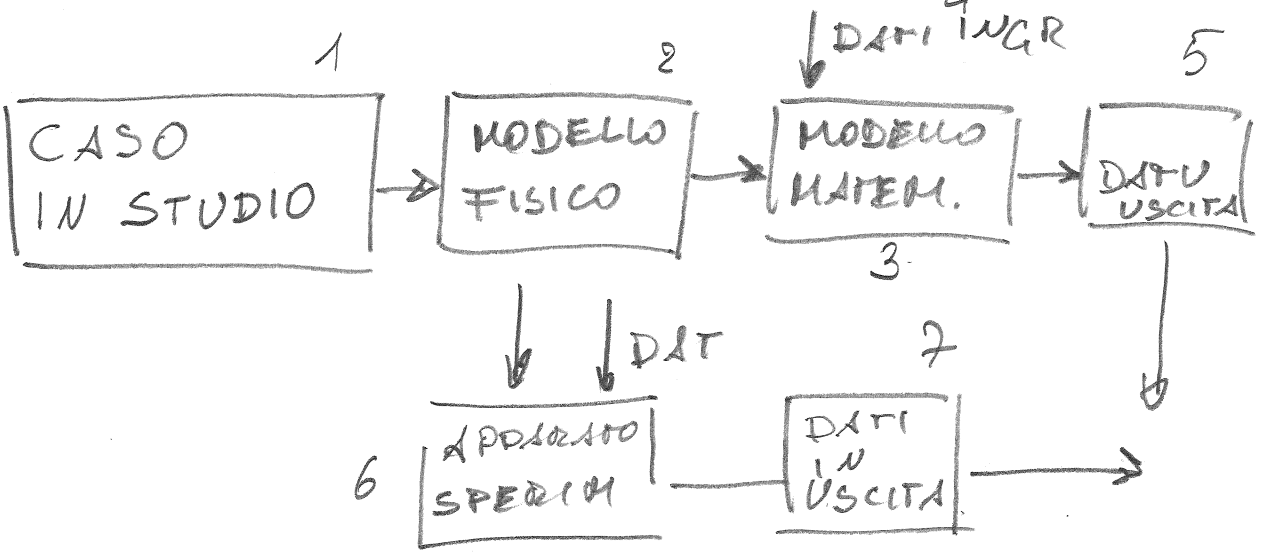
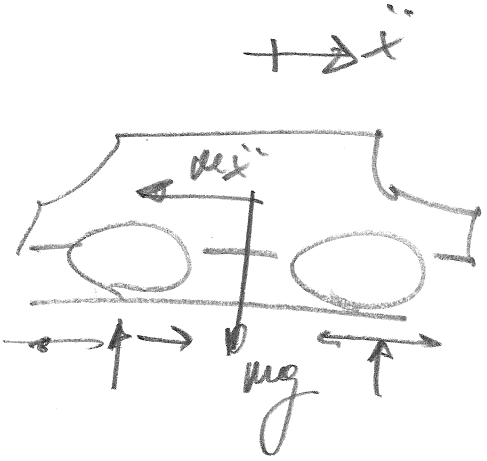
27.IX-2016





1 MOTO AUTOMOBILE

2 MOD. SEMPL.

3 MOD MAT

EQ. EQUILIBRIO
BIL. E MEDIA

4 CARATT.

PESO PASSO
ATTRITO ...
AERODIN

(5) POS MOT
TIPO PN. ||

6 SPERIM. PISTA. STRADA → (5)

(7) DATI MISURATI

5 ↔ 7 ERRORE
SEMPLIFICAZIONI
ERRORI MISURA

CINEMATICA

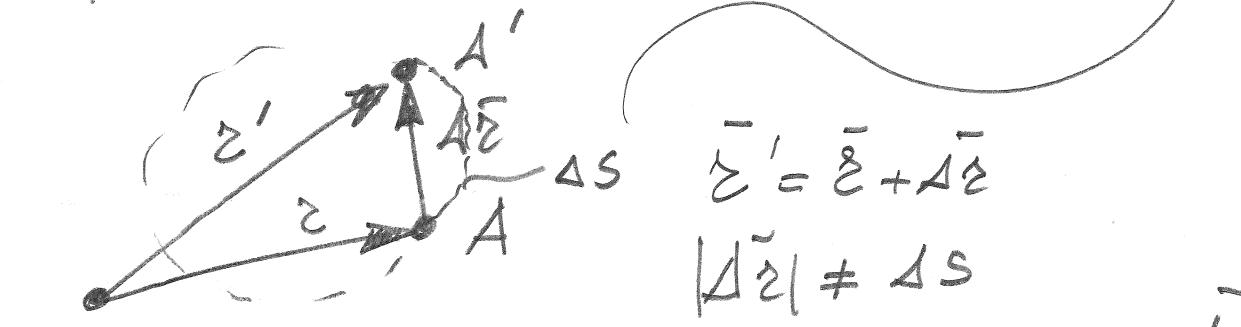
κίνημα

POSIZIONI TEMPO

- PUNTO MATERIALE
- CORPO ESTESO
  - RIGIDO
  - DEFORMABILE

PUNTO

TRAIETTORIE



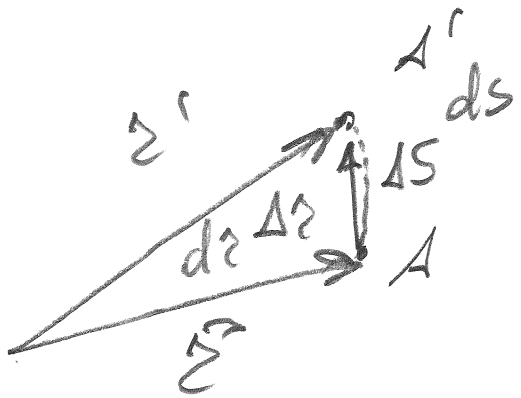
$\vec{r}' = \vec{r} + \Delta\vec{r}$

$|\Delta\vec{r}| \neq \Delta s$

$\vec{V}_M = \dfrac{\Delta\vec{r}}{\Delta t}$

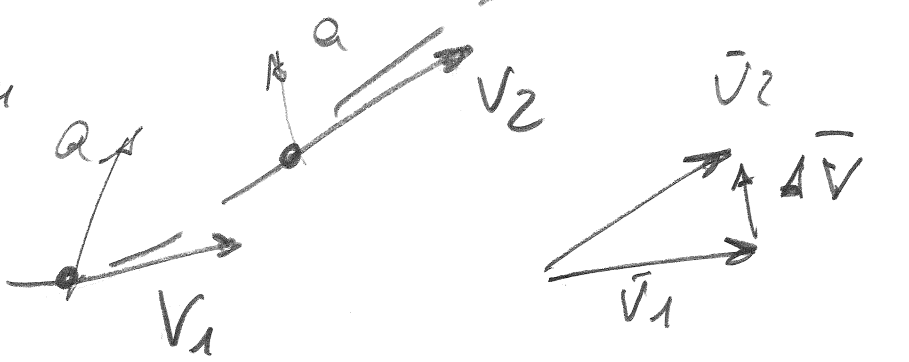
$\vec{V} = \lim_{\Delta t \to 0} \vec{V}_M = \lim_{\Delta t \to 0} \dfrac{\Delta\vec{r}}{\Delta t}$

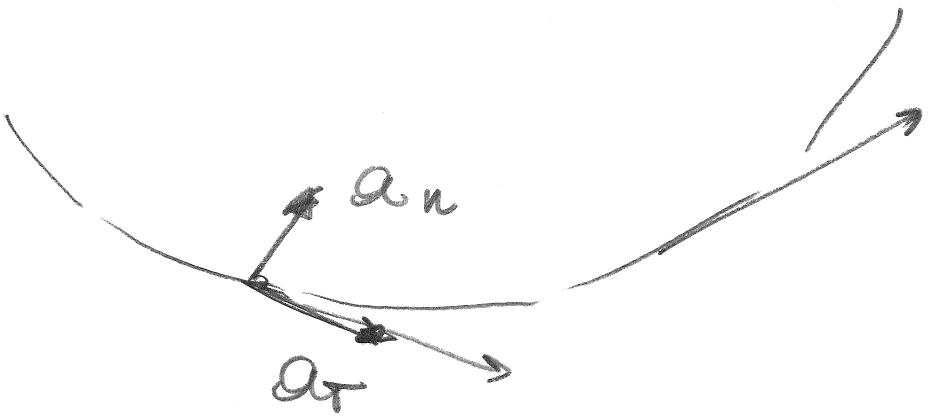
VEL. ISTANTANEA



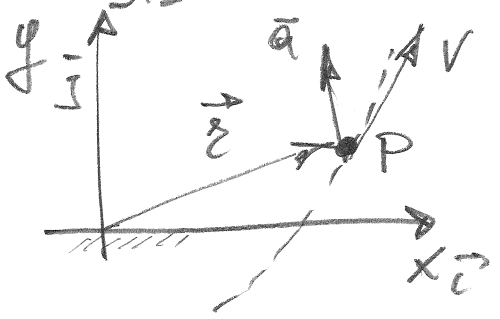
$$\vec{a}_{ср} = \frac{\Delta \vec{v}}{\Delta t}$$

$$\vec{a} = \lim_{\Delta t \to 0} \vec{a}_{ср}$$





SIST CARTESIANO



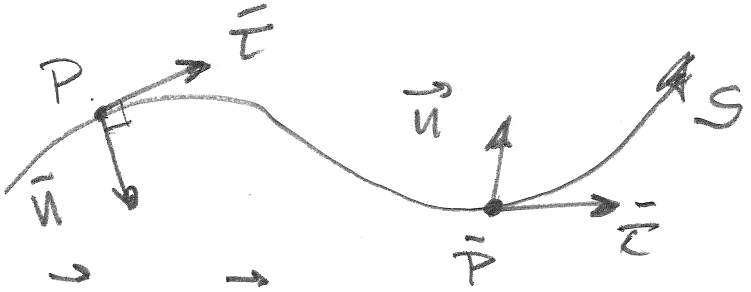
$$\vec{r} = x\vec{i} + y\vec{j}$$

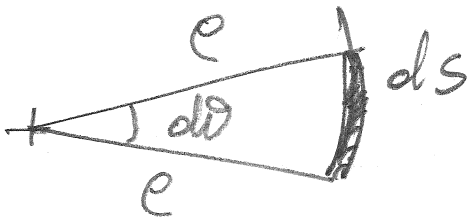
$$\vec{V} = \frac{d\vec{r}}{dt} = \dot{x}\vec{i} + \dot{y}\vec{j} = \vec{V}_x + \vec{V}_y$$

$$\vec{a} = \frac{d\vec{V}}{dt} = \ddot{x}\vec{i} + \ddot{y}\vec{j} = \vec{a}_x + \vec{a}_y$$

$|\vec{V}|$, $|\vec{a}|$

SIST LOCALE





$$\vec{V} = V\vec{\tau}$$

$$V = \frac{ds}{dt} = \frac{\rho\, d\vartheta}{dt} = \rho\dot{\vartheta}$$

$$\vec{V} = V\vec{\tau} = \rho\dot{\vartheta}\vec{\tau}$$

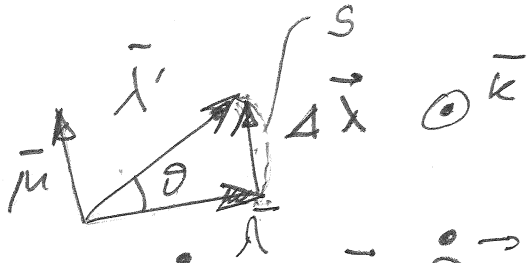
$$\vec{a} = \frac{d\vec{V}}{dt} = \dot{V}\vec{\tau} + V\dot{\vec{\tau}} =$$

$$= \dot{V}\vec{\tau} + V\cdot\vec{\omega}\wedge\vec{\tau} =$$

$$= \dot{V}\vec{\tau} + V\dot{\vartheta}\vec{n} =$$

$$= \rho\ddot{\vartheta}\vec{\tau} + \rho\dot{\vartheta}^2\vec{n} =$$

$$= \dot{V}\vec{\tau} + \frac{V^2}{\rho}\vec{n}$$

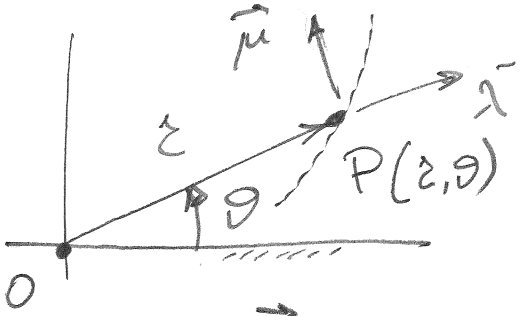


$$\vartheta = \dot{\vartheta}\Delta t \qquad \vec{\omega} = \dot{\vartheta}\vec{k}$$

$$\Delta\vec{\lambda} = |\vec{\lambda}|\vartheta\vec{\mu}$$

$$\frac{d\Delta\vec{\lambda}}{d\Delta t} = |\vec{\lambda}|\dot{\vartheta}\vec{\mu}$$

$$(*)\ \frac{d\vec{\lambda}}{dt} = \dot{\vec{\lambda}} = \vec{\omega}\wedge\vec{\lambda}$$



$\rho = \rho(t)$

$\vartheta = \vartheta(t)$

$\vec{\rho} = \rho\,\vec{\lambda}$

$\frac{d\vec{\lambda}}{dt} = \vec{\omega} \wedge \vec{\lambda} = \dot{\vartheta}\,\vec{\mu}$

$\frac{d\vec{\mu}}{dt} = \vec{\omega} \wedge \vec{\mu} = -\dot{\vartheta}\,\vec{\lambda}$

$$\vec{V} = \frac{d\vec{\rho}}{dt} = \dot{\vec{\rho}} = \dot{\rho}\vec{\lambda} + \rho\dot{\vec{\lambda}}$$

$$\vec{V} = \dot{\rho}\vec{\lambda} + \rho\dot{\vartheta}\vec{\mu}$$

$$\vec{a} = \frac{d\vec{V}}{dt} = \dot{\vec{V}} = \ddot{\rho}\vec{\lambda} + \dot{\rho}\dot{\vec{\lambda}} + \dot{\rho}\dot{\vartheta}\vec{\mu} + \rho\ddot{\vartheta}\vec{\mu} + \rho\dot{\vartheta}\dot{\vec{\mu}} =$$

$$= \ddot{\rho}\vec{\lambda} + \dot{\rho}\dot{\vartheta}\vec{\mu} + \dot{\rho}\dot{\vartheta}\vec{\mu} + \rho\ddot{\vartheta}\vec{\mu} - \rho\dot{\vartheta}^2\vec{\lambda} =$$

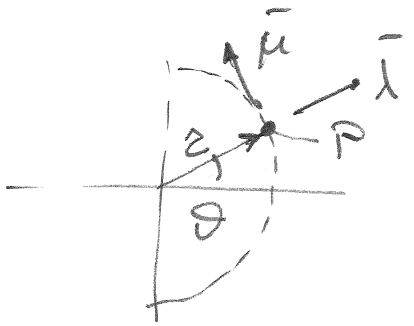
$$= \vec{\lambda}\left(\ddot{\rho} - \rho\dot{\vartheta}^2\right) + \vec{\mu}\left(\rho\ddot{\vartheta} + 2\dot{\rho}\dot{\vartheta}\right)$$

$$= \vec{a}_\lambda + \vec{a}_\mu$$

MOTO CIRCOLARE $\rho = \cos t$

$$\vec{V} = \rho\dot{\vartheta}\vec{\mu}$$

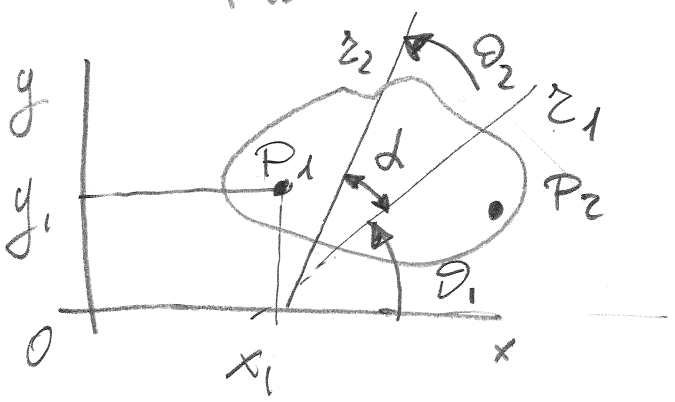
$$\vec{a} = -\rho\dot{\vartheta}^2\vec{\lambda} + \rho\ddot{\vartheta}\vec{\mu}$$



CORPO RIGIDO

MUTUE DISTANZE DEI SUOI PUNTI NON CAMBIANO

MOTO TRASLATORIO
ROTATORIO
PIANO GENERICO



$x_1 y_1 \vartheta_1$

$x_2 y_2 \vartheta_2$

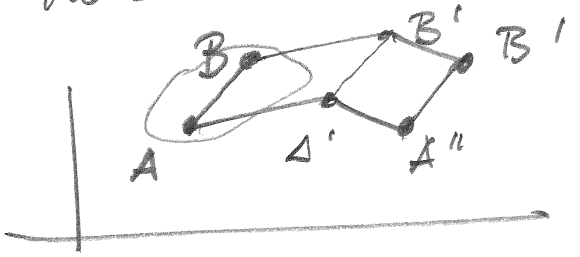
$\bar{\omega}_1 = \frac{d\bar{\vartheta}_1}{dt}$ $\bar{\omega}_2 = \frac{d\bar{\vartheta}_2}{dt}$

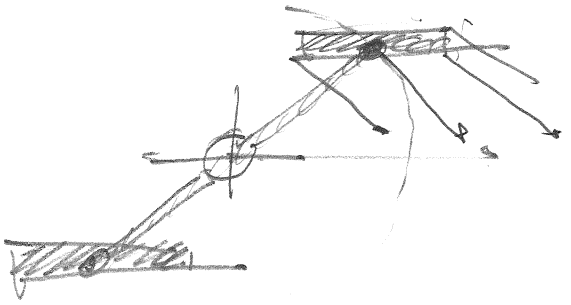
$\vartheta_2 = \vartheta_1 + \alpha$

$\dot{\vartheta}_2 = \dot{\vartheta}_1$

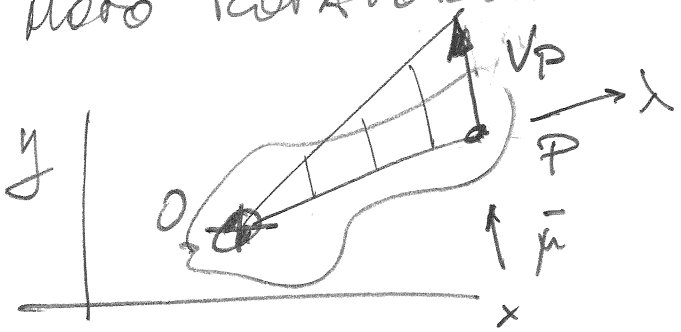
ω PER TUTTO IL CORPO

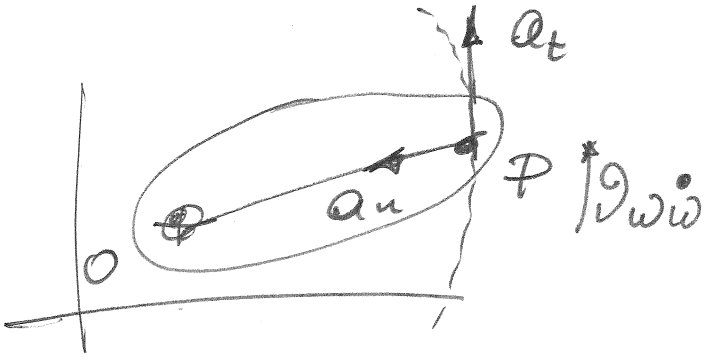
MOTO TRASLATORIO





MOTO ROTATORIO

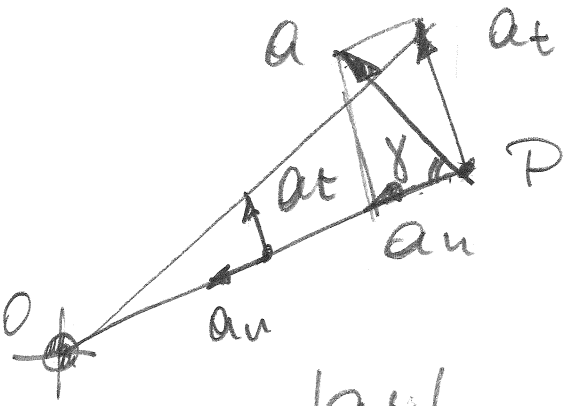


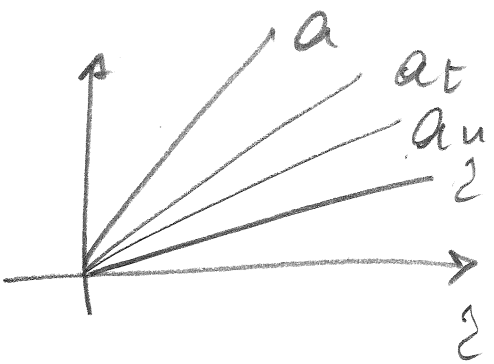


$$\vec{V}_P = \omega \ell \vec{\mu} \qquad |V_P| = \omega \ell$$

$$\vec{a}_n = -\ell \omega^2 \vec{\lambda} \qquad |a| = \sqrt{a_n^2 + a_t^2} = \ell \sqrt{\omega^4 + \dot{\omega}^2}$$

$$\vec{a}_t = \dot{\omega} \ell \vec{\mu}$$





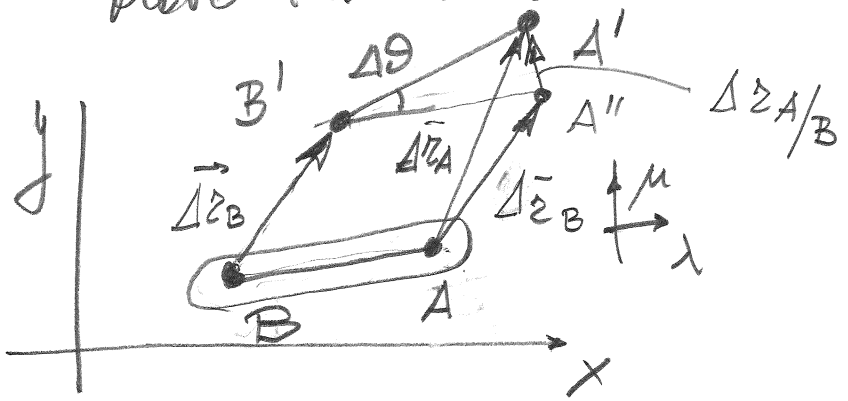
$$\operatorname{tg}\gamma = \frac{|a_t|}{|a_n|} = \frac{\dot{\omega}\ell}{\omega^2 \ell} = \frac{\dot{\omega}}{\omega^2}$$

COSO SUL CORPO

$\gamma = 0 \Rightarrow \dot{\omega} = 0 \qquad \omega = \text{COST}$ MOTO CIRC. UNIF.

$\gamma = \frac{\pi}{2} \Rightarrow \omega = 0 \qquad \dot{\omega} \neq 0$ MOTO INCIPIENTE

MOTO PIANO GENERICO



$AB = \ell$

$\vec{\ell} = \vec{BA}$

$\Delta\vec{\Sigma}_A = \Delta\vec{\Sigma}_B + \Delta\vec{\Sigma}_{A/B}$; $\Delta\vec{\Sigma}_{A/B} = \ell\,\Delta\vartheta\,\vec{\mu}$

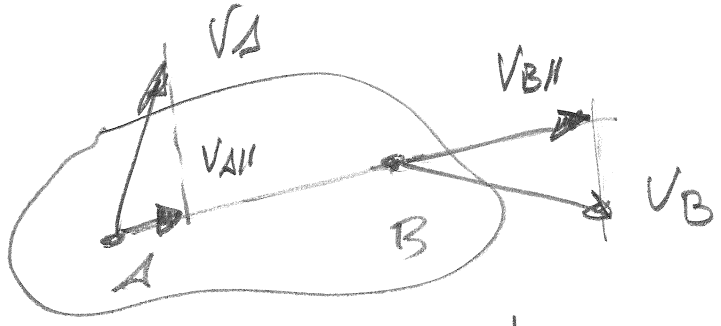
$\vec{V}_A = \vec{V}_B + \vec{V}_{A/B}$ FORMULA FONDAMENTALE DELLA CINEMATICA (GALILEO)

$\vec{V}_{A/B} = \vec{\omega} \wedge \vec{\ell} = \omega\ell\,\vec{\mu}$

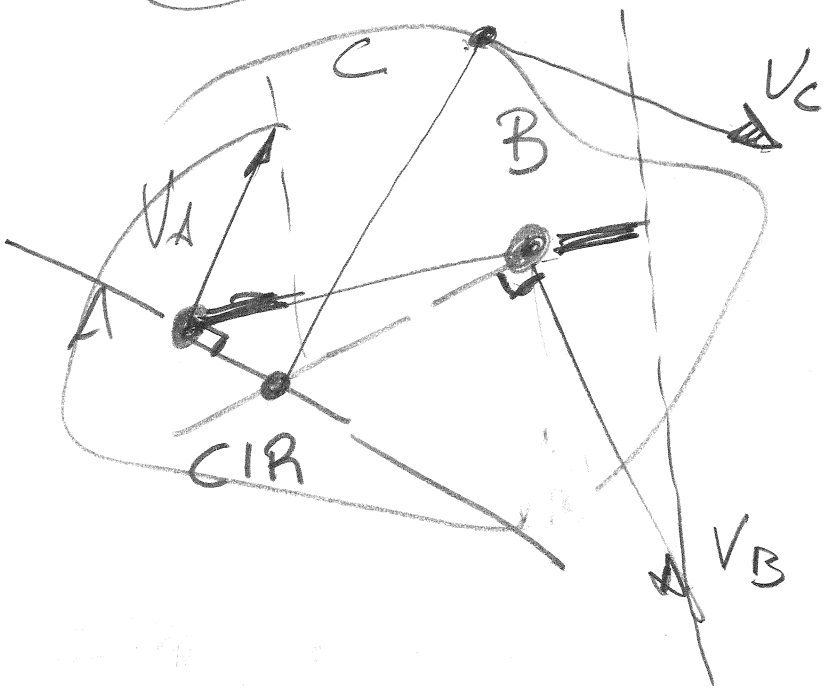
$\vec{a}_A = \vec{a}_B + \vec{a}_{A/B}$; $\vec{a}_{A/B} = \vec{a}_{A/B})_n + \vec{a}_{A/B})_t$

$\vec{a}_{A/B})_n = \omega^2\ell\,(-\vec{\lambda})$

$\vec{a}_{A/B})_t = \dot{\omega}\,\ell\,\vec{\mu}$



? NO



SI

CENTRO

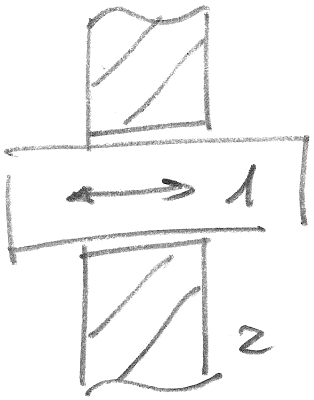
ISTANTANEA

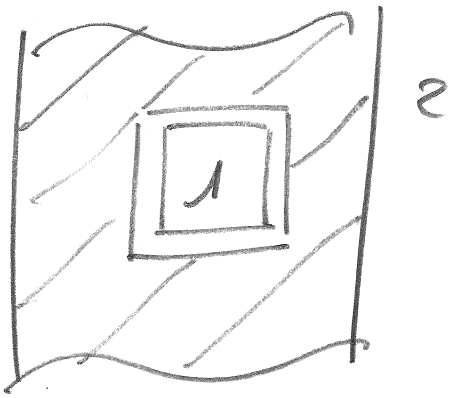
ROTAZIONE

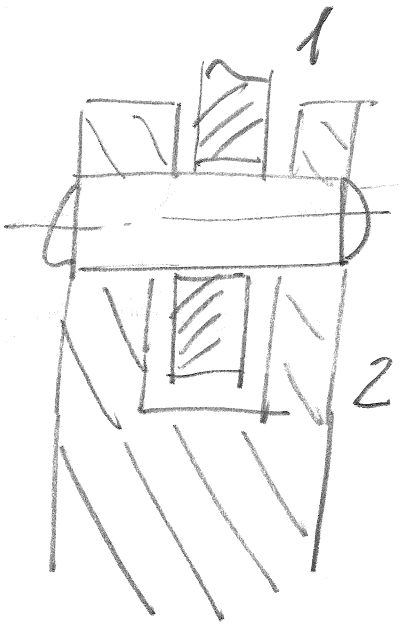
1) COPPIA CINEMATICA

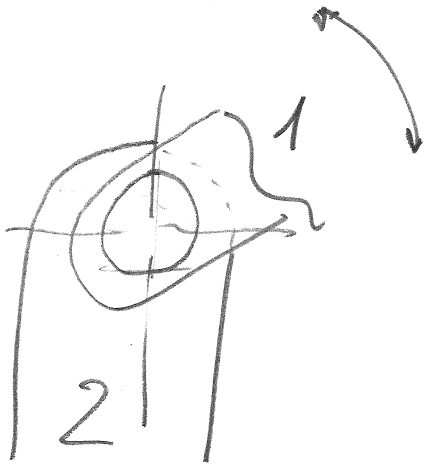
2) COPPIA DI FORZA

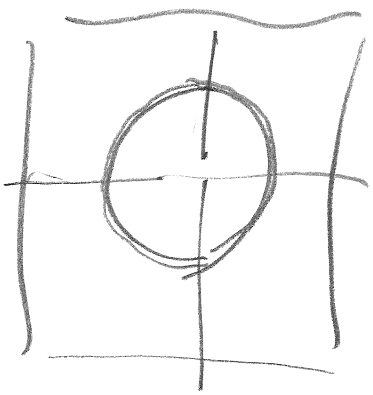
1)

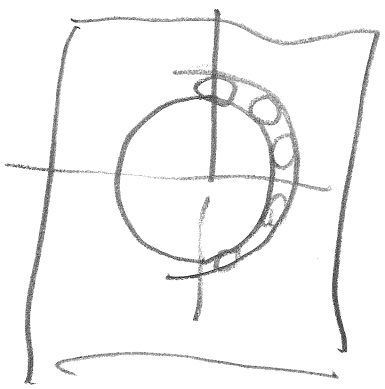


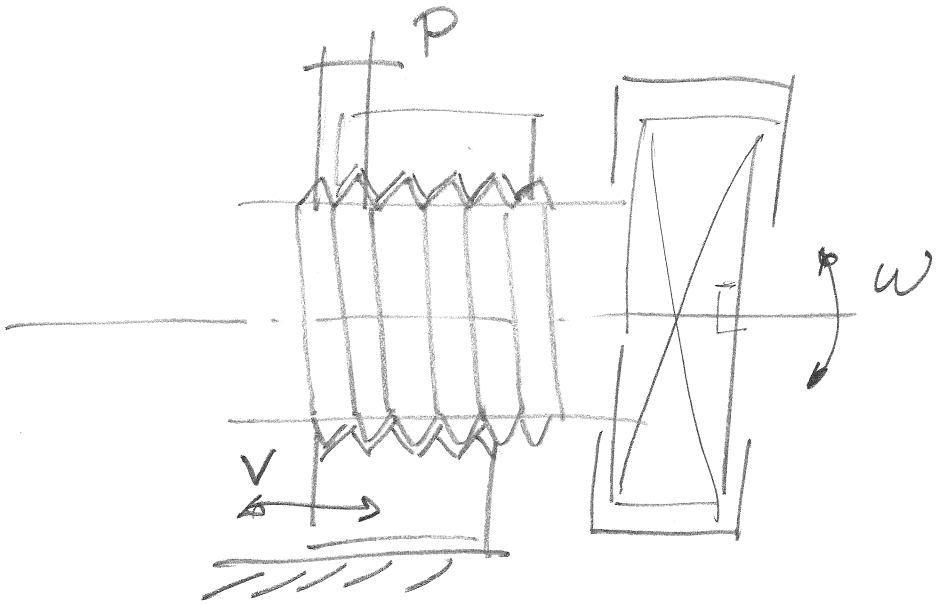












$$V = \frac{P}{t} \; ; \; \omega = \frac{2\pi}{t} \; ; \; t = \frac{2\pi}{\omega} = \frac{P}{V}$$

$$V = \frac{P}{2\pi}\omega$$