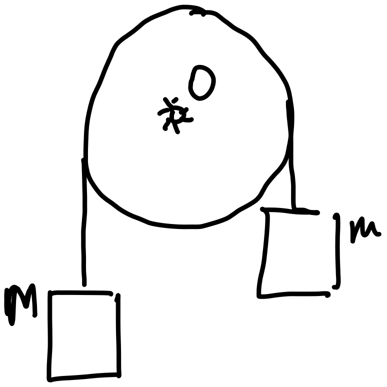
Esercitazione 13 - Studio Dinamico di Sistemi Dinamici

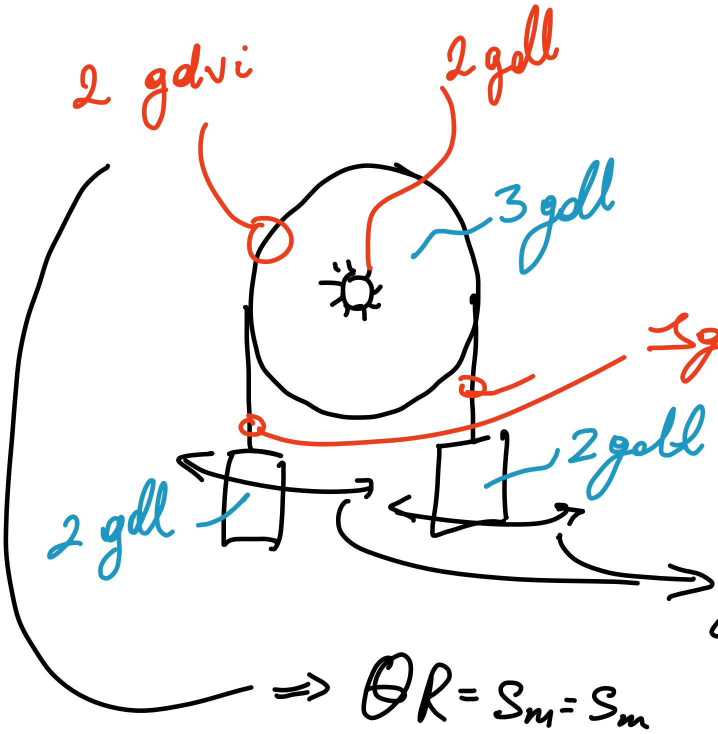
Con Tanzi

Esercizio 1



$M = 50\,kg$ $\quad R = 0{,}2\,m$

$m = 30\,kg$



La fune ha un suo numero di gradi di libertà

$\Rightarrow S_M = S_m$

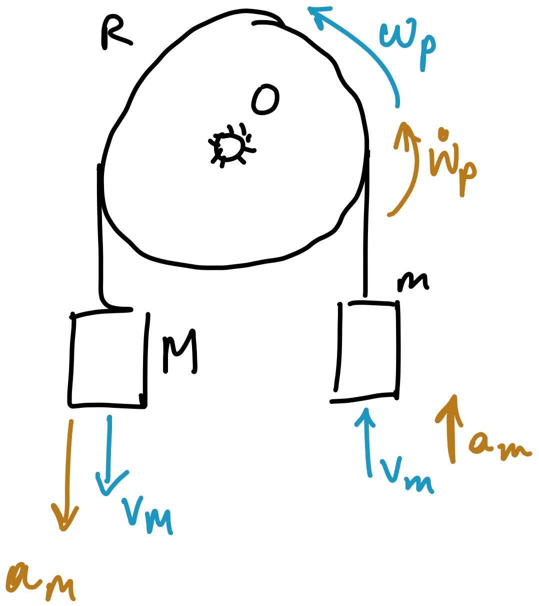
gdl che non sono attivati da forze nel problema

$\Rightarrow \theta R = S_M = S_m$

Aderenza

$\longrightarrow$ è giusto 3gdl

Schema Cinematico

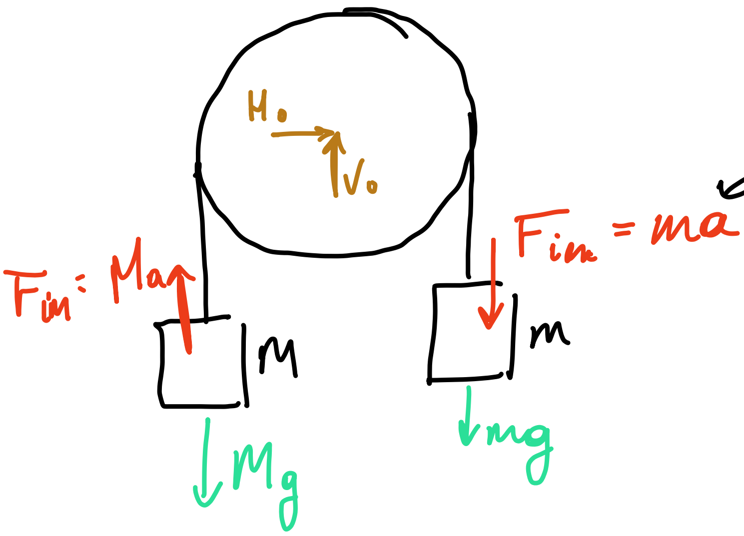


$$a_M = a_m = a$$

$$v_M = v_m = v$$

$$\omega_p = \frac{v}{R} \qquad \dot{\omega}_p = \frac{a}{R}$$

Schema Dinamico



Vedi dove va e metti nella direzione opposta

$$\sum M_o^{\text{TUTTO}} = 0 \qquad MgR - F_{in}R - F_{in}R - mgR = 0$$

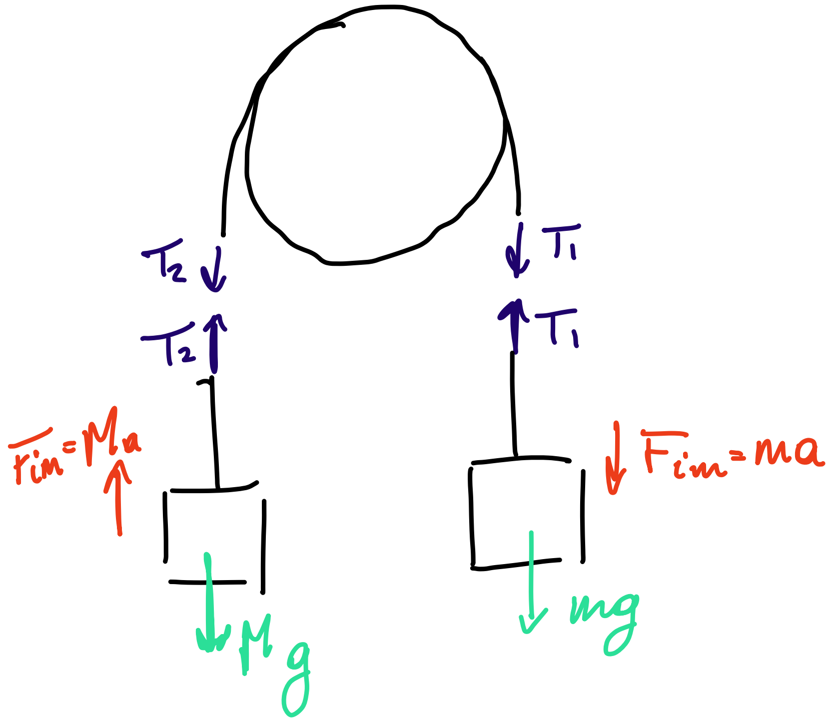
$$Mg\cancel{R} - Ma\cancel{R} - ma\cancel{R} - mg\cancel{R} = 0$$

$$Ma + ma = Mg - mg$$

$$a(M+m) = (M-m)g$$

$$a = \frac{(M-m)g}{M+m} = \frac{(50-30)\cdot 9{,}81}{50+30} = 2{,}45\ \frac{m}{s^2}$$

Trovare le tensione

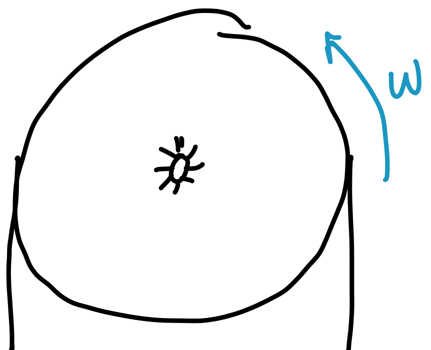


$$\sum M_0^{PUL} = 0 \qquad T_2 R - T_1 R = 0 \rightarrow T_1 = T_2$$

$$T_2 = Mg - Ma = 50(9{,}81 - 2{,}45) = 368\ N$$

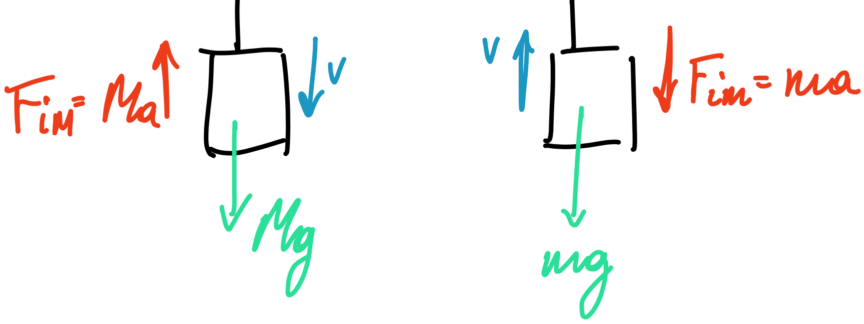
$$T_1 = mg + ma = 367{,}8\ N \approx 368\ N$$ ha senso devono esser uguali

Schema Dinamico per Bilancio delle Potenze



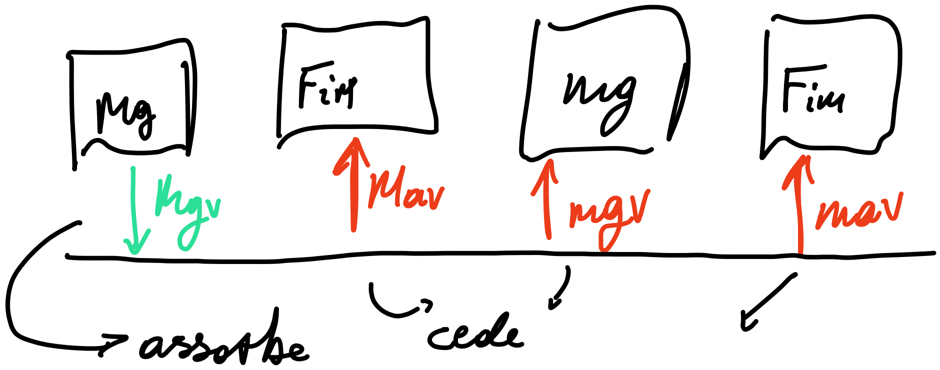
$$\cancel{\frac{dE_c}{dt} = \sum_i W}$$

↳ Non ha senso usarlo



$$\sum_i W_i^* = 0$$

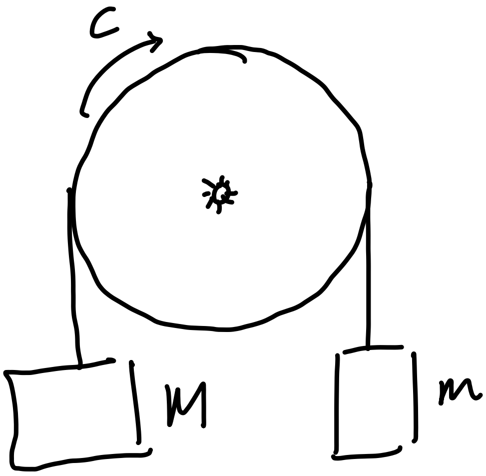
↳ con forze d'inerzia



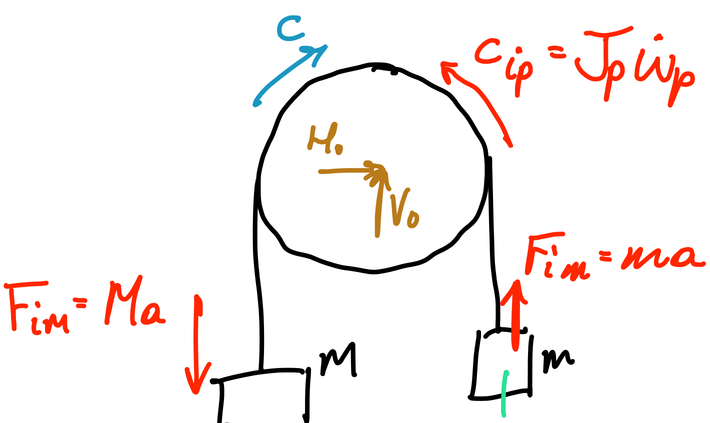
$$Mgv - Mav - mgv - mav = 0$$

Esercizio 2

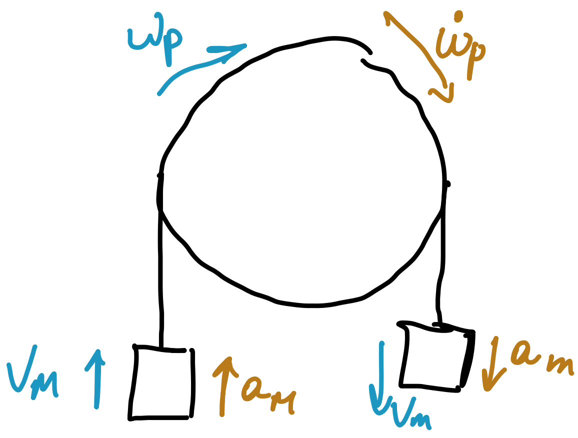
$J_p = 0{,}4\,kg\,m^2$



Schema Dinamico



Schema Cinematico



$$\downarrow Mg \qquad \downarrow mg$$

$$V_M = V_m = V$$

$$a_M = a_m = a$$

$$\omega_p = \frac{V}{R}$$

$$\dot{\omega}_p = \frac{a}{R}$$

$$\sum_i^{\text{TUTTO}} M_o = 0$$

$$c - C_{ip} - F_{iM} \cdot R - MgR - F_{im}R + mgR = 0$$

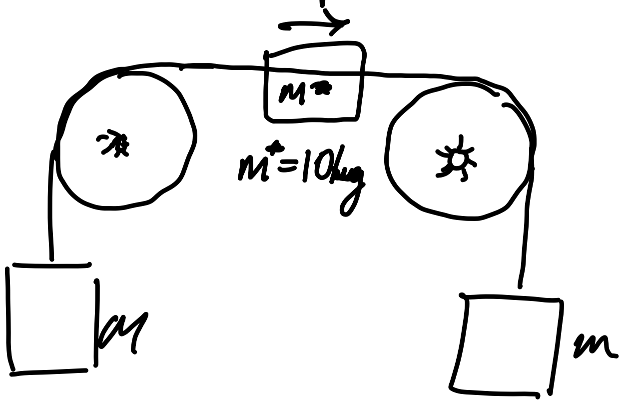
$$c - J_p\dot{\omega}_p - MaR - MgR - maR + mgR = 0$$

$$J_p\dot{\omega}_p + MaR + maR = c - MgR + mgR$$

$$J_p \frac{a}{R^2} + Ma\cancel{R} + ma\cancel{R} = \frac{c}{R} - Mg\cancel{R} + mg\cancel{R}$$

$$a\left(\frac{J_p}{R^2} + M + m\right) = \frac{c}{R} - Mg + mg$$

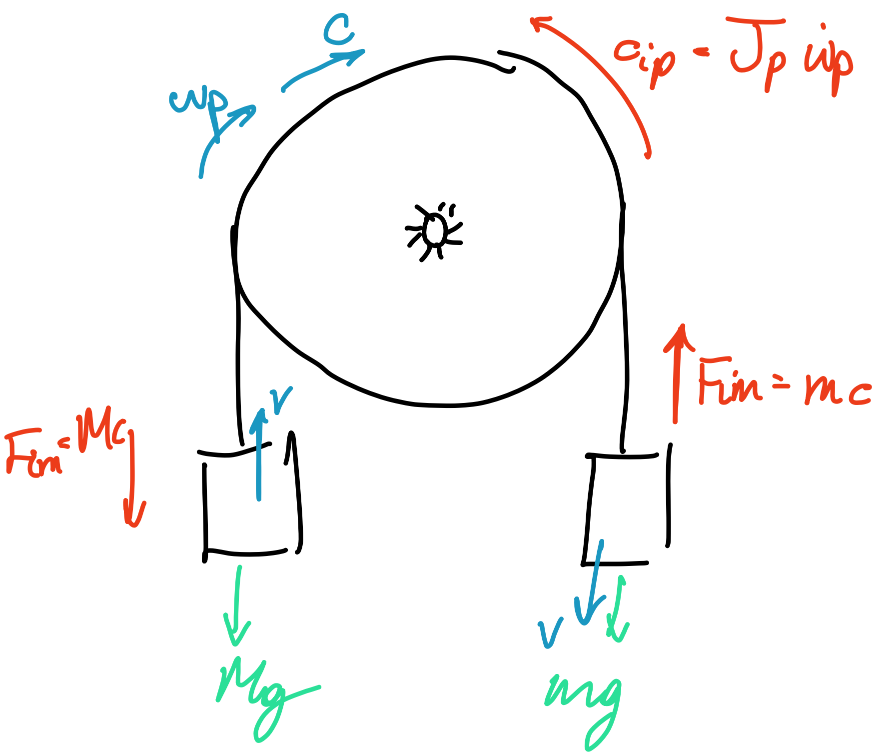
$$a = \frac{\frac{c}{R} - Mg + mg}{\frac{J_p}{R^2} + M + m} = \frac{400 - 490{,}5 + 294{,}3}{10 + 50 + 30} = \frac{203{,}8}{90} = 2{,}26\ \frac{m}{s^2}$$

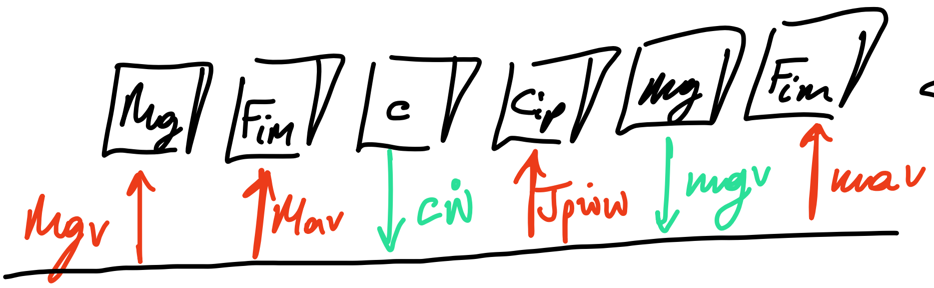


$$F = \frac{c}{R}$$

↳ questo è equivalente in termini di potenza all'istante

Schema Dinamico per Bilancio di Potenza



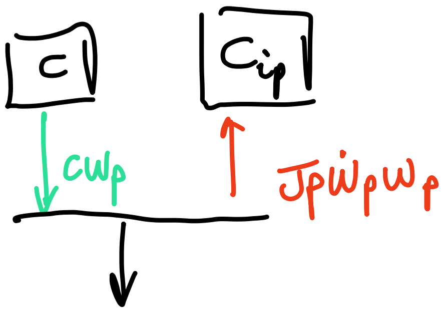


$$\sum_i W_i^* = 0$$

$$-Mgv - Mav + c\dot\omega - J_p\dot\omega\omega + mgv - mav = 0$$

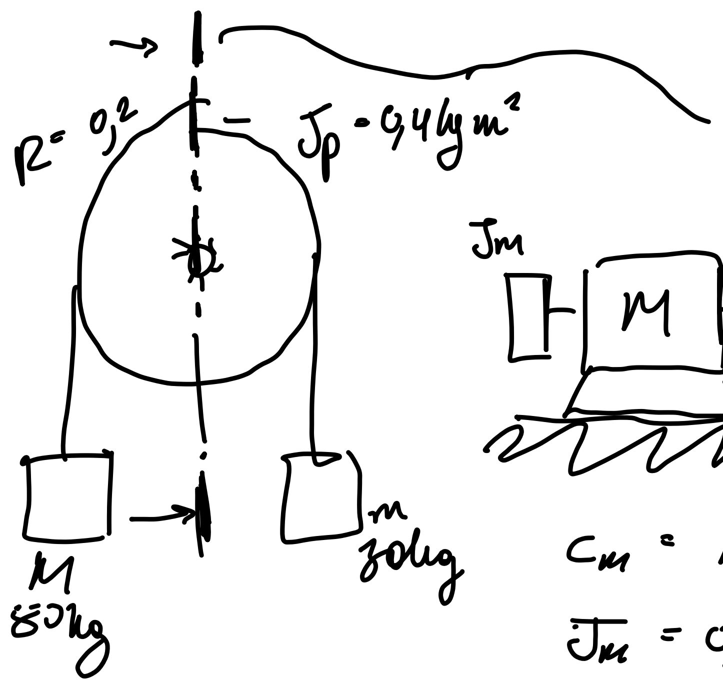
$$\omega = \frac{v}{R} \qquad \dot\omega = \frac{a}{R} \qquad \omega = \frac{v}{R}$$

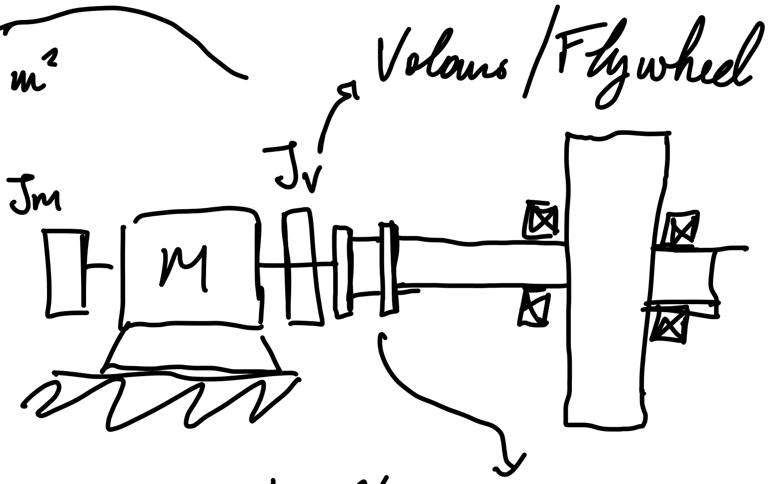
$$-Mg - Ma + c/R - \frac{J_p}{R^2} + mg - ma = 0$$



$$\left(c\,\omega_p - J_p\,\dot{\omega}_p\,\omega_p\right)\eta - Mgv - Mav + mgv - mav = 0$$

Efficienza → perdita nella trasmissione intorno alla puleggia





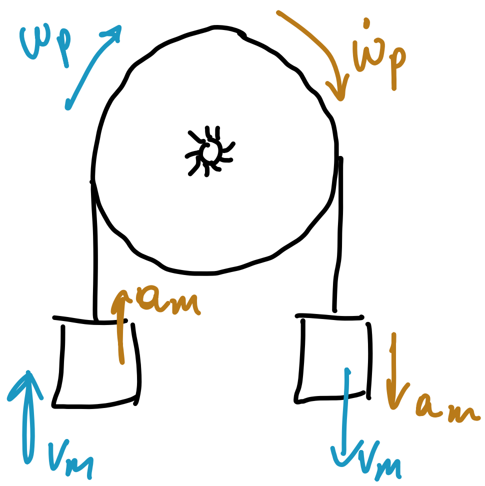
$C_m = 100\ Nm$

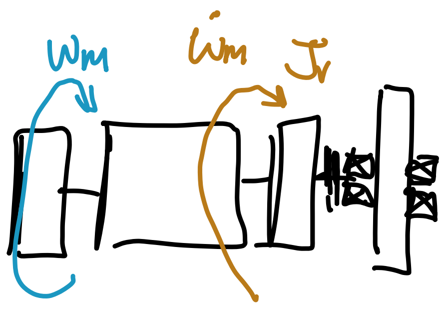
$J_m = 0,1\ kg\,m^2$

$J_v = 0,5\ kg\,m^2$

Giunto che trasferisce solo momento torcente se no ci sarebbero forze estreme sui cuscinetti.

Schema Cinematico





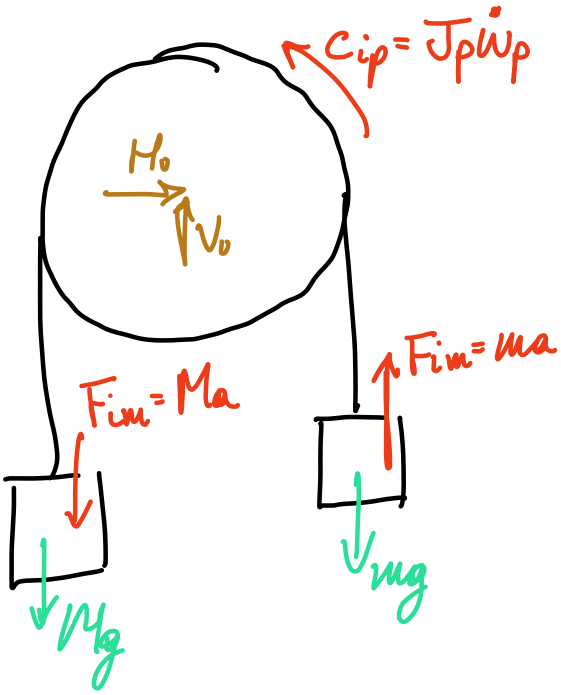
$a_M = a_m = a$

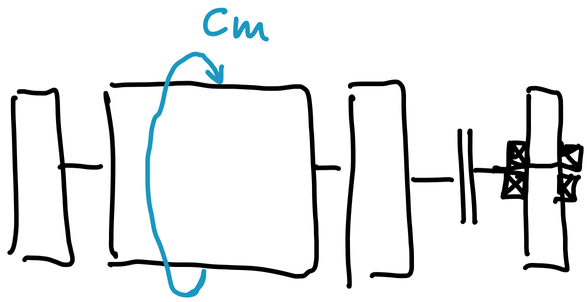
$V_M = V_m = V$

$\omega_p = \frac{V}{R} \quad \omega_m = \omega_p$

$\dot{\omega}_p = \frac{a}{R} \quad \dot{\omega}_m = \omega_p$

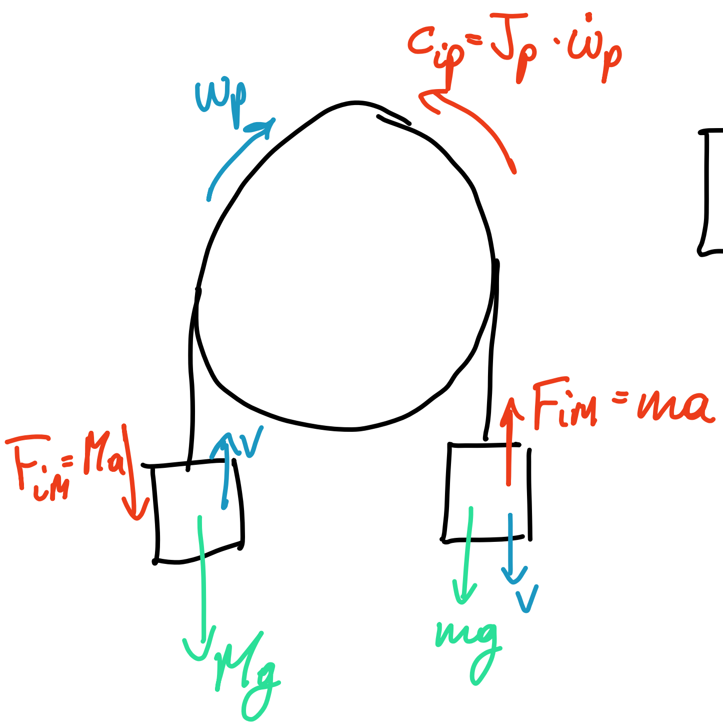
Schema Dinamico

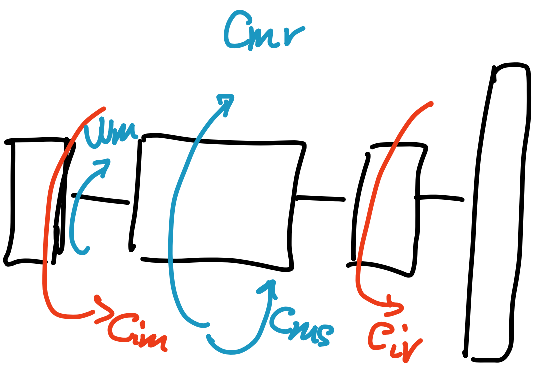


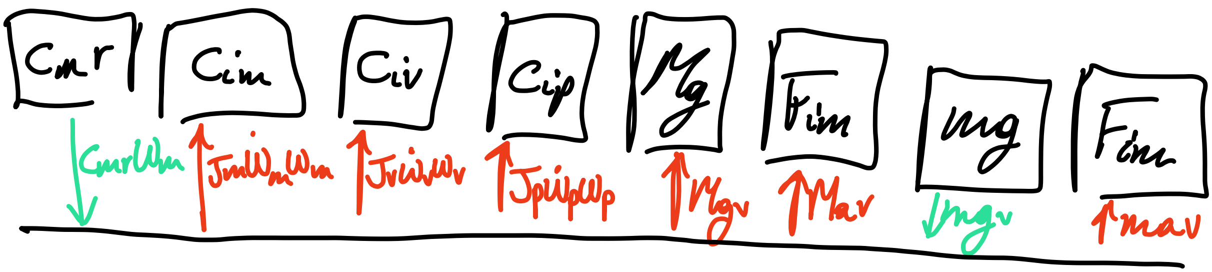


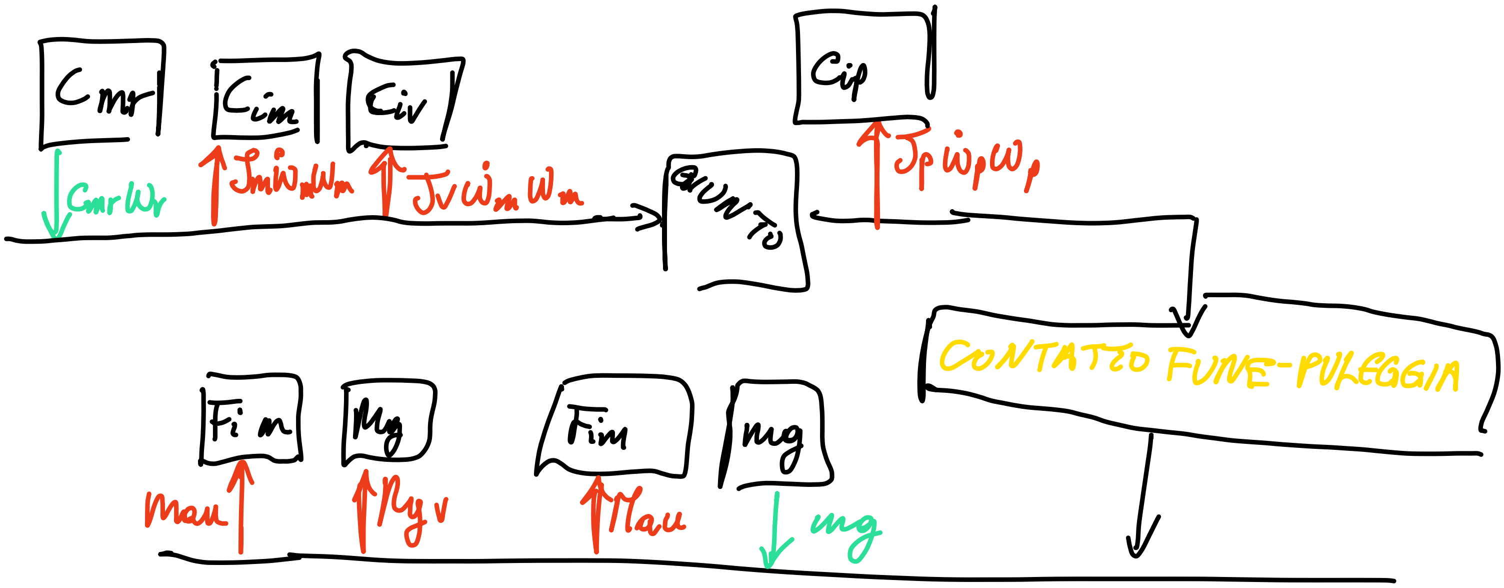
↳ non sarebbe giusto ma non ha effetto sul risultato finale

$$\sum M_0^{\text{TUTTO}} = 0 \qquad C_{mr} - C_{im} - C_{iv} - C_{ip} - F_{ima} - MgR - F_{iM}R + mgR = 0$$









$$W_{EG} - C_{mr} W_m - J_m \dot{\omega}_m W_m - J_v \dot{\omega}_m W_m$$

Entrante al Giunto

$$W_{EG} - J_p \dot{\omega}_p W_p = W_{SPUL-FUNE}$$

Questo metodo ci permette di analizzare la transizione della potenza in un meccanismo.

A regime $a=0$

$$C_{mr} \omega_{reg} - M_g v_{reg} + mg\, v_{reg} = 0 \qquad \omega_{reg} = \frac{v_{reg}}{R}$$

ω di regime   velocità di regime

$$C_{mr} \frac{v_{REG}}{R} - M_g v_{REG} + mg\, v_{REG} = 0$$

$$C_{mr}^{Reg} = R\left(Vg - mg\right)$$