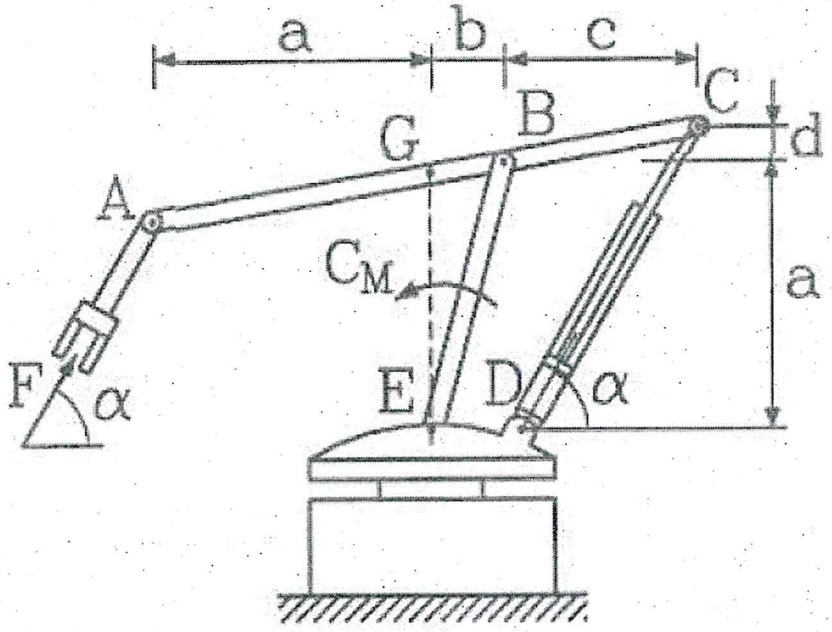
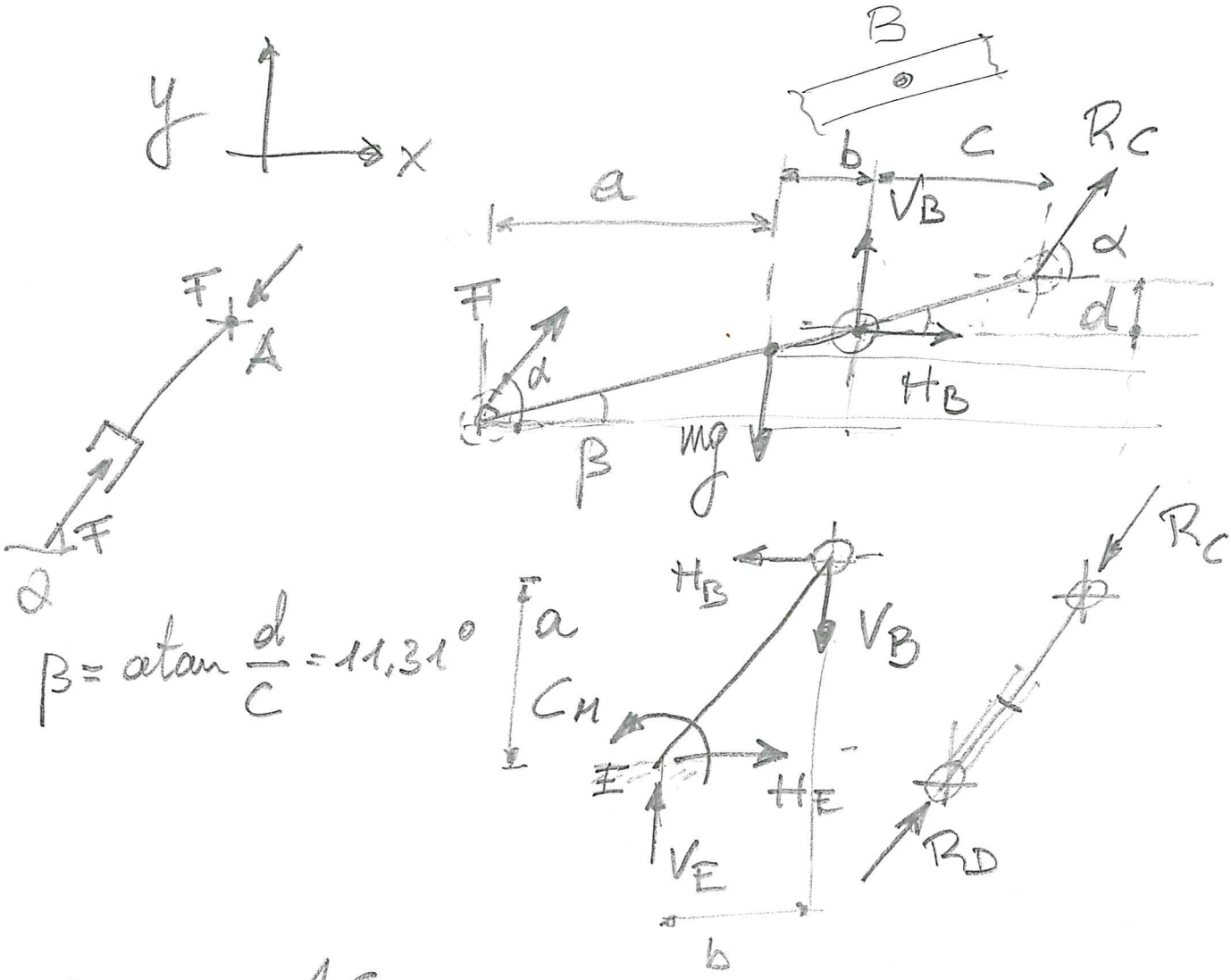
Al robot rappresentato in figura è applicata una forza $F=100\ N$ sulla sua estremità. Il braccio BE viene mantenuto nella posizione indicata da un motore posizionato in E. Si trascurino tutte le masse della struttura, ad eccezione della massa del braccio AC, che vale $m=25\ kg$ ed ha baricentro in G. Sono dati: $a=0.75\ m$, $b=0.25\ m$, $c=0.5\ m$, $d=0.1\ m$, $\alpha=60°$.
Calcolare: la forza esercitata dal cilindro idraulico CD, la reazione vincolare nella cerniera B e la coppia del motore in E.





$$\beta = \operatorname{atan}\frac{d}{c} = 11{,}31°$$

CORPO AC

x) $F\cos\alpha + H_B + R_C\cos\alpha = 0$

y) $F\sin\alpha - mg + V_B + R_C\sin\alpha = 0$

B)) $F\sin\alpha\,(a+b) - F\cos\alpha\,(a+b)\,\mathrm{tg}\,\beta - mg\,b - R_C\sin\alpha\cdot c + R_C\cos\alpha\cdot d = 0$

E)) $C_M + H_B\,a - V_B\cdot b = 0$

$H_B,\ R_C,\ V_B,\ C_M$

$$R_C (d\cos\alpha - c\sin\alpha) = mg\,b + F(a+b)(\cos\alpha\,\mathrm{tg}\,\beta - \sin\alpha)$$

$$R_C = \frac{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad}{\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad} = 39{,}9\,N$$

$$V_B = mg - F\sin\alpha - R_C\sin\alpha = 124{,}1\,N$$

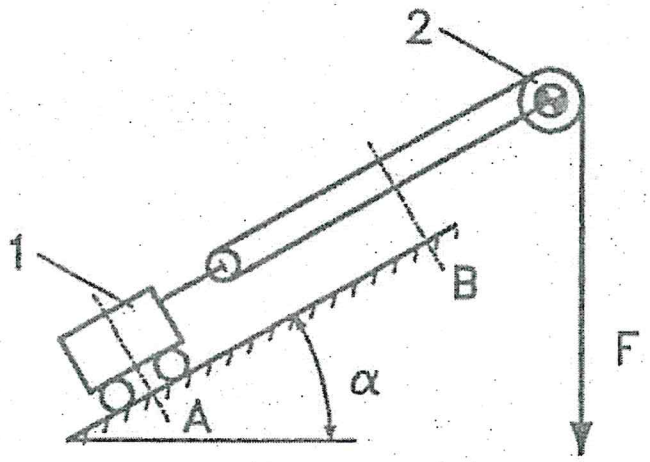
$$25 \cdot 9{,}81 - 100\sin 60 - 39{,}9 \cdot \sin 60 = 124{,}1\,N$$

$$H_B = -F\cos\alpha - R_C\cos\alpha = -69{,}9\,N$$

$$C_M = V_B \cdot b - H_B \cdot a = 83{,}5\,Nm$$

Carrello su piano inclinato

Il carrello 1, avente massa $m_1 = 50\ kg$, si muove sul piano inclinato di un angolo $\alpha = 30°$. Inizialmente, con carrello in posizione A, il sistema è in quiete. Nota la massa della puleggia 2, $m_2 = 4\ kg$, trascurando gli attriti, determinare la velocità del carrello in corrispondenza del punto B ($\overline{AB}$=2 m) quando viene applicata una forza costante $F=250\ N$.



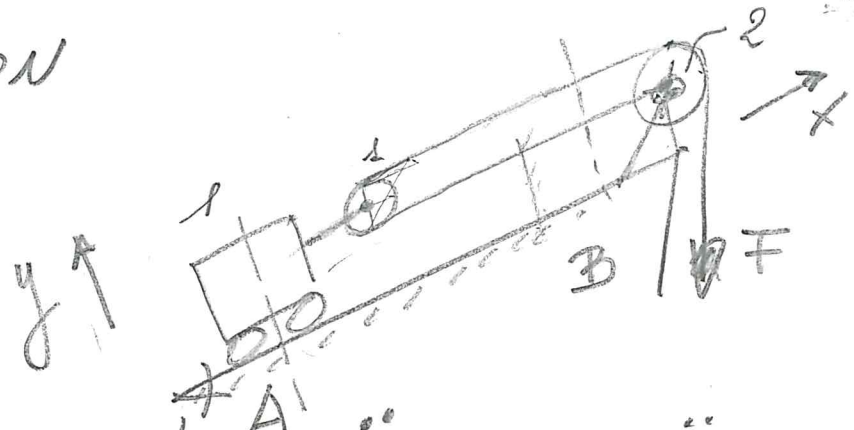
$m_1 = 50\,kg$ $\quad F = 250\,N$

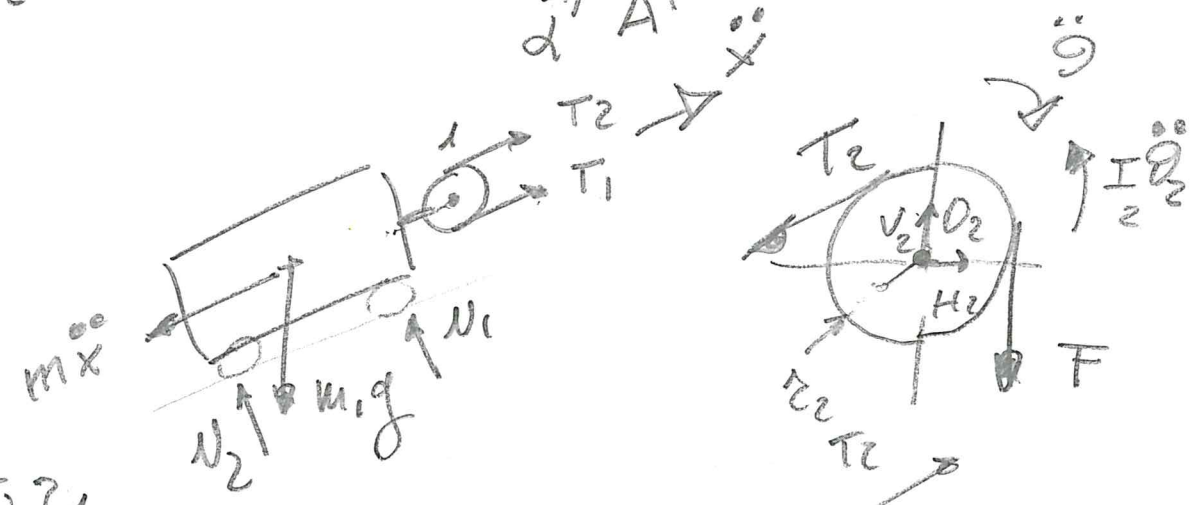
$\alpha = 30°$

$m_2 = 4\,kg$

$AB = 2\,m$

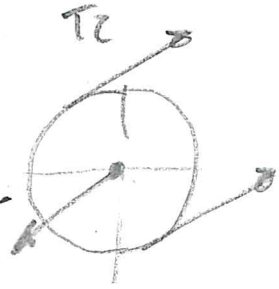
v_B ?





$T_1 r_1 = T_2 r_2$

$T = T_1 + T_2 = 2T_2$ *



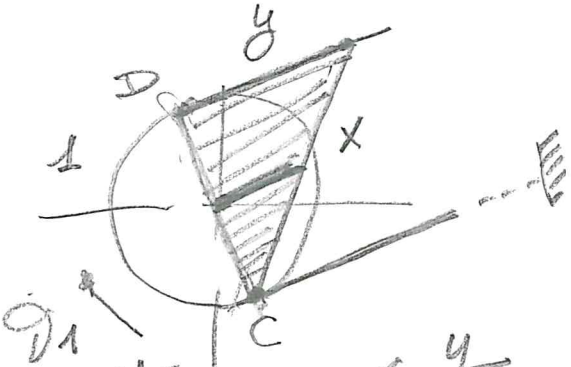
x) $T_1 + T_2 - m_1 g \sin\alpha - m_1 \ddot{x} = 0$ *

O_2) $T_2 \cdot r_2 - F \cdot r_2 + \frac{m_2 r_2^2}{2} \ddot{\vartheta}_2 = 0$ * $\quad I_2 = \frac{m_2 r_2^2}{2}$

$T_1, T_2, \ddot{x}, (\ddot{\vartheta})$

$\ddot{y} = 2\ddot{x} = \ddot{\vartheta}_2 r_2$

$\ddot{\vartheta}_2 = \frac{2\ddot{x}}{r_2}$



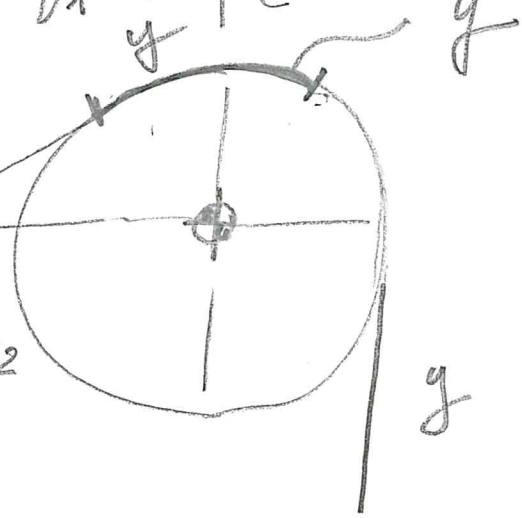
$T_2 r_2 - F r_2 + \frac{m_2 r_2}{2} \frac{2\ddot{x}}{r_2} = 0$

$T_2 - F + m_2 \ddot{x} = 0$

$T_2 = F - m_2 \ddot{x}$

$\ddot{\vartheta}_2 = \frac{\ddot{y}}{r_2}$

$y = \vartheta_2 \cdot r_2$



$$\begin{cases} 2T_2 - m_1 g \sin\alpha - m_1 \ddot{x} = 0 \\ T_2 = F - m_2 \ddot{x} \end{cases}$$

$$2F - 2m_2\ddot{x} - m_1 g \sin\alpha - m_1 \ddot{x} = 0$$

$$\ddot{x}(2m_2 + m_1) = 2F - m_1 g \sin\alpha$$

$$\ddot{x} = \frac{2F - m_1 g \sin\alpha}{2m_2 + m_1} = \frac{2 \cdot 250 - 50 \cdot 9{,}81 \sin 30}{2 \cdot 4 + 50} =$$

$$= 4{,}39 \ m/s^2$$

$$\begin{cases} V_B = V_A + \ddot{x} t \\ x = AB = x_0 + V_A t + \frac{1}{2}\ddot{x} t^2 \end{cases} \qquad V_B = \ddot{x} t \quad t = \frac{V_B}{\ddot{x}}$$

$$AB = \frac{1}{2}\ddot{x}\frac{V_B^2}{\ddot{x}^2} = \frac{1}{2}\frac{V_B^2}{\ddot{x}}$$

$$V_B^2 = AB \cdot 2\ddot{x} = 2 \cdot 2 \cdot 4{,}39 = 17{,}57 \ \frac{m^2}{s^2}$$

$$V_B = \pm 4{,}19 \ m/s$$

CON BILANCIO ENERGETICO

$$L_e + L_i = \Delta E_c + \Delta E_g + \Delta E_k + \dots$$

$$L_e = F \cdot 2AB$$

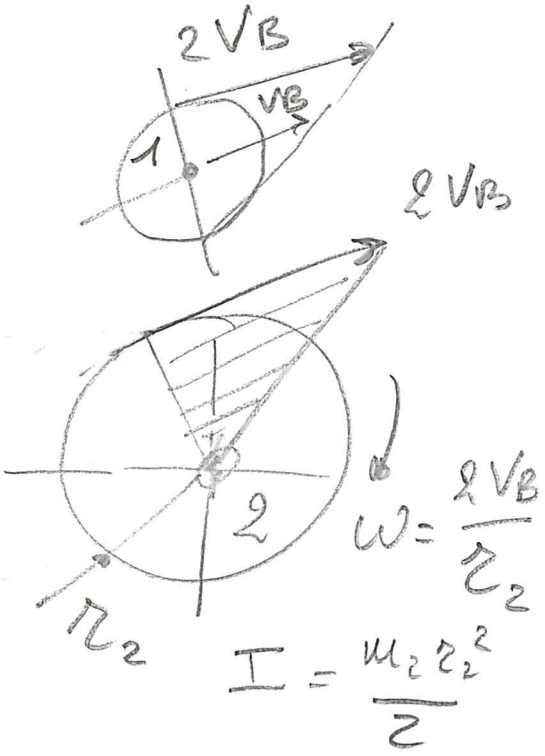
$$L_i = 0$$

$$E_{cA} = 0$$

$$E_{cB} = \frac{1}{2} m_1 V_B^2 + \frac{1}{2} I \omega^2 =$$

$$= \frac{1}{2} m_1 V_B^2 + \frac{1}{2} \frac{m_2 r_2^2}{2} \frac{4 V_B^2}{r_2^2} =$$

$$= \frac{1}{2} V_B^2 (m_1 + 2 m_2)$$



$$E_{k_A} = E_{k_B} = 0$$

$$E_{g_A} = 0$$

$$E_{g_B} = m_1 g AB \sin\alpha$$

$$F \, 2AB = \frac{1}{2} V_B^2 (m_1 + 2 m_2) + m_1 g AB \sin\alpha$$

$$V_B = 4{,}19 \text{ m/s}$$