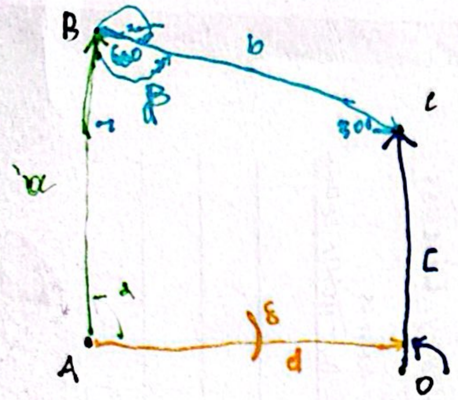


$a = 0{,}5\,m$ $\alpha = 90°$

$\dot{\alpha} = 2\ rad/s$ $\ddot{\alpha} = 3\ rad/s^2$

$b = 1\,m$ $\beta = 270 + 60 = 330°$ $\dot{\beta}, \ddot{\beta} \neq 0$

$c = 0{,}25\,m$ $\gamma = 90°$ $\dot{\gamma}, \ddot{\gamma} \neq 0$

$d; \delta$ FISSI

$$\begin{cases} a\cos\alpha + b\cos\beta = c\cos\gamma + d\cos\delta \\ a\sin\alpha + b\sin\beta = c\sin\gamma + d\sin\delta \end{cases}$$

$$\begin{cases} -a\dot{\alpha}\sin\alpha - b\dot{\beta}\sin\beta = -c\dot{\gamma}\sin\gamma \\ a\dot{\alpha}\cos\alpha + b\dot{\beta}\cos\beta = c\dot{\gamma}\cos\gamma \end{cases}$$

$$\begin{cases} b\dot{\beta}\sin\beta - c\dot{\gamma}\sin\gamma = -a\dot{\alpha}\sin\alpha \\ b\dot{\beta}\cos\beta - c\dot{\gamma}\cos\gamma = -a\dot{\alpha}\cos\alpha \end{cases}$$

$$\begin{vmatrix} b\sin\beta & -c\sin\gamma \\ b\cos\beta & -c\cos\gamma \end{vmatrix} \cdot \begin{vmatrix} \dot{\beta} \\ \dot{\gamma} \end{vmatrix} = \begin{vmatrix} -a\dot{\alpha}\sin\alpha \\ -a\dot{\alpha}\cos\alpha \end{vmatrix}$$

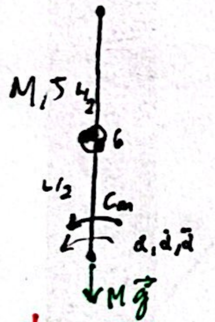
$$\begin{vmatrix} -0{,}5 & -0{,}25 \\ 0{,}866 & 0 \end{vmatrix} \cdot \begin{vmatrix} \dot{\beta} \\ \dot{\gamma} \end{vmatrix} = \begin{vmatrix} -0{,}5 \\ 0 \end{vmatrix} \qquad \begin{cases} \dot{\beta} = 0 \\ \dot{\gamma} = 2\ rad/s \end{cases}$$

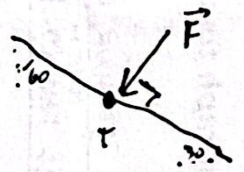
$\vec{\omega}_{DISCO} = \dot{\gamma}\hat{k} = (2\hat{k})\ rad/s$

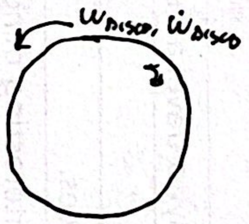
$$\begin{cases} b\ddot{\beta}\sin\beta + b\dot{\beta}^2\cos\beta - c\ddot{\gamma}\sin\gamma - c\dot{\gamma}^2\cos\gamma = -a\ddot{\alpha}\sin\alpha - a\dot{\alpha}^2\cos\alpha \\ b\ddot{\beta}\cos\beta - b\dot{\beta}^2\sin\beta - c\ddot{\gamma}\cos\gamma + c\dot{\gamma}^2\sin\gamma = -a\ddot{\alpha}\cos\alpha + a\dot{\alpha}^2\sin\alpha \end{cases}$$

$$\begin{vmatrix} -0{,}5 & -0{,}25 \\ 0{,}866 & 0 \end{vmatrix} \cdot \begin{vmatrix} \ddot{\beta} \\ \ddot{\gamma} \end{vmatrix} = \begin{vmatrix} -1{,}5 \\ -0{,}5 \end{vmatrix} \qquad \begin{cases} \ddot{\beta} = -0{,}577\ rad/s^2 \\ \ddot{\gamma} = 7{,}15\ rad/s^2 \end{cases}$$

$\vec{\dot{\omega}}_{DISCO} = \ddot{\gamma}\hat{k} = (7{,}15\hat{k})\ rad/s^2$







$\frac{d}{dt}K = \Sigma P$

$\frac{d}{dt}K = M\, v_G\, a_G^{(t)} + J\ddot{\alpha}\dot{\alpha} + J_d\, \dot{\omega}_{DISCO}\, \omega_{DISCO}$

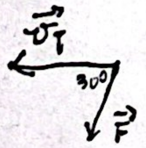
$\vec{v}_G = \vec{v}_A + \dot{\alpha}\hat{k} \times L/2\,\hat{j} = (-0{,}25\,\hat{i})\ m/s$ $\qquad a_G = a_A + \ddot{\alpha}\hat{k} \times L/2\,\hat{j} - \dot{\alpha}^2(G-O)$ $\qquad a_G^{(t)} = (-0{,}75\,\hat{i})\ m/s^2$

$\Rightarrow \frac{d}{dt}K = 9{,}63\,W$

$\Sigma P = C_m\dot{\alpha} + \vec{v}_T \cdot \vec{F}$

$\vec{v}_T = \vec{v}_B + \vec{\dot{\beta}} \times (T - B) = \vec{v}_B$

$\vec{v}_B = \vec{v}_A + \vec{\dot{\alpha}} \times L\hat{j} = (-0{,}5\,\hat{i})\ m/s$



$\vec{v}_T \cdot \vec{F} = v_T F \cos(30)$

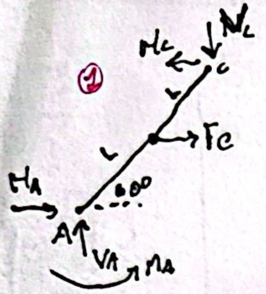
$\dot{\alpha} C_m + F v_T \cos(30) = 9{,}63\,W$

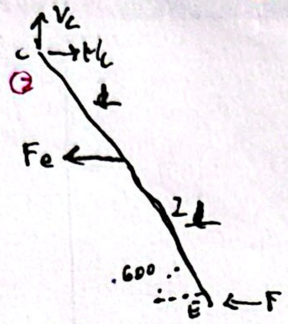
$C_m = -15{,}37\,Nm$

Scanned with CamScanner

$n = 3 \cdot 3 - (3_A + 2_B + 2_C + 2_D) = 0$

$F_e = k(BD - L_0) = k(L - 2L)$



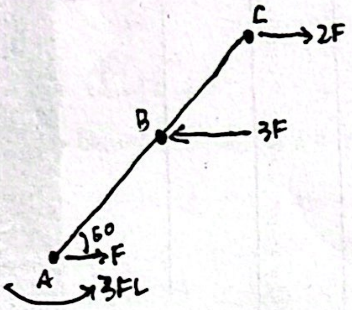


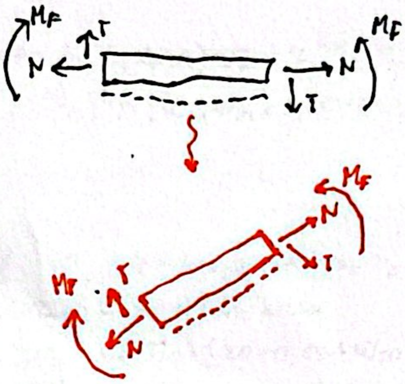
$$\begin{cases} 1 \begin{cases} H_A + F_e - H_C = 0 \\ V_A - V_C = 0 \\ A:\ M_A - L F_e \sin(60) + 2L H_C \sin(60) - 2L V_C \sin(30) = 0 \end{cases} \\ 2 \begin{cases} H_C - F_e - F = 0 \\ V_C = 0 \\ C:\ -L F_e \sin(60) - 3L F \sin(60) = 0 \end{cases} \end{cases}$$

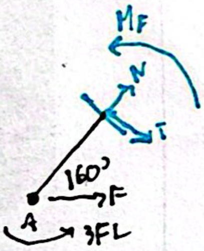
$F_e = -3F \quad H_C = -2F \quad V_C = 0 \quad V_A = 0$

$H_A = F \quad M_A = \sqrt{3}/2\, FL$

$-3F = k(L - 2L) \Rightarrow k = 3F/L$





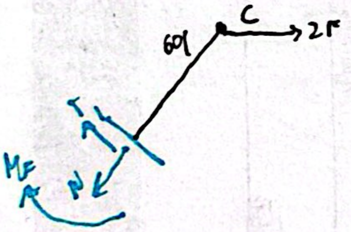


$$\begin{cases} N + F\cos(60) = 0 \\ T + F\sin(60) = 0 \\ M_F + \sqrt{3}/2\, FL + F x \sin(60) = 0 \end{cases}$$

$N = -F/2$

$T = -\sqrt{3}/2\, F$

$M_F(0) = -\sqrt{3}/2\, FL \quad M_F(L) = -\sqrt{3}FL$



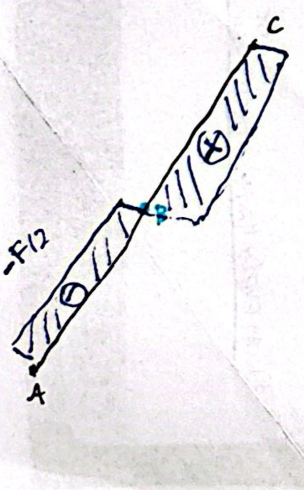
$$\begin{cases} N - 2F\cos(60) = 0 \\ T - 2F\sin(60) = 0 \\ -M_F - 2F x \sin(60) = 0 \end{cases}$$

$N = F$

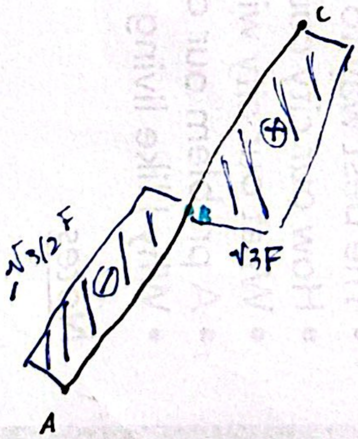
$T = \sqrt{3}F$

$M_F(0) = 0 \quad M_F(L) = -\sqrt{3}FL$

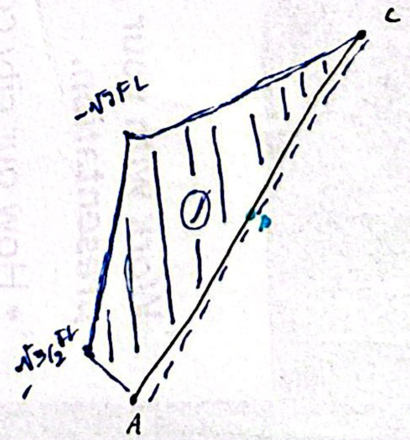
N

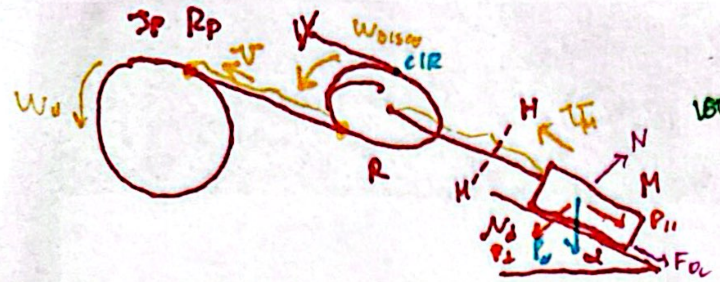


T



M_F





M IN SALITA

LEGAMI CINEMATICI

$$\begin{cases} \omega_v = \tau \omega_m & \dot\omega_v = \tau \dot\omega_m \\ v = R_p \omega_v = \tau R_p \omega_m & a = \tau R_p \dot\omega_m \qquad \dot\omega_{disco} = \tau \left(\frac{R_p}{2R}\right) \dot\omega_m \\ v = v_{CIR} + 2R\omega_{disco} \Rightarrow \omega_{disco} = \tau \left(\frac{R_p}{2R}\right) \omega_m \\ v_M = v_{CIR} + R\omega_{disco} = \frac{\tau}{2} R_p \omega_m & a_M = \frac{\tau}{2} R_p \dot\omega_m \end{cases}$$

BILANCIO DI POTENZE: $P_1 + P_2 + P_T = 0$

$P_1 = \sum P^{(m)} - \frac{d}{dt} K^{(m)} = C_m \omega_m - J_m \dot\omega_m \omega_m$

$P_2 = \sum P^{(u)} - \frac{d}{dt} K^{(u)}$

$\sum P^{(u)} = (\vec{F}_{\parallel} + \vec{F}_a) \cdot \vec{v}_M = (-Mg\sin\alpha - \mu_d Mg\cos\alpha) v_M = \tau \frac{R_p}{2} Mg(-\sin\alpha - \mu_d\cos\alpha)\omega_m = -6{,}6\omega_m$

$\frac{d}{dt} K = J_p \dot\omega_v \omega_v + M v_M a_M = \tau^2 (J_p + (\frac{R_p}{2})^2 M) \dot\omega_m \omega_m = 0{,}0098 \dot\omega_m \omega_m$

$C_m \omega_m - J \dot\omega_m \omega_m - 6{,}6\omega_m - 0{,}0098 \dot\omega_m \omega_m + P_T = 0$

CASO 1) $C_m = 20Nm$ a_M?

$P_1 = (20 - 0{,}04\dot\omega_m)\omega_m \gtrless 0$? $\quad P_2 = (-6{,}6 - 0{,}098\dot\omega_m)\omega_m \gtrless 0$?

H_p MOTO DIRETTO $\quad P_T = -(1-\eta_D)(20 - 0{,}04\dot\omega_m)\omega_m$

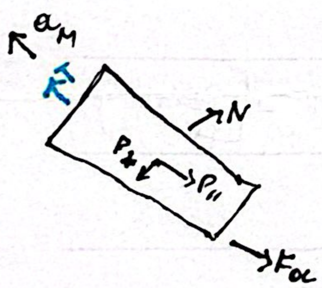
$(20 - 0{,}04\dot\omega_m)\cancel{\omega_m} + (-6{,}6 - 0{,}0098\dot\omega_m)\cancel{\omega_m} - (1-\eta_D)(20 - 0{,}004\dot\omega_m)\cancel{\omega_m} = 0 \rightarrow \dot\omega_m = 250\ rad/s^2$ $\quad a_M = 2{,}25\ m/s^2$

CASO 2) REGIME C_m? $P_1 = 10\omega_m \geq 0$ ✓

$C_m \omega_m - 6{,}6\omega_m + P_T = 0 \qquad P_2 = -6{,}6\omega_m < 0 \Rightarrow$ MOTO DIRETTO

$C_m \cancel{\omega_m} - 6{,}6\cancel{\omega_m} - (1-\eta_d) C_m \cancel{\omega_m} = 0 \qquad C_m = 7{,}33Nm$

DA CASO 1, ~~AT~~ TIRO FUNE IN H—H'



$$\begin{cases} \sum F_x = -M|a_M| \\ \sum F_y = 0 \end{cases} \qquad \begin{cases} P_\parallel + \overbrace{Fa}^{\mu_d N} - T = -M|a_M| \\ -P_\perp + N = 0 \rightarrow N = Mg\cos\alpha \end{cases}$$

$T = M(|a_M| + g(\sin\alpha + \mu_d\cos\alpha)) = 1570N$