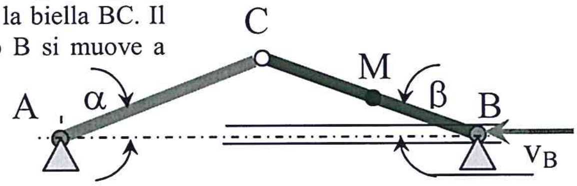
11.11.2016 1

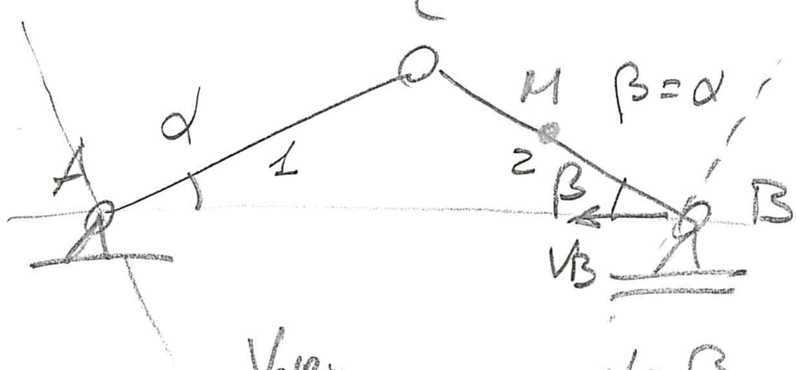
Esercizio 1
Il meccanismo in figura ha il punto A fisso e B scorrevole lungo la guida orizzontale AB; in C si ha una cerniera tra la manovella AC e la biella BC. Il punto M rappresenta il punto medio della biella BC. Il punto B si muove a velocità costante v_B, come in figura.



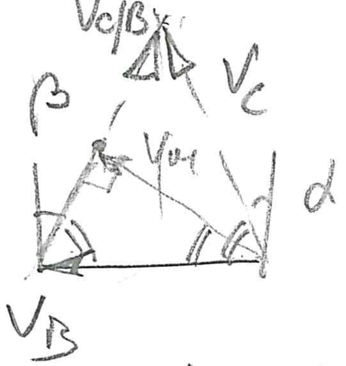
Dati:
AC=BC=1m dimensioni geometriche;
α=30° angolo della manovella AC all'istante iniziale considerato;
v_B=1m/s velocità del punto B;
t=0,5s tempo.

Si chiede di calcolare:
1. la velocità del punto medio M della biella BC e la velocità angolare della manovella AC;
2. l'accelerazione angolare della manovella AC e della biella BC;
3. il valore dell'angolo β dopo il tempo t trascorso dall'istante iniziale.

$\alpha = 30°$



$\alpha = \beta$



$$\bar{V}_C = \bar{V}_B + \bar{V}_{C/B}$$

M	$\omega_1 AC$?	1 m/s	$\omega_2 CB$?
D	$\perp AC$	// x	$\perp CB$
V	?	←	?

$$V_B = V_C = V_{C/B} = 1\ m/s$$

$$\omega_1 = 1\ rad/s\ (+k)$$

$$\omega_2 = 1\ rad/s\ (-k)$$

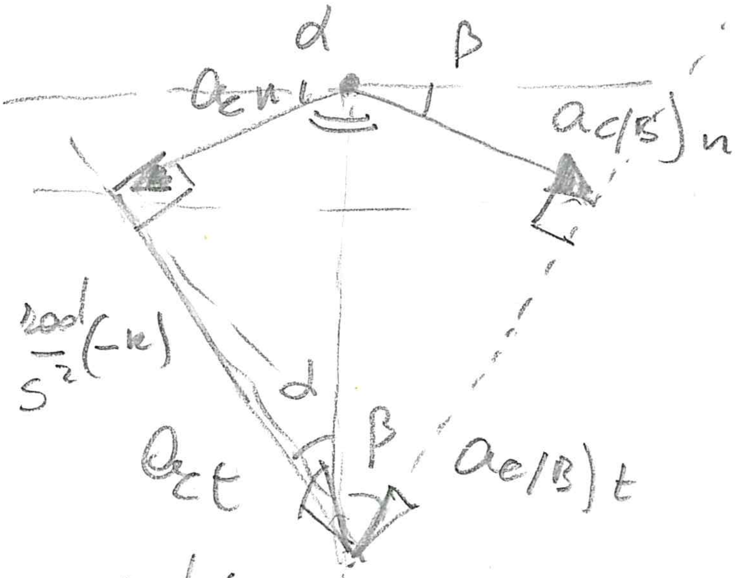
$$V_M = V_B + V_{M/B}$$

M	?	1 m/s	$\omega_2 MB$
D	?	// x	
V	?	←	

$$V_M = 0{,}87\ m/s$$

$$a_C = a_B + a_{C/B})_n + a_{C/B})_t = a_{Cn} + a_{Ct}$$

0	$\omega_2^2 CB$ $1\,m/s^2$	$\dot{\omega}_2 CB$?	$\omega_1^2 AC$ $1\,m/s^2$	$\dot{\omega}_1 AC$?	M
∀	$\parallel CB$	$\perp CB$	$\parallel AC$	$\perp AC$	D
∀	$C \to B$	?	$C \to A$	?	V



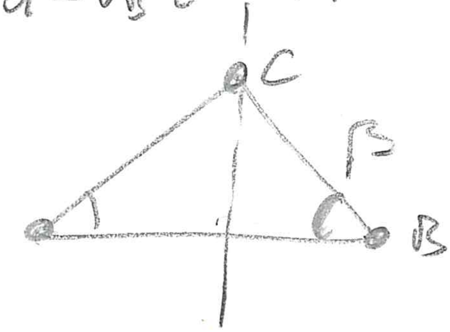
$$\dot{\omega}_1 = \frac{a_{Ct}}{AC} = 1{,}73\ \frac{rad}{s^2}(-k)$$

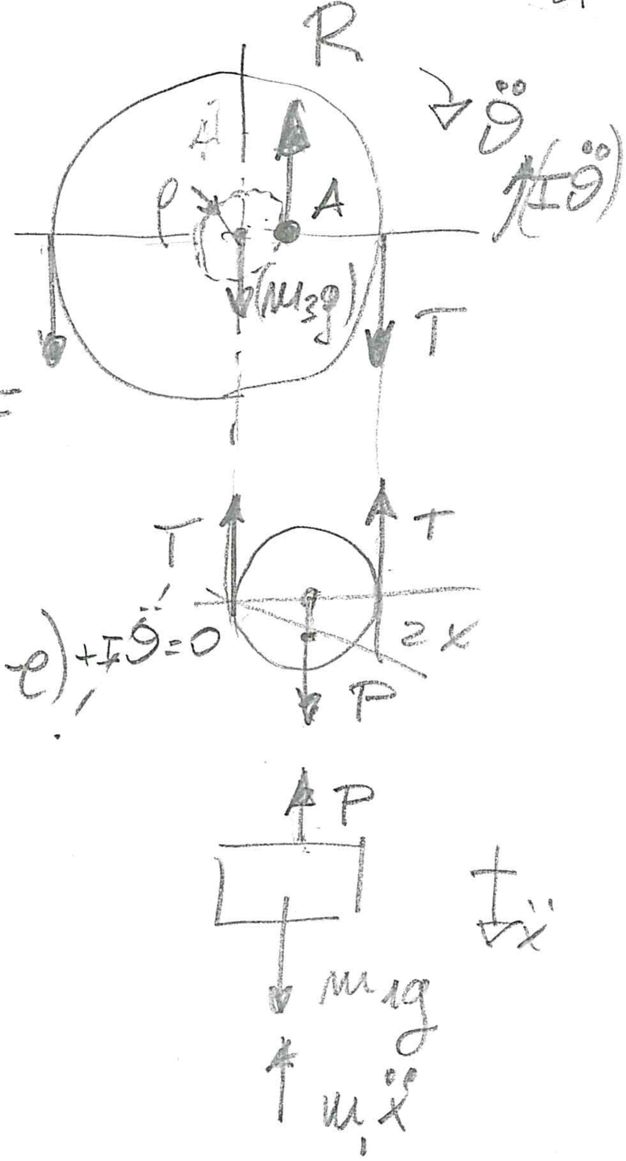
$$\dot{\omega}_2 = \frac{a_{C/B})_t}{CB} = 1{,}73\ \frac{rad}{s^2}(+k)$$

$$AB' = AB - V_B t = 2AC\cos\alpha - V_B t = 1{,}23\ m$$

$$2CB\cos\beta = AB'$$

$$\beta = \arccos\frac{AB'}{2CB} = 52{,}05°$$





$\varphi_P = \operatorname{atan} f_P$

$\rho = r_P \sin\varphi_P = 2{,}8\,mm$

$\overset{\curvearrowleft}{A})\ F\cdot(R_3+\rho) + \cancel{m_3 g \rho} - T(R_3-\rho) + I\ddot{\vartheta} = 0$

$T = 257{,}36\,N$

$2T - P = 0$

$P = 514{,}72\,N$

$P - m_1 g + m_1 \ddot{x} = 0$

$\ddot{x} = 4.66\,m/s^2$

$L_W = R\cdot\rho\cdot\vartheta \qquad \vartheta = \vartheta_0 + \dot{\vartheta}_0 t + \frac{1}{2}\ddot{\vartheta}t^2$

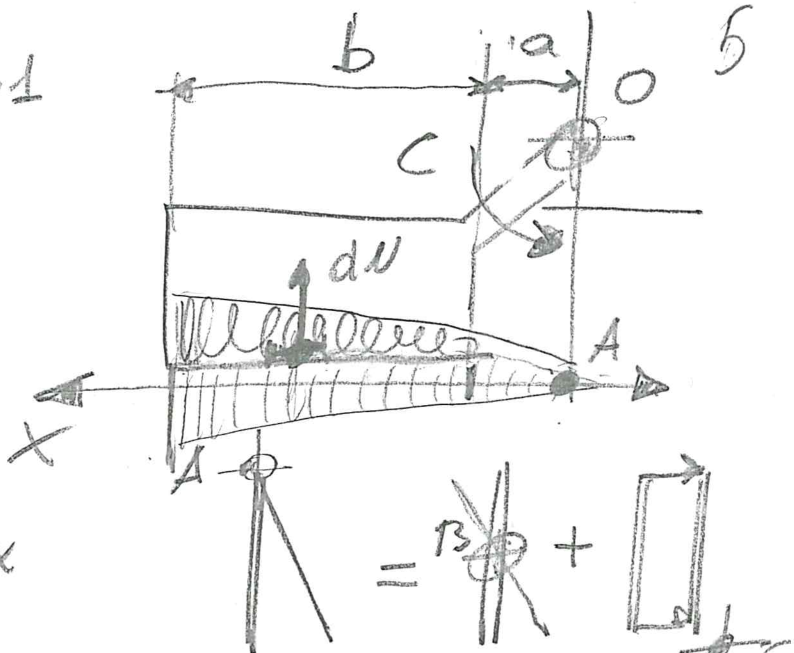
$\ddot{\vartheta} = \dfrac{2\ddot{x}}{R_3} = 46{,}62\,rad/s^2 \rightarrow \vartheta = 23\,rad$

$R = F + T = 507{,}36\,N$

$L_W = 32{,}67\,J$

ACC RIGIDO

$$dV = \delta\, dA = K' f\, p\, dA \cdot V_2 \cdot 1$$



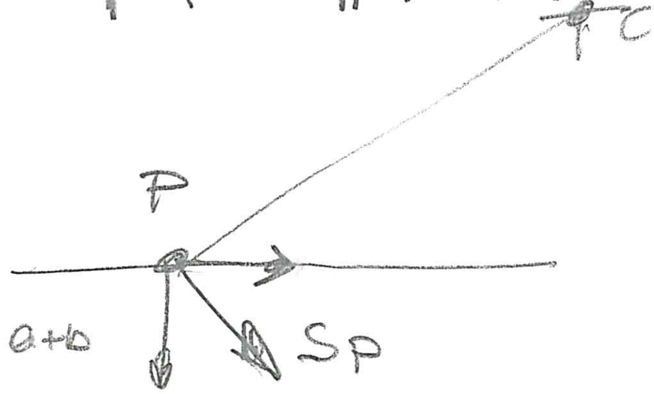
$$\delta = K'' P$$

$$\delta = K''' x$$

$$P = K x$$

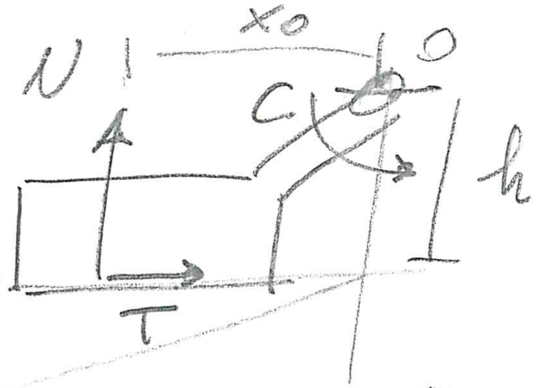
$$dN = P \cdot dx \cdot 1 = K x\, dx$$

$$N = \int_a^{a+b} K x\, dx$$



$$x_0 N = x_0 \int_a^{a+b} K x\, dx =$$

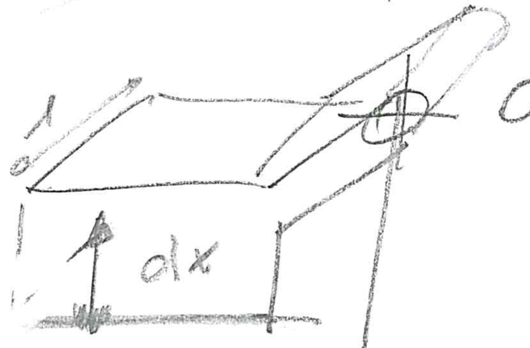
$$= K x_0 \int_a^{a+b} x\, dx = K x_0 \left[\frac{x^2}{2}\right]_a^{a+b}$$



$$x_0 N = \int_a^{a+b} P x\, dx =$$

$$= K \int_a^{a+b} x^2\, dx = K \left[\frac{x^3}{3}\right]_a^{a+b}$$

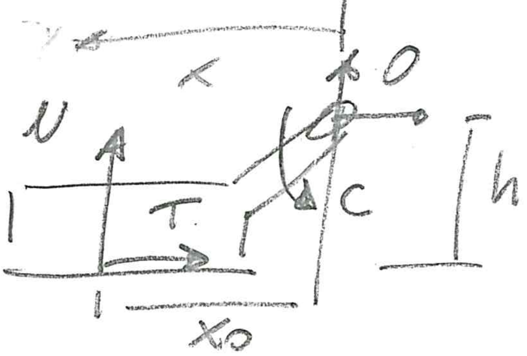
$$x_0 = \frac{2}{3}\, \frac{(a+b)^3 - a^3}{(a+b)^2 - a^2}$$



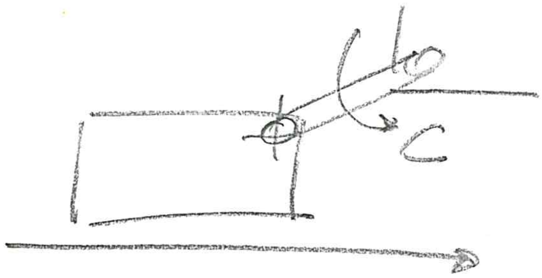
$$\begin{cases} C - N x_0 + T h = 0 \\ T = f N \end{cases}$$

$$C - \frac{T}{f} x_0 + T h = 0$$

$$T\left(\frac{x_0}{f} - h\right) = C$$

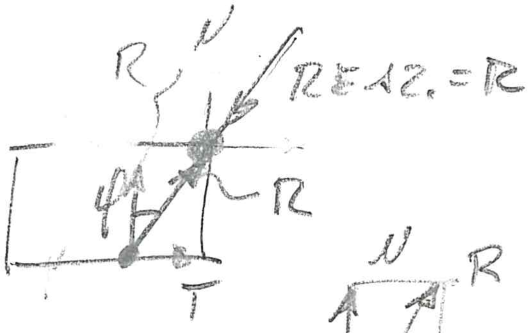


ACC. LIBERO



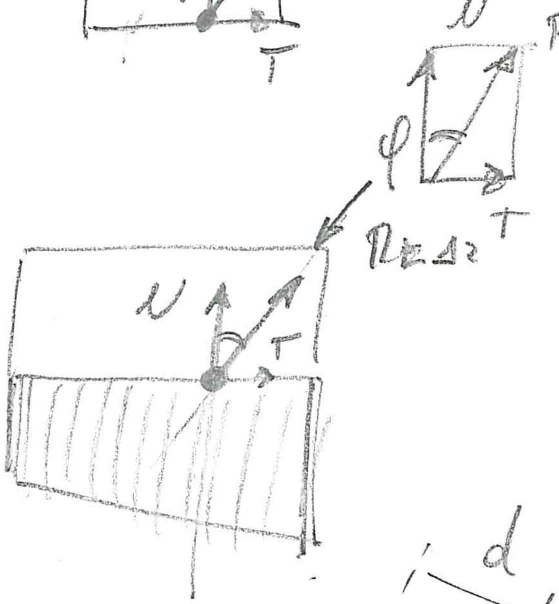
$$dW = \delta\, q\, dA = K' f P\, dA\, v_2 \cdot 1$$

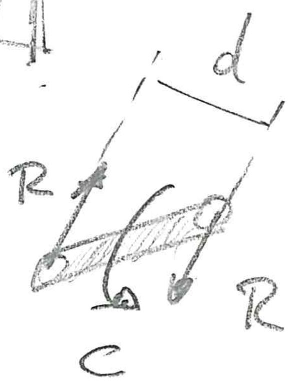
$$\delta = K'' P$$

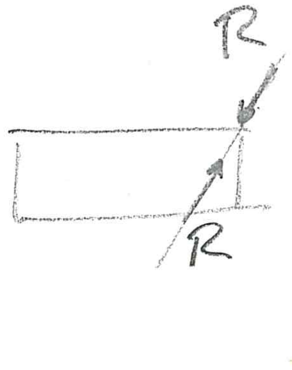


$$R \cdot d = C$$

$$T = R \sin\varphi = \frac{C}{d} \sin\varphi$$

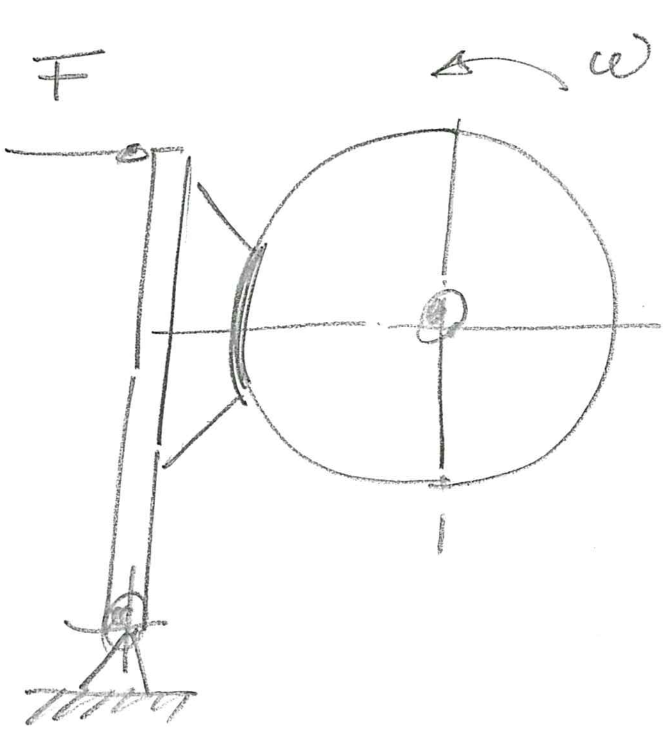


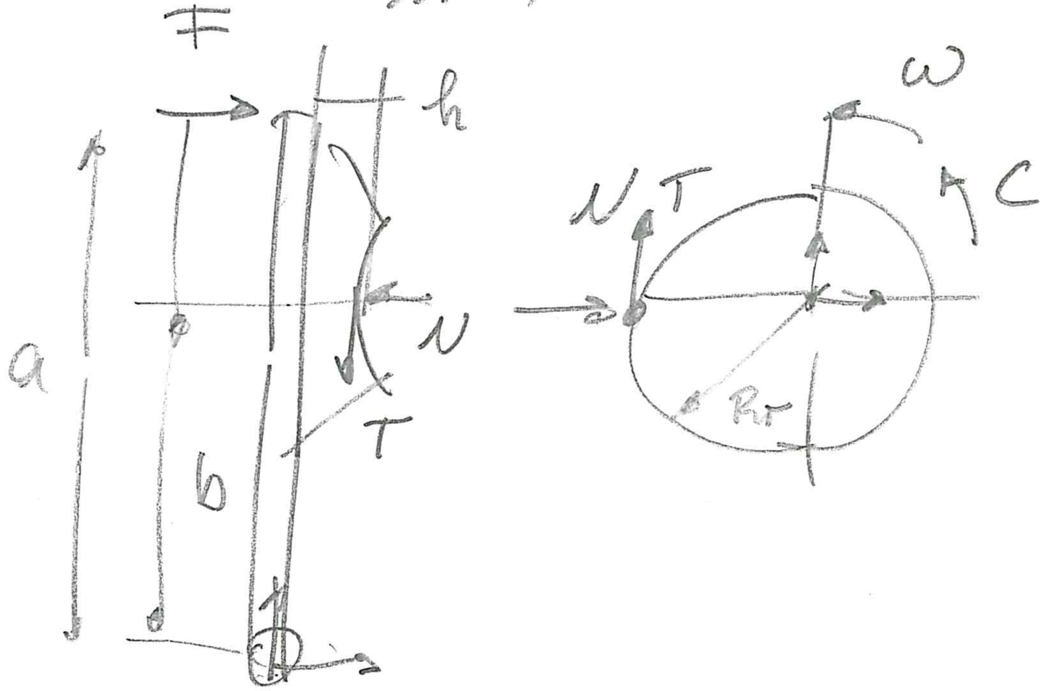




ACC. RIGIDO

$$\begin{cases} C - T R_r = 0 \\ T = f N \\ F a - N b + T h = 0 \end{cases}$$





ACC. LIBERO

$$\begin{cases} \rho = R_T \sin \varphi \\ C = R\,\rho \\ F = R \cos \varepsilon \\ \varepsilon = \arcsin \dfrac{e}{R_T + h} \end{cases}$$