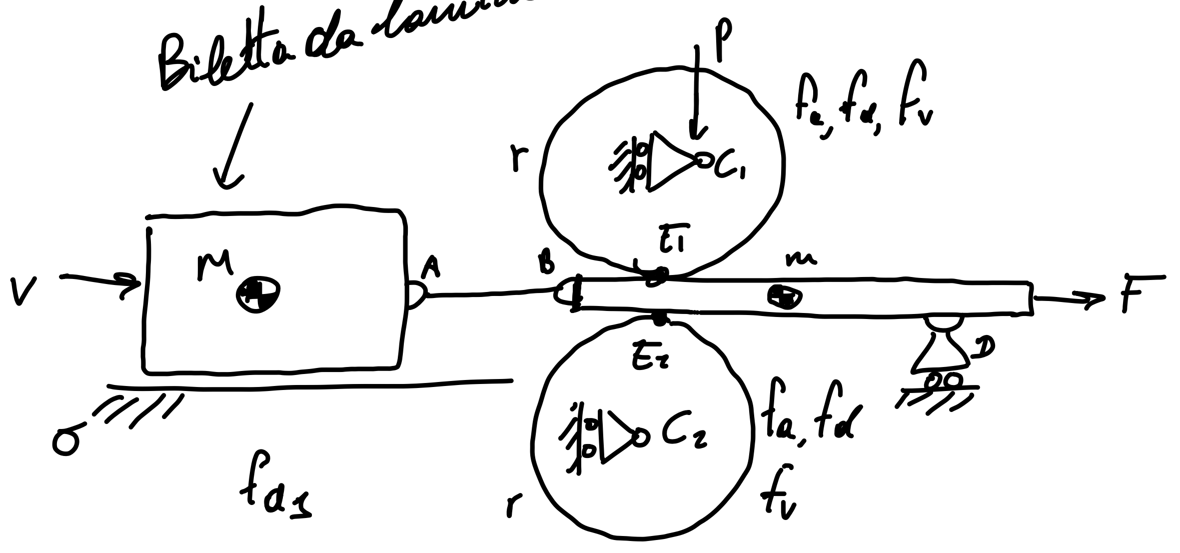
Esercitazione 16 -

ES1) Esercizi 1.2 TdE 1/9/2023: Laminatoio



Dati:

$M = 100\,kg$

m = Trascurabile

$f_{d1} = 0,1$

$P = 2000\,N$

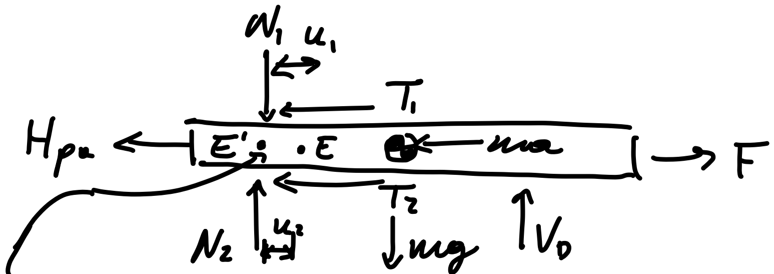
$r = 0,2\,m$

$f_a = 0,4 \quad f_d = 0,1 \quad f_v = 0,2$

Trovare

F per garantire $v = cost$

1) Studio la lamina



Dove fa il contatto
dato resistenza
alla rotazione

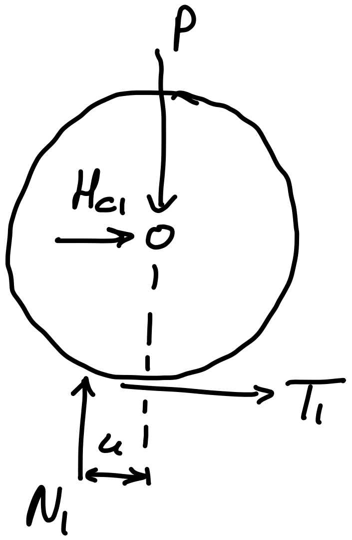
H_B: → u trascurabile
↳ t_{lamina} traslante
↳ T_1 e T_2 su E'

① $\sum M_{E'}^{LAMINA} = 0 \Rightarrow V_D = 0$

② $\sum M_F^{LAMINA} = 0 \Rightarrow N_2 - N_1 = 0 \quad N_2 = N_1$

③ $\sum F_H^{LAMINA} = 0 \quad F - H_B - T_1 - T_2 = 0$

2) Studio il rullo superiore



4) $\sum F_V^{RULLO.SUP} = 0$

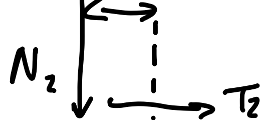
$N_1 - P = 0 \qquad N_1 = P \rightarrow N_2 = P$

⑤ $\sum M_{C1}^{RULLO\ SUP} = 0 \quad T_1 r - \underbrace{N_1}_{P} \underbrace{u}_{r \cdot f_v} = 0$

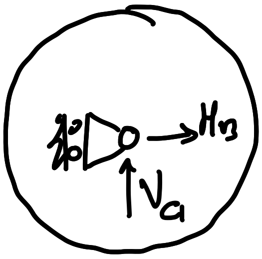
$T_1 \cancel{r} = P f_v \cancel{r}$

<u>Studio Secondo Disco</u>

6) $\sum M_{C2}^{RULLO\ INF} = 0$



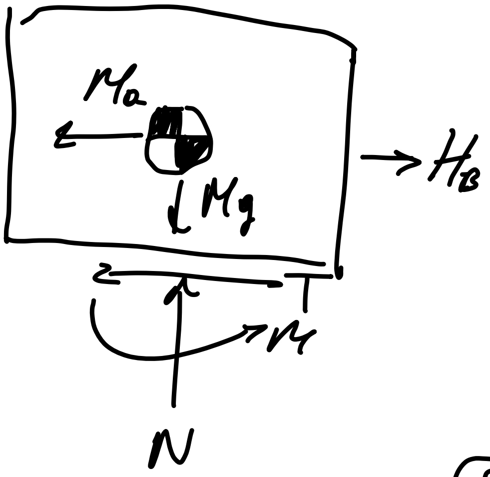
$-T_2 r + N_2 u_2 = 0$



$T_2 r = P f_v \cdot r$

$T_2 = P \cdot f_v$

Studio Biletta



(7) $\sum F_H^H = 0$

$\Rightarrow H_B - \underbrace{Ma}_{\to 0} - T = 0$

↳ a regime quindi $a = 0$

$T = H_B$

(8) $T = f_{d_1} N$

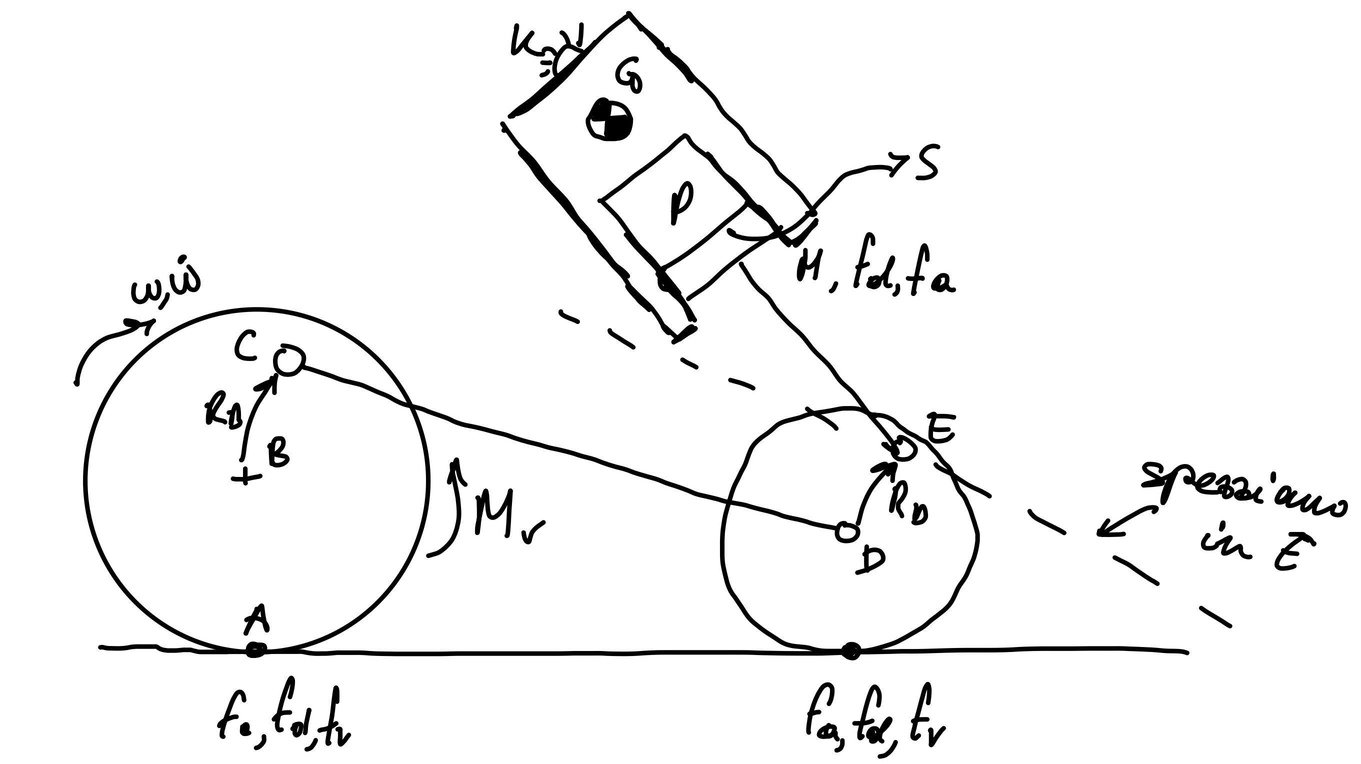
↳ possiamo dirlo solo se sappiamo che è dinamico

↳ sappiamo che $a = 0$ ma può esser statico o dinamico, in questo caso sappiamo che è dinamico quindi lo possiamo scrivere

(9) $\sum F_v^n = 0 \quad N - Mg = 0$

$\Rightarrow$ parti da 3) $F = H_B + T_1 + T_2 = f_{d_1} Mg + Pf_v + Pf_v = 898{,}1\,N$

2) Esercizio: Locomotrice



Dati:

- Geometria
- $\omega, \dot{\omega}$
- M_r
- f_a, f_d, f_v
- Inerzie $\quad m_B, m_D, m_G$

J_B, J_D, J_G

Trovare:

1) gdl residui
2) $\vec{v}_G$, $\vec{v}_B$
3) $\vec{a}_G$, $\vec{a}_B$
4) P per garantire moto senza dissipazioni
5) P " " " con dissipazioni
6) Verifica di aderenza in A e F

1) gdl residui

3 gdl per 3 corpi rigidi = 15 gdl

1 in K cerniera a terra = 2 gdv

3 in C, D, E cerniere libere = 6 gdv

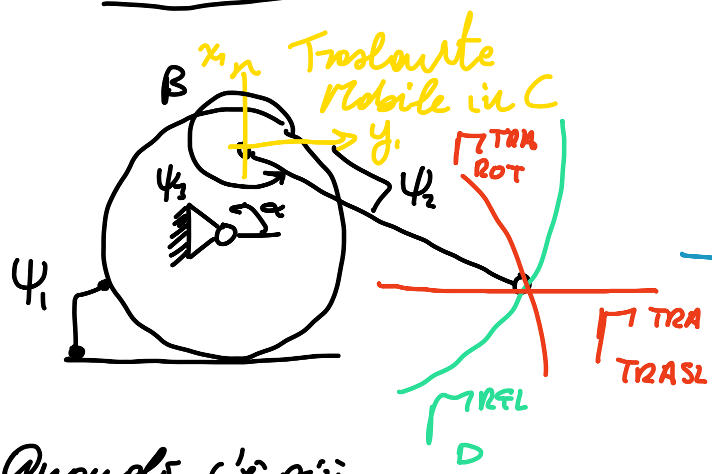
2 contatti di rotolamento in A e F = 4 gdv

1 contatto in H = 2 gdv

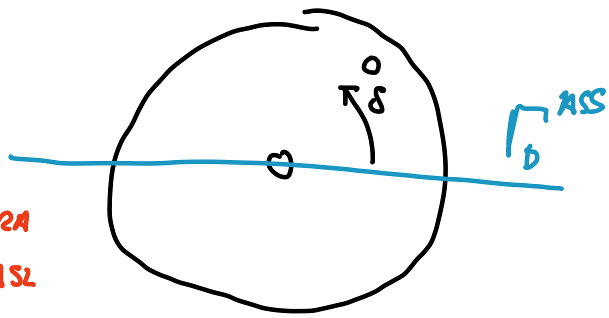
2) ci viene dato solo ω, quindi andiamo passo per passo

separiamo in

sottosistema 1



sottosistema 2



Quando c'è più di 1 gdl residuo, per la traslazione si mettono due vincoli in questo caso ψ_2 e ψ_3

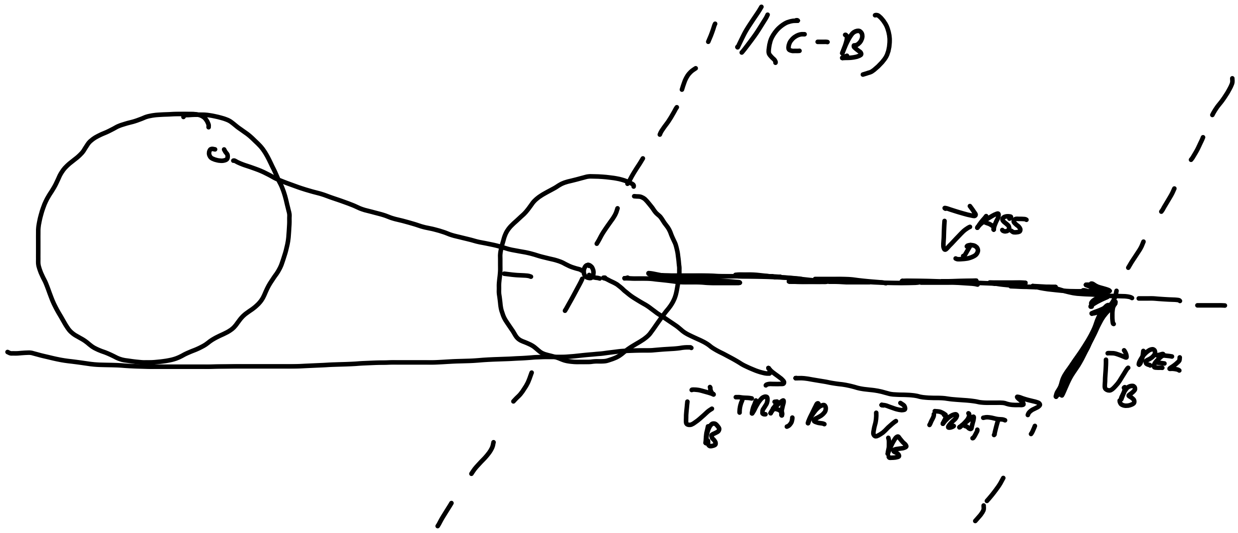
$$\dot{\beta} = -\omega \quad e \quad \ddot{\beta} = -\dot{\omega}$$

Velocità

$$\vec{V}_{D\,S1}^{ASS} = \vec{V}_{D\,S2}^{ASS}$$

$\vec{V}_{D\,S1}^{REL}$ +	$\vec{V}_{D\,S1}^{TRA,R}$ +	$\vec{V}_{D\,S1}^{TRA,T}$ =	$\vec{V}_{D\,S1}^{ASS}$

M	$\dot{j}\,\overline{CD}$?	$\dot{\beta}\,\overline{CB}$	$\dot{\beta}\,\overline{BA}$	$\dot{\delta}\,\overline{DF}$?
D	$\perp(D-C)$	$\perp(C-B)$	$\perp(B-A)$	$\perp(D-F)$



$\Longrightarrow$ RICAVO $\left|\vec{V}_{DS1}^{ASS}\right|$, $\left|\vec{V}_{DS1}^{REL}\right|$

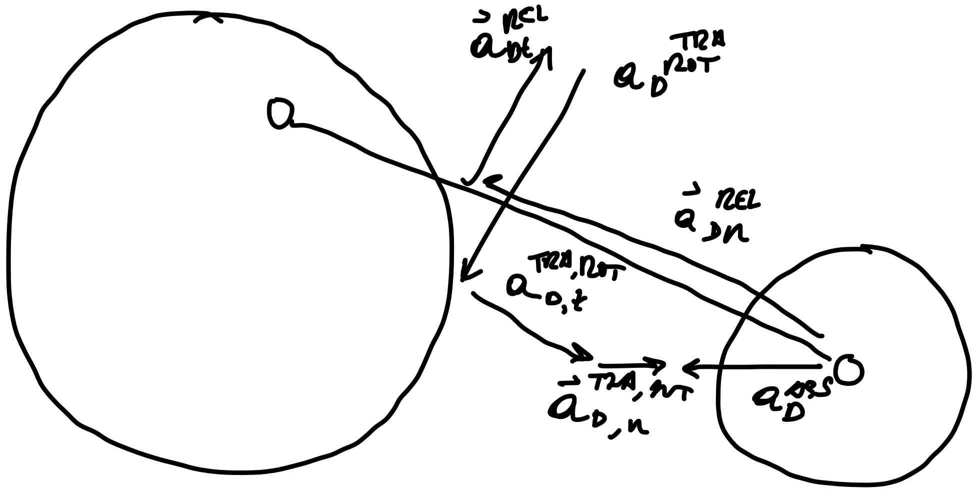
$$\dot{\delta} = -\frac{\left|\vec{V}_{DS1}^{ASS}\right|}{\overline{DF}}\,\hat{k}$$

<u>Accelerazione:</u>

$$\vec{a}_{DS1}^{ASS} = \vec{a}_{DS2}^{ASS}$$

$$\vec{a}_{D\,S1}^{REL} + a_{A\,S1}^{REL} + \vec{a}_{Dt\,S1}^{TRA\,ROT} + a_{Dt}^{TRA\,ROT} + \vec{a}_{Dn}^{TRA\,TRA} + \vec{a}_{Dt}^{TRA\,TRA} + \vec{a}_D^{COR} = \vec{a}_{DS2\,n}^{REL} + \vec{a}_{ES2\,t}^{TRA}$$

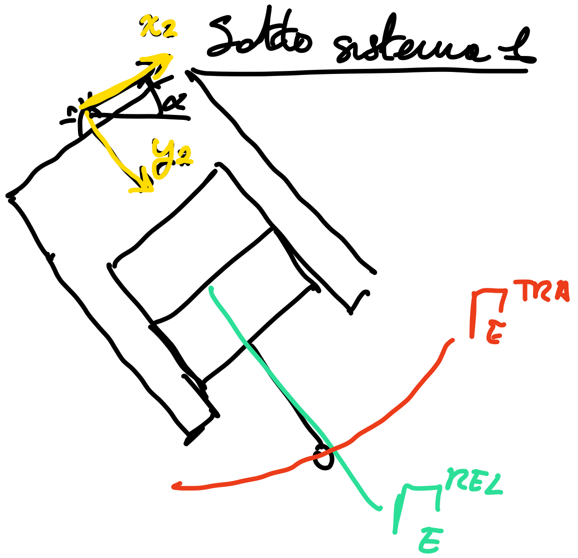
$\dot{j}\,\overline{CD}$	$\ddot{j}\,\overline{CD}$	$\dot{\beta}^2\,\overline{CB}$	$\ddot{\beta}\,\overline{CB}$	$\times$	$\ddot{\beta}\,\overline{BA}$	$\times$	$\times$	$\ddot{\delta}\,\overline{DF}$?
$\parallel(C-D)$	$\perp(D-C)$	$\parallel(C-B)$	$\perp(C-B)$		$\perp(B-A)$			$\perp(D-F)$
$D\to C$		$C\to B$						



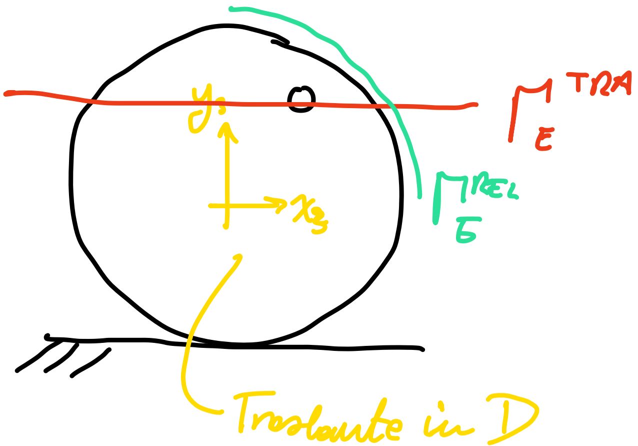
$\Rightarrow$ Ricavo $|\vec a^{REL}_{Dt\,S_2}|$ e $|\vec a^{ASS}_{Dt\,S_2}|$

$$\ddot S = \frac{|\vec a^{ASS}_{Dt\,S_2}|}{R_D}\hat n$$

Sottosistema 1



Sottosistema 2

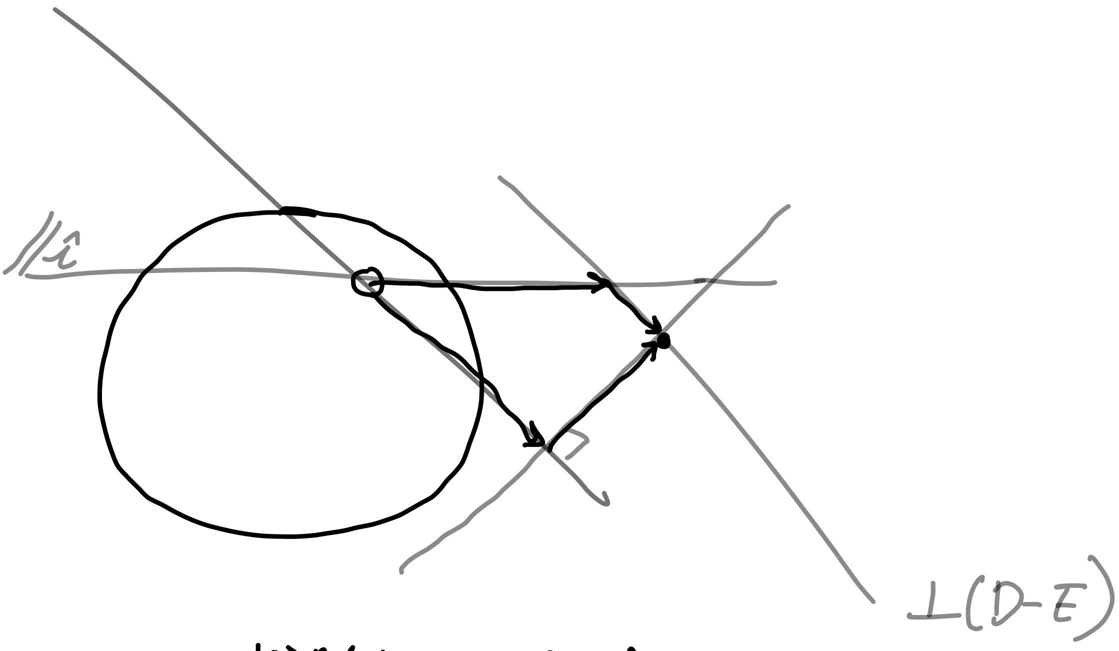


Tenuta rotolante solidale e cilindro

Velocità $\vec V^{ASS}_{E\,S1} = \vec V^{ASS}_{E\,S2}$

	$\vec V^{TRA}_{E\,S1}$ +	$\vec V^{REL}_{E\,S1}$ =	$\vec V^{TRA}_{E\,S2}$ +	$\vec V^{REL}_{E\,S2}$
M	$\dot\alpha\,\overline{EK}$	?	$\dot S\,\overline{ED}$	$\dot S\,\overline{DF}$

D	$\perp(E-k)$	$\parallel \hat{i}_2$	$\perp(E-D)$	$\perp(D-F)$



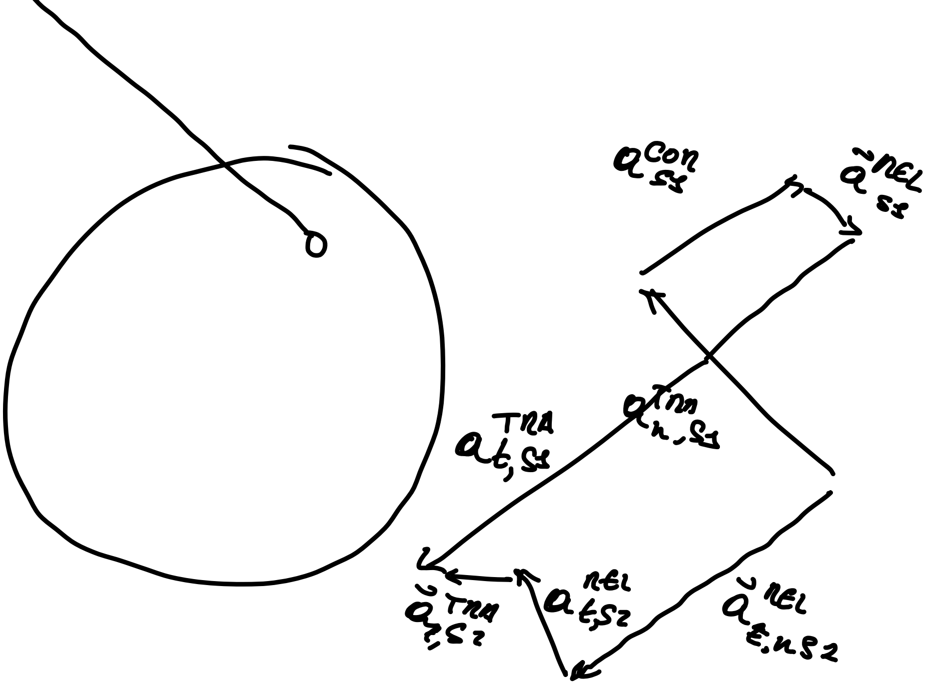
$\Longrightarrow$ Ricavo $|\vec{V}_E^{REL}|$ e $|\vec{V}_{E\,S2}^{TRA}|$

$$\dot{\alpha} = \frac{|V_{E\,S1}^{REL}|}{\overline{Ek}}\,\hat{k}$$

<u>Accelerazione</u> $\quad \vec{a}_{E\,S1}^{ABS} = \vec{a}_{E\,S2}^{ABS}$

$$a_{n\,S1}^{REL} + a_{t,S1}^{REL} + a_{n,S1}^{TRA} + a_{t,S1}^{TRA} + a_{S1}^{COR} = a_{n,S2}^{REL} + a_{t,S2}^{REL} + a_{n,S2}^{TRA} + a_{t,S2}^{TRA} + a_{S2}^{COR}$$

$a_{n\,S1}^{REL}$	$a_{t,S1}^{REL}$	$a_{n,S1}^{TRA}$	$a_{t,S1}^{TRA}$	a_{S1}^{COR}	$a_{n,S2}^{REL}$	$a_{t,S2}^{REL}$	$a_{n,S2}^{TRA}$	$a_{t,S2}^{TRA}$	a_{S2}^{COR}
X		$\dot{\alpha}^2\,\overline{Ek}$	$\ddot{\alpha}\,\overline{Ek}$	$2\dot{\alpha}V_{TRA}$	$\dot{\delta}\,\overline{ED}$	$\ddot{\delta}\,\overline{ED}$	X	$\ddot{\delta}\,\overline{DF}$	X
	$\parallel \hat{i}_2$	$\parallel(E-k)$ $E \to k$	$\perp(E-k)$	$\perp(E-k)$	$\parallel(E-D)$ $E \to D$	$\perp(E-D)$		$\perp(D-F)$	



$\Longrightarrow$ ricavo $\left|a^{REL}_{t,t\,S1}\right|$ e $\left|a^{TRA}_{t,t,S2}\right|$

$$\ddot{\alpha} = -\frac{\left|a^{TRA}_{t,S2}\right|}{\overline{Bh}}\hat{k}$$

$$\vec{V}_G = \ddot{\alpha}\hat{k} \times (G-h)$$

$$\vec{a}_G = \ddot{\vec{\alpha}} \times (G-h) - \dot{\alpha}^2 (G-h)$$