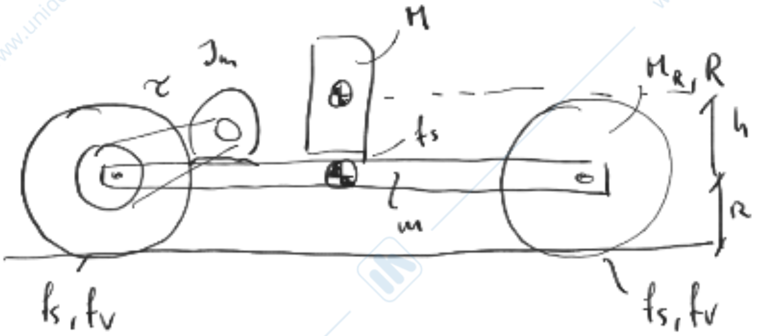
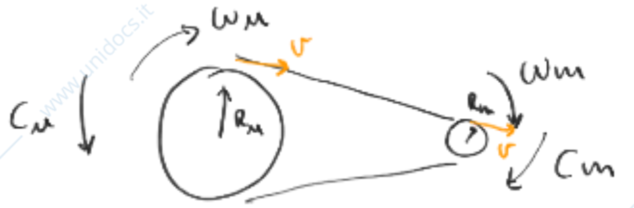
Dinamica longitudinale della moto



Analisi trasmissione a catena



dalla cinematica

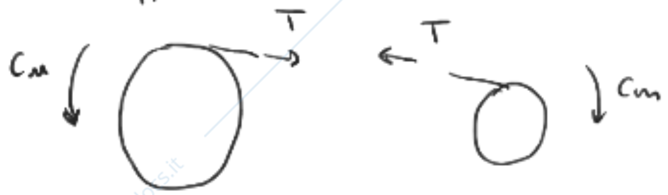
$$\tau = \frac{\omega_u}{\omega_m} \rightarrow \omega_u = \omega_m \tau$$

$$v = v$$

$$\omega_u R_u = \omega_m R_m$$

$$\frac{\omega_u}{\omega_m} = \frac{R_m}{R_u} = \tau < 1 \quad (R_u > R_m)$$

Coppie?



$$C_m = T R_m \qquad T = \frac{C_m}{R_m}$$

$$C_u = T R_u$$

$$C_u = C_m \frac{R_u}{R_m} = C_m^*$$

$$C_m^* = C_m \frac{R_u}{R_m} = \frac{C_m}{\tau} \leftarrow C \text{ aumenta}$$

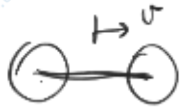
$$\omega_u = \tau \omega_m \leftarrow \omega \text{ diminuisce}$$

$$W_m = C_m \omega_m$$

$$W_m^* = C_m^* \omega_u = \frac{C_m}{\cancel{\tau}} \cancel{\tau} \omega_m \leftarrow W \text{ invariato}$$

La trasmissione trasforma Coppia e Velocità lasciando invariata la potenza (caso ideale)

Cinematica moto



v variabile indipendente

$$\omega_R = v/R$$

$$\omega_m = \frac{\omega_R}{\tau} = \frac{v}{R\tau}$$

Dinamica

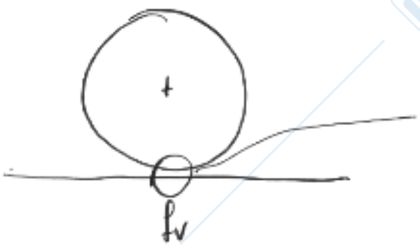
$$\Sigma W = \frac{dE_c}{dt}$$

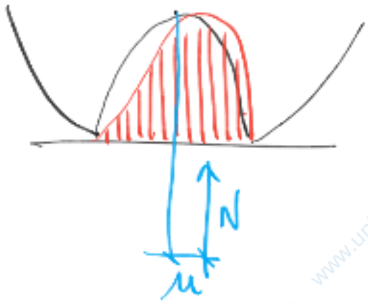
$$E_c = \frac{1}{2}(m+M)v^2 + \frac{1}{2}\,2\,M_R v^2 + \frac{1}{2}\,2\,J_R\omega_R^2 + \frac{1}{2}J_m\omega_m^2$$

$$= \frac{1}{2}\left[m+M+2M_R + 2\,J_R/R^2 + J_m/R^2\tau^2\right]v^2$$

$$= \frac{1}{2}m_{eq}v^2$$

$$\frac{dE_c}{dt} = m_{eq}\dot{v}\,v$$





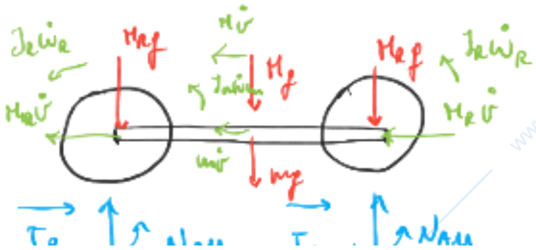
$$C_{res\,rot} = N u \qquad u = f_v R$$

$$\vec{C}_{res\,rot} = -|N|u\frac{\vec{\omega}}{|\vec{\omega}|}$$

$$W_{res\,rot} = -Nu\omega$$

$$\Sigma W = C_m\omega_m - N_A u\,\omega_R - N_P u\,\omega_R$$

N_A, N_P ?



$$\sum F_\perp = 0 \qquad N_A + N_P = (m + M + 2M_R) g$$

$$\sum W = C_m \omega_m - (m + M + 2M_R) g f_v R \omega_R$$

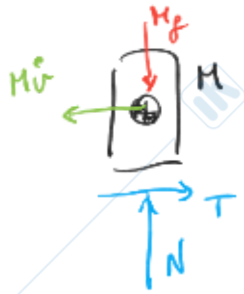
$$\sum W = \left(\frac{C_m}{R\tau} - m_{TOT} g f_v \right) v$$

$$\frac{dE_c}{dt} = m_{eq} \dot{v} v$$

$$\frac{C_m}{R\tau} - m_{TOT} g f_v = m_{eq} \dot{v}$$

$$\dot{v} = \frac{C_m / R\tau - m_{TOT} g f_v}{m_{eq}}$$

•) Verifica slittamento M



$$T \leq T_{max} = f_s N$$

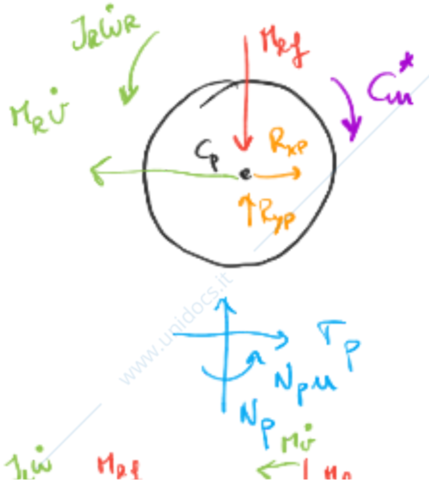
$$\sum F_x = 0 \qquad T = M \dot{v}$$

$$\sum F_y = 0 \qquad N = M g$$

$$M \dot{v} \leq f_s M g$$

$$\dot{v} \leq f_s g$$

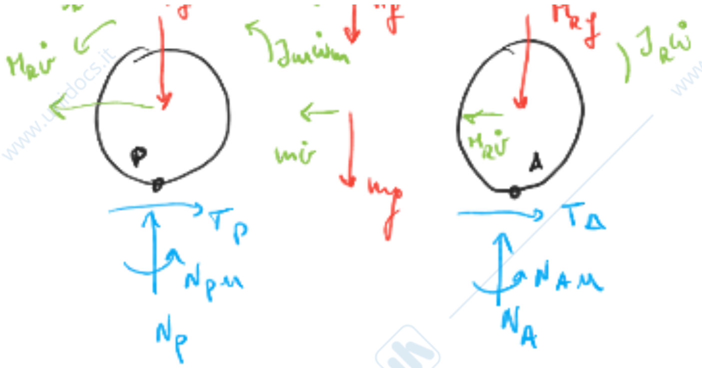
•) Verifica aderenza ruota motrice $\quad T_p \leq T_{p\,max}$



$$\sum M_{C_p} = 0 \qquad T_p R + N_p u + J_R \dot{\omega}_R = C_m^*$$

$$T_p = \left(C_m^* - J_R \dot{\omega}_R - N_p u \right) / R$$

$$\sum F_y = 0 \qquad N_p + R_{yp} - M_R g = 0$$



$\Sigma F_y = 0 \qquad N_A + N_P = m_{TOT}\, g$

$$\Sigma M_A = 0 \qquad N_A u + 2 J_R \dot{\omega}_R + J_m \dot{\omega}_m + (m + 2M_R)\dot{v} R + M\dot{v}(R+h) +$$
$$+ (m+M) g \frac{L}{2} + M_R g L - N_P L + N_P u = 0$$

$$m_{TOT}\, g f_v R - \cancel{N_P f_v R} + \underbrace{\left[(m + 2M_R)R + M(R+h) + \frac{2J_R}{R} + \frac{J_m}{R\tau}\right]}\dot{v} +$$
$$+ \left(\frac{m+M}{2} + M_R\right) g L - N_P L + \cancel{N_P f_v R} = 0$$

$$N_P = \frac{1}{L}\left\{ m_{TOT}\, g f_v R + \left(\frac{m+M}{2} + M_R\right) g L + [\quad]\dot{v} \right\}$$

$$N_P = \frac{m+M}{2} g + M_R g + m_{TOT}\, g f_v \frac{R}{L} + [\quad]\frac{\dot{v}}{L}$$

$$N_A = m_{TOT}\, g - N_P = (m + M + 2M_R) g - N_P$$

$$N_A = \frac{m+M}{2} g + M_R g - m_{TOT}\, g f_v \frac{R}{L} - [\quad]\dot{v}/L$$

$$T_P \leq f_s N_P$$

$$\frac{C_m}{\tau R} - \frac{J_R}{R^2}\dot{v} - N_P f_v \leq f_s N_P$$

$$\frac{C_m}{\tau R} - \frac{J_R}{R^2}\dot{v} \leq (f_s + f_v) N_P$$