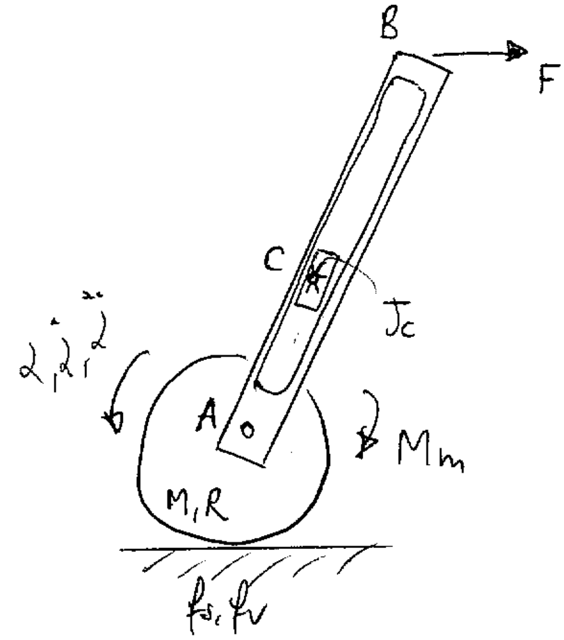
TEMA d'ESAME FMTA 2015

Allievi Energetici 3 FEBBRAIO

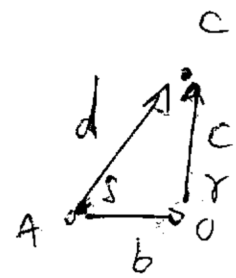
Vettore	Mod	FASE
b	VARIA NOTO	COST
c	COST	COST
d	VARIA?	VARIA?



$$\boxed{\vec b + \vec c = \vec d}$$

CALCOLO $\dot\delta, \ddot\delta$

$\dot d, \ddot d$



$$\begin{cases} b\cos\beta + c\underbrace{\cos\gamma}_{0} = d\cos\delta \\ b\underbrace{\operatorname{sen}\beta}_{0} + c\operatorname{sen}\gamma = d\operatorname{sen}\delta \end{cases}$$

vel
$$\begin{cases} \dot b\cos\beta + \quad = \dot d\cos\delta - d\dot\delta\operatorname{sen}\delta \\ \dot b\underbrace{\operatorname{sen}\beta}_{0} = \dot d\operatorname{sen}\delta + d\dot\delta\cos\delta \end{cases}$$

acc
$$\begin{cases} \ddot b\cos\beta = \ddot d\cos\delta - \dot d\dot\delta\operatorname{sen}\delta - \dot d\dot\delta\operatorname{sen}\delta - d\ddot\delta\operatorname{sen}\delta - d\dot\delta^2\operatorname{sen}\delta \\ \ddot b\underbrace{\operatorname{sen}\beta}_{0} = \ddot d\operatorname{sen}\delta + \dot d\dot\delta\cos\delta + \dot d\dot\delta\cos\delta + d\ddot\delta\cos\delta - d\dot\delta^2\operatorname{sen}\delta \end{cases}$$

$$\vec v_B = \vec v_A + \dot\delta \wedge (B-A)$$

DOVE $\vec v_A = -R\dot\alpha\vec i$ $\Rightarrow$ $\boxed{-R\dot\alpha = \dot b}$

QUINDI
$$\begin{cases} v_{Bx} = -R\dot\alpha\vec i - L\dot\delta\operatorname{sen}\delta\,\vec i \\ v_{By} = L\dot\delta\cos\delta\,\vec j \end{cases}$$

$$\vec{a}_B = \vec{a}_A + \ddot{\delta} \wedge (B-A) - \dot{\delta}^2 (B-A)$$

$$\boxed{\vec{a}_A = -R\ddot{\alpha}\vec{i}}$$

$$\begin{cases} a_{Bx} = -R\ddot{\alpha}\vec{i} - L\ddot{\delta}\,\mathrm{sen}\,\delta\,\vec{i} - \dot{\delta}^2 L \\ a_{By} = (L\ddot{\delta}\cos\delta - L\dot{\delta}^2\,\mathrm{sen}\,\delta)\,\vec{j} \end{cases}$$

P.TO 2) F? → BILANCIO POTENZE

$$\boxed{\Sigma W + \Sigma W_{REATT} = \frac{dE_c}{dt}}$$

$$\Sigma W = \vec{F} \times \vec{v}_B + M_a\vec{g} \times \vec{v}_G + \cancel{M_c\vec{g} \times \vec{v}_c} + \vec{M}_m \times \vec{\omega}_M - N\mu\omega$$

$$\vec{v}_G = \vec{v}_A + \vec{\omega} \wedge (G-A)$$

$$= -R\dot{\alpha}\vec{i} - \dot{\delta}\frac{L}{2}\,\mathrm{sen}\,\delta\,\vec{i} + \dot{\delta}\frac{L}{2}\cos\delta\,\vec{j}$$

$$\Sigma W = F_B v_{Bx} - M_a g\, v_{Gy} - M_M\dot{\alpha} - N f_v R\dot{\alpha}$$

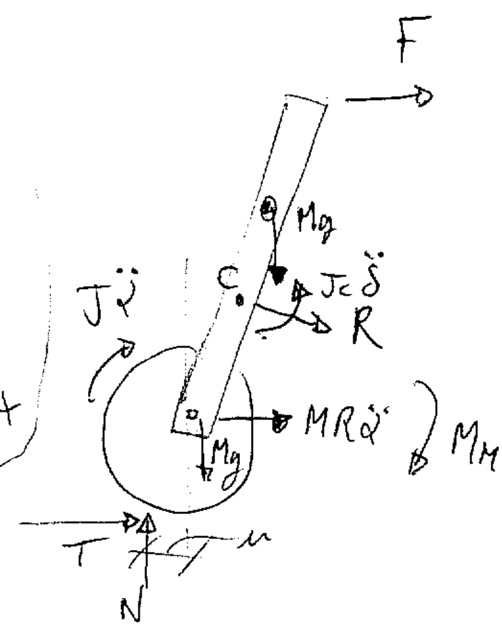
N ?

$$\boxed{\Sigma M_c = \phi} \quad +\circlearrowleft$$

$$-F(L-d)\,\mathrm{sen}\,\delta - J\ddot{\alpha} - M_M - M_g(G-d)\cos\delta +$$

$$+ MR\ddot{\alpha}\,d\,\mathrm{sen}\,\delta + M_g d\cos\delta + J_c\ddot{\delta}$$

$$+ T(d\,\mathrm{sen}\,\delta + R) - N(f_v R + d\cos\delta) = \phi$$



T ? $\Rightarrow \boxed{\sum M_{A\,\text{solo disco}} = \emptyset}$

$$\Rightarrow \quad -J\ddot{\alpha} + TR - N\mu - M_m = \emptyset$$

↳ RICAVO T in funzione di N e poi sostituisco nell'equazione precedente e RICAVO N in FUNZIONE di F. così poi posso RICAVARE F TRAMITE il BILANCIO di POTENZE.

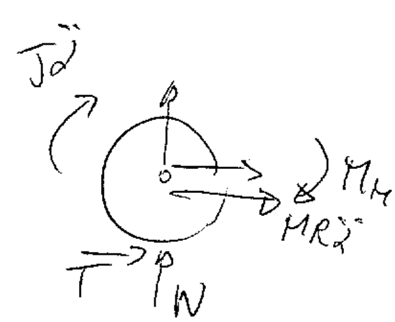
$$E_c = \frac{1}{2} M R^2 \dot{\alpha}^2 + \frac{1}{2} M_G v_G^2 + \frac{1}{2}\left(\frac{1}{2} M R^2\right)\dot{\alpha}^2 + \frac{1}{2} J_c \dot{\delta}^2 + \frac{1}{2} J_G \dot{\delta}^2$$

$$\frac{dE_c}{dt} = M_d R^2 \dot{\alpha}\ddot{\alpha} + \left(\frac{1}{2} M R^2\right)\dot{\alpha}\ddot{\alpha} + M_G v_{Gx} a_{Gx} + M_G v_{Gy} a_{Gy} + J_G \dot{\delta}\ddot{\delta} + J_c \dot{\delta}\ddot{\delta}$$

quindi

$\boxed{\sum W = \frac{dE_c}{dt}}$ $\Rightarrow$ RICAVO F

P.TO 3)



$\boxed{\sum M_{A\,\text{disco}} = \emptyset}$ $+\circlearrowright$

$$-J\ddot{\alpha} - M_M + TR = \emptyset$$

↳ $T = \dfrac{J\ddot{\alpha} + M_m}{R}$

$\boxed{\sum M_c = \emptyset}$ $\rightarrow$ N come prima MA moltiplico solo $(d\cos\delta)$ $\Rightarrow$ $\boxed{|T| \leq f_s |N|}$

ESE 2

(4)

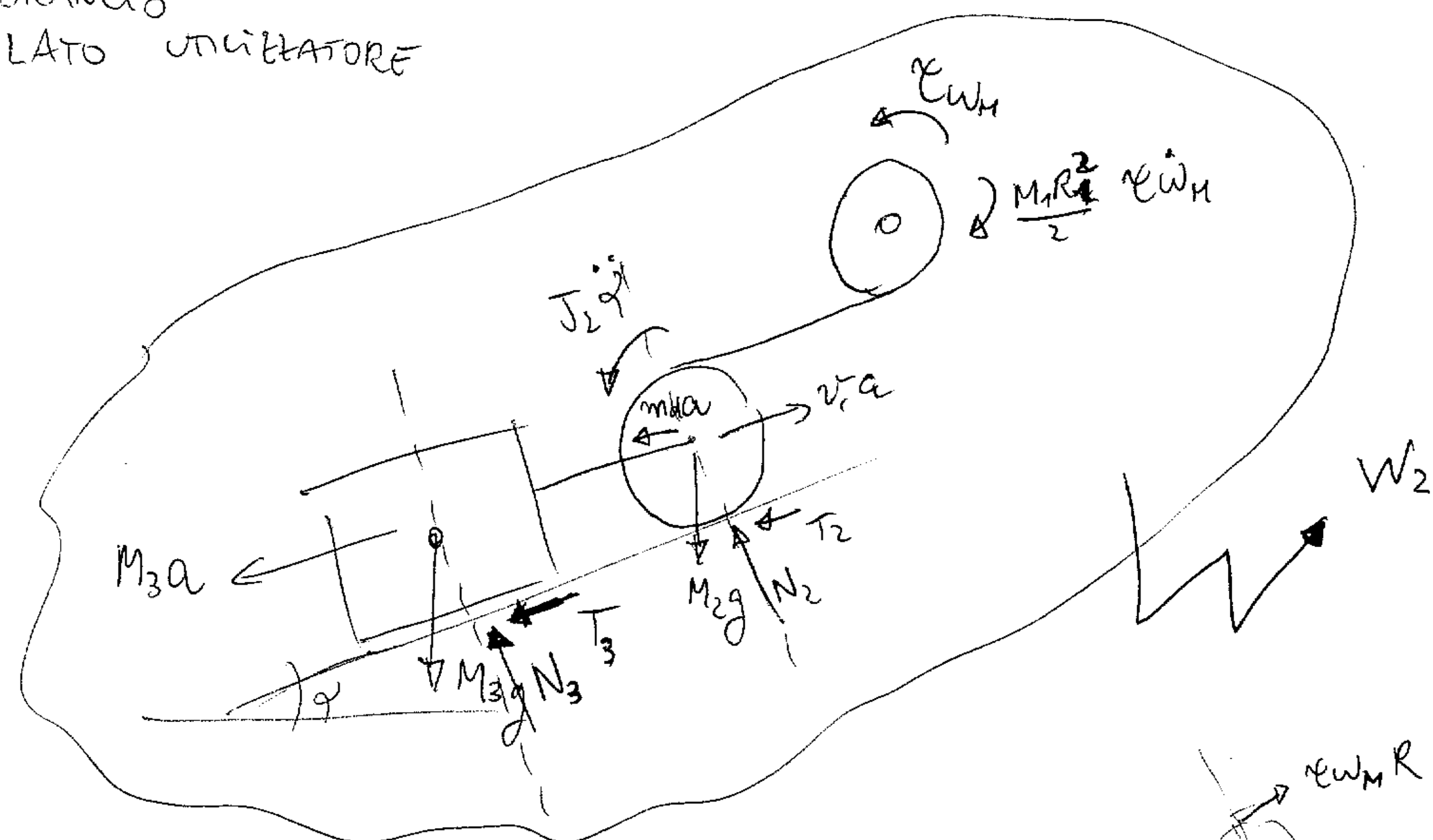
P.TO 1 $\to$ ACC. SPUNTO IN SALITA.

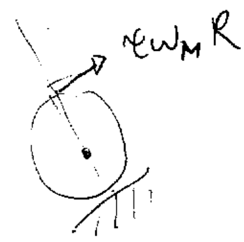
$$\boxed{W_M + W_P + W_U = \frac{dE_c}{dt}}$$

MTU

FLUSSO di POTENZA!

BILANCIO
LATO UTILIZZATORE





$$-W_2 + W_M = \frac{dE_c}{dt}$$

$2R\omega_{d_2} = \tau\omega_M R$

$$\omega_{d_2} = \frac{\tau\omega_M}{2}$$

$$E_c = \frac{1}{2}M_3\left(\frac{\tau\omega_M R}{2}\right)^2 + \frac{1}{2}M_2\left(\frac{\tau\omega_M}{2}R\right)^2 + \frac{1}{2}\left(\frac{M_2R^2}{2}\right)\left(\frac{\tau\omega_M}{2}\right)^2 +$$

$$+ \frac{1}{2}J_P\left(\tau\omega_M\right)^2$$

$$\frac{dE_c}{dt} = M_3\frac{\tau^2R^2}{4}\omega_M\dot{\omega}_M + M_2\frac{\tau^2R^2}{4}\omega_M\dot{\omega}_M + \left(\frac{M_2R^2}{2}\right)\frac{\tau^2}{4}\omega_M\dot{\omega}_M + J_P\tau^2\omega_M\dot{\omega}_M$$

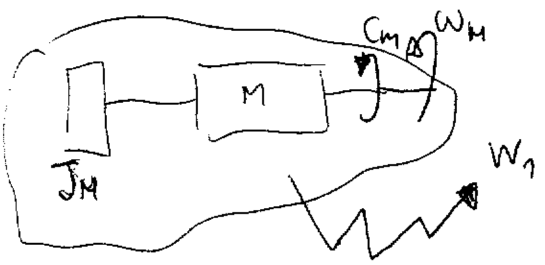
$$W_u = -M_3 g \,\mathrm{sen}\,\alpha \cdot \frac{\tau\omega_M R}{2} - M_2 g \,\mathrm{sen}\,\alpha \cdot \frac{\tau\omega_M R}{2} - T_3 \cdot \frac{\tau\omega_M R}{2}$$

quindi

$$W_2 = -\left(M_3 g \,\mathrm{sen}\,\alpha + M_2 g \,\mathrm{sen}\,\alpha + T_3\right)\frac{\tau\omega_M R}{2} - \left(M_3 + \frac{3}{2}M_2\right)\frac{\tau^2 R^2}{4}\omega_m\dot{\omega}_M + \cancel{\ }$$
$$- J_p \tau^2 \omega_M \dot{\omega}_M$$

quindi ?

LATO MOTORE



$$-W_1 + \underset{C_m\omega_M}{W_M} = \underset{J_M\omega_M\dot{\omega}_M}{\frac{dE_c}{dt}}$$

$$\boxed{W_1 = C_m\omega_M - J_M\omega_M\dot{\omega}_M}$$

quindi ?

Hp: MOTO DIRETTO

- $W_M = C_m\omega_M$
- $W_p = -(1-\eta)W_e = -(1-\eta)\left[C_m\omega_M - J_p\omega_p\dot{\omega}_p\right]$
- W_U = vedi sopra
- $\frac{dE_c}{dt}$ = vedi sopra + aggiunta del volano lato motore $\left(\frac{1}{2}J_M\omega_M^2\right)$

quindi $\boxed{W_M + W_p + W_U = \frac{dE_c}{dt}}$

$$C_m\omega_M\eta - J_m\omega_M\dot{\omega}_M\eta - \left(M_3 g \,\mathrm{sen}\,\alpha + M_2 g \,\mathrm{sen}\,\alpha + T_3\right)\frac{\tau\omega_M R}{2} - \left(M_3 + \frac{3}{2}M_2\right)\frac{\tau^2R^2}{4}\omega_M\dot{\omega}_M +$$
$$- J_p\tau^2\omega_M\dot{\omega}_M \doteq \phi$$

$$\boxed{\dot{\omega}_M = \frac{C_M \cancel{\omega_M} \eta - \left(M_3 g \, sen\alpha + M_2 g \, sen\alpha + T_3\right) \frac{\tau \cancel{\omega_M} R}{2}}{J_M \cancel{\omega_M} \eta + J_P \tau^2 \cancel{\omega_M} + \left(M_3 + \frac{3}{2} M_2\right) \frac{\tau^2 R^2}{4} \cancel{\omega_M}}}$$

RICAVO $\dot{\omega}_M$ e POI DEVO VERIFICARE L'Hp FATTA SUL FLUSSO di POTENZA. ...

2.) VELOCITA' di SALITA A REGIME

ma $\frac{dE_c}{dt} = \emptyset$ FLUSSO di POTENZA ?

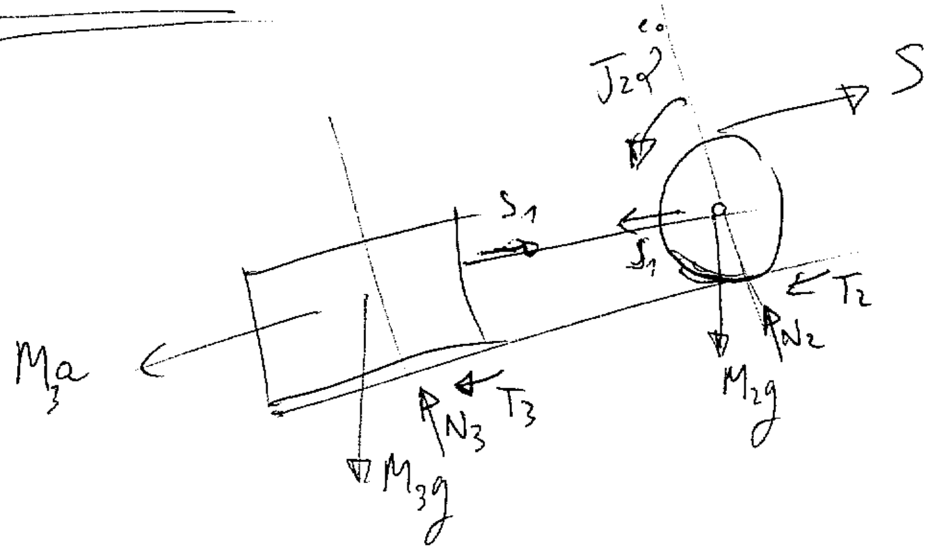
Hp: ANCORA MOTO DIRETTO x' IN SALITA

$$C_M \cancel{\omega_M} \eta - (M_3 + M_2) g \, sen\alpha \frac{\tau \cancel{\omega_M} R}{2} - T_3 \frac{\tau \cancel{\omega_M} R}{2} = \emptyset$$

$$\boxed{C_M = C_{M0} - K \omega_M}$$

$$\omega_M = \frac{C_{M0} \eta - (M_3 + M_2) g \, sen\alpha \frac{\tau R}{2} - T_3 \frac{\tau R}{2}}{K \eta}$$

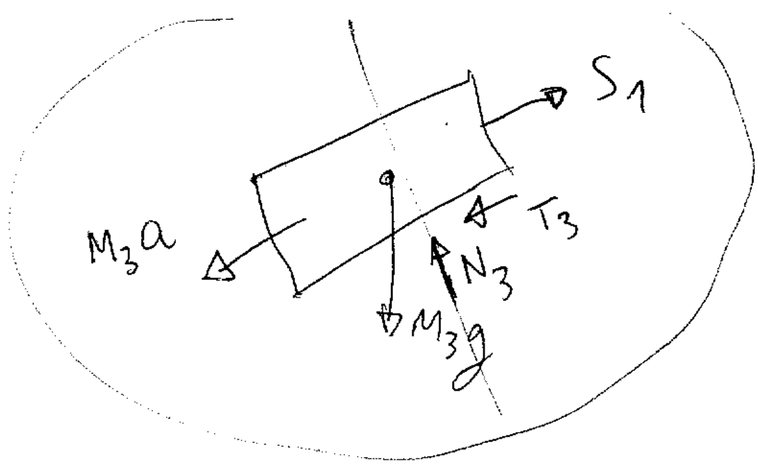
P.TO 3 TIRO FUNE



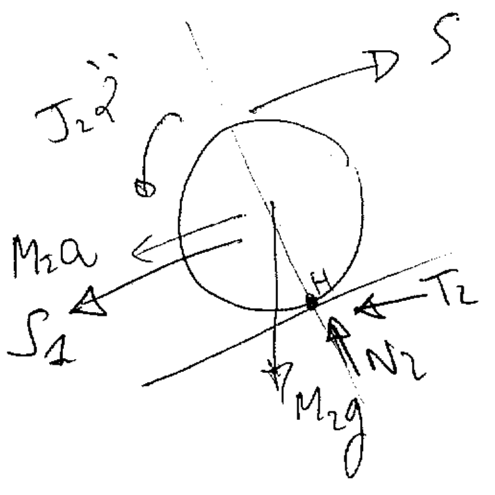
PASSAGGI

1. SPEZZO SOLO IL CARICO M_3 → TROVO T_3 e S_1

- $N_3 = M_3 g \cos\alpha$
- $T_3 = f_d |N_3|$
- $S_1 = M_3 \frac{\dot{\omega}_M R}{2} + T_3 +$
  $+ M_3 g \operatorname{sen}\alpha$



2. CONSIDERO IL SOLO DISCO 2 e RICAVO S



$\boxed{\Sigma M_H = 0}$

↳ RICAVO $\boxed{S}$