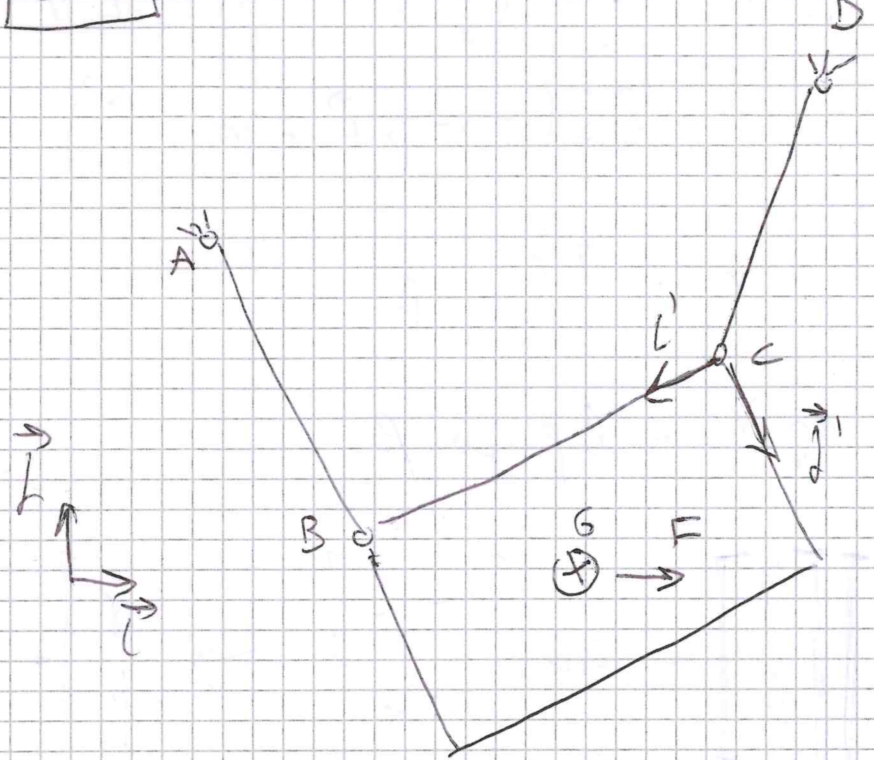
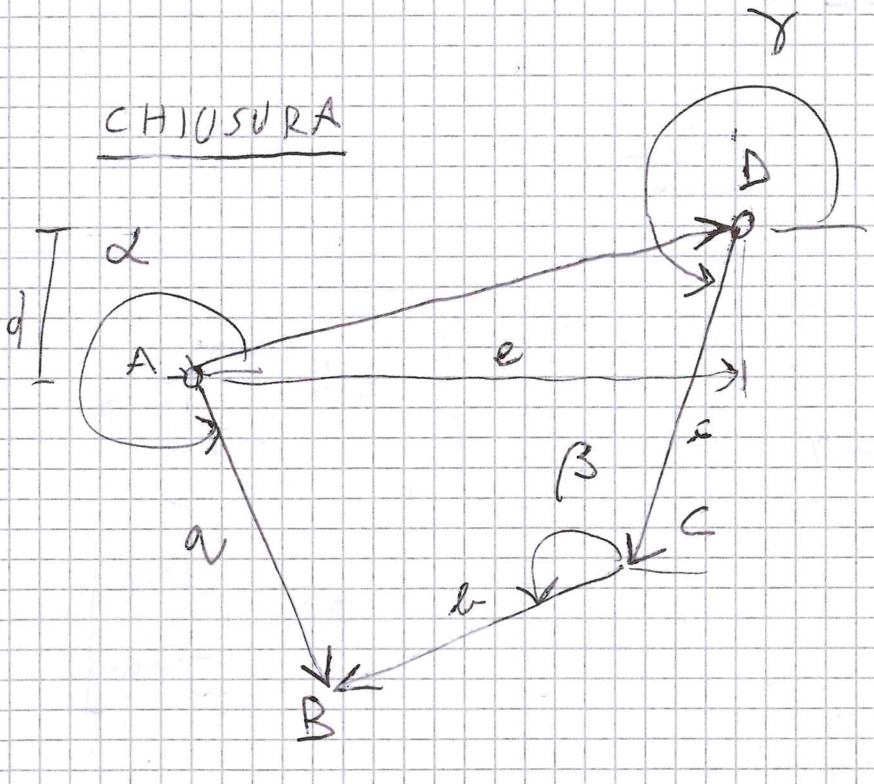
Es. 1



CHIUSURA



$$(B-A) = (B-C) + (C-D) + (D-A)$$

IN VELOCITÀ

$$\vec{V}_B = \vec{V}_C + \dot{\beta}\vec{k} \wedge (B-C)$$

$$\dot{\alpha}\vec{k} \wedge (B-A) = \dot{\gamma}\vec{k} \wedge (C-D) + \dot{\beta}\vec{k} \wedge (B-C)$$

$$a\dot{\alpha}\left(-\sin\alpha\,\vec{i}+\cos\alpha\,\vec{j}\right)=\dot{\gamma}c\left(-\sin\gamma\,\vec{i}+\cos\gamma\,\vec{j}\right)+$$
$$b\dot{\beta}\left(-\sin\beta\,\vec{i}+\cos\beta\,\vec{j}\right)$$

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

$$\begin{bmatrix} c\sin\gamma & b\sin\beta \\ c\cos\gamma & b\cos\beta \end{bmatrix}\begin{bmatrix}\dot{\gamma}\\ \dot{\beta}\end{bmatrix}=a\dot{\alpha}\begin{bmatrix}\sin\alpha\\ \cos\alpha\end{bmatrix}\rightarrow\begin{bmatrix}\dot{\gamma}\\ \dot{\beta}\end{bmatrix}=$$

$$\Big\downarrow d/dt$$

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

$$\rightarrow\begin{bmatrix}\ddot{\gamma}\\ \ddot{\beta}\end{bmatrix}=\ldots$$

$$\vec{\omega}_{BC}=\dot{\beta}\,\vec{k}\qquad\qquad \vec{\dot{\omega}}_{BC}=\ddot{\beta}\,\vec{k}$$

$$\vec{\omega}_{CD}=\dot{\gamma}\,\vec{k}\qquad\qquad \vec{\dot{\omega}}_{CD}=\ddot{\gamma}\,\vec{k}$$

$$\vec{V}_G = \vec{V}_B + \vec{\omega}_{BC} \wedge (G-B) = V_{Gx}\,\vec{i} + V_{Gy}\,\vec{j}$$

CON $$(G-B) = -\ell\,\vec{i}\,' + h\,\vec{j}\,''$$

$$\vec{i}\,' = \cos\beta\,\vec{i} + \sin\beta\,\vec{j}$$
$$\vec{j}\,' = -\sin\beta\,\vec{i} + \cos\beta\,\vec{j}$$

$$\frac{dE_c}{dt} = m\vec{g}\cdot\vec{V}_G + \vec{F}\cdot\vec{V}_G$$

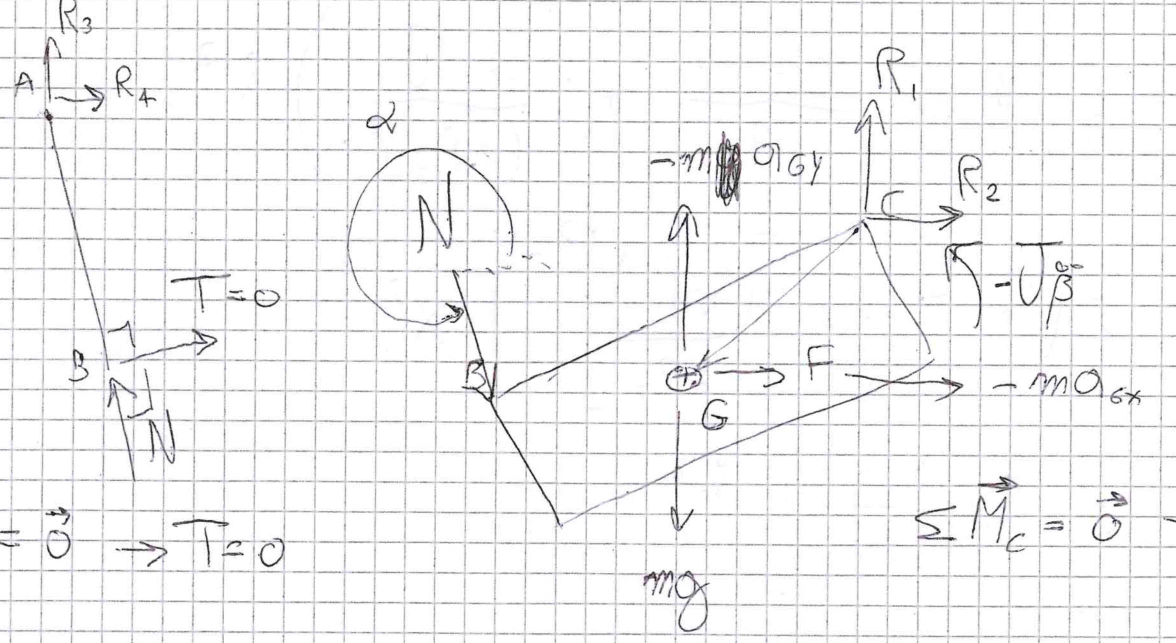
$$m\,\vec{V}_G\cdot\vec{a}_G + J\,\dot{\vec{\omega}}_{BC}\cdot\vec{\omega}_{BC} = -mg\,V_{Gy} + F\,V_{Gx}$$

$$\Downarrow$$

$$\vec{a}_B + \dot{\vec{\omega}}_{BC}\wedge(G-B) - \omega_{BC}^2\,(G-B)$$

TROVO F

REAZIONI ISOLO AB e BC



$$\Sigma\vec{M}_A = \vec{0} \rightarrow T=0 \qquad \Sigma\vec{M}_C = \vec{0} \rightarrow N$$

$$\vec{M}_C = (G-C) \wedge \left((F - m a_{Gx}) \vec{i} + (-mg - m a_{Gy}) \vec{j} \right) +$$

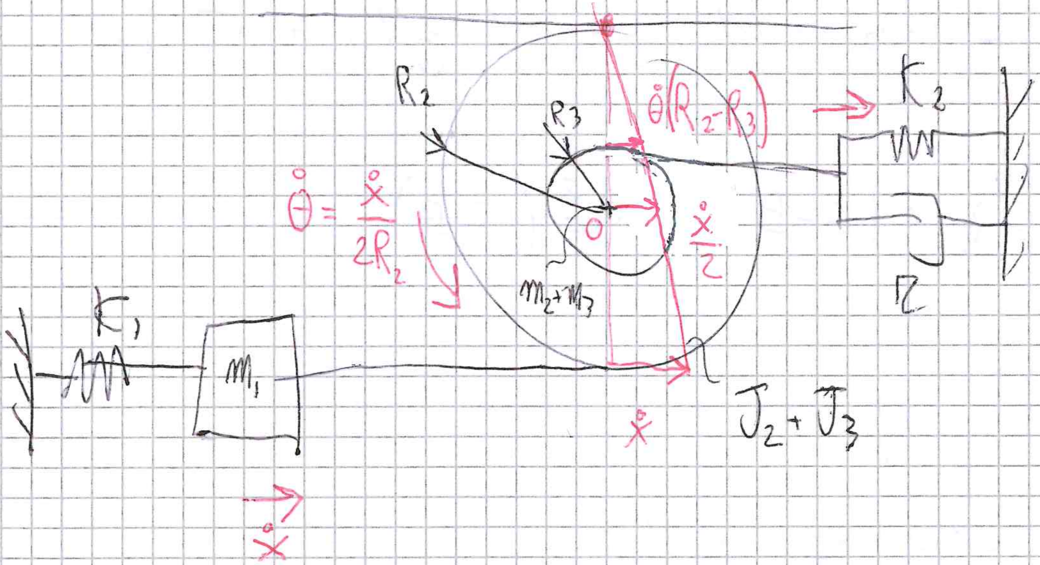
$$- J \ddot{\beta} \vec{k} + (B-C) \wedge \left(N \cos\alpha \, \vec{i} + N \sin\alpha \, \vec{j} \right)$$

$$= 0 \vec{k}$$

CON

$$(G-C) = (b-l) \vec{i}\,' + h \vec{j}\,'$$

$\boxed{\text{es 2}}$



$$E_C = \frac{1}{2} \left(m_1 + \frac{m_2 + m_3}{4} + \frac{J_2 + J_3}{(2R_2)^2} \right) \dot{x}^2$$

$$V = \frac{1}{2} \left(K_1 + K_2 \left[\frac{(R_2 - R_3)}{2R_2} \right]^2 \right) x^2$$

$$D = \frac{1}{2} r \left(\frac{R_2 - R_3}{2R_2} \right)^2 \dot{x}^2$$

$$\delta L = C \, \delta\theta = \frac{C}{2R_2}$$