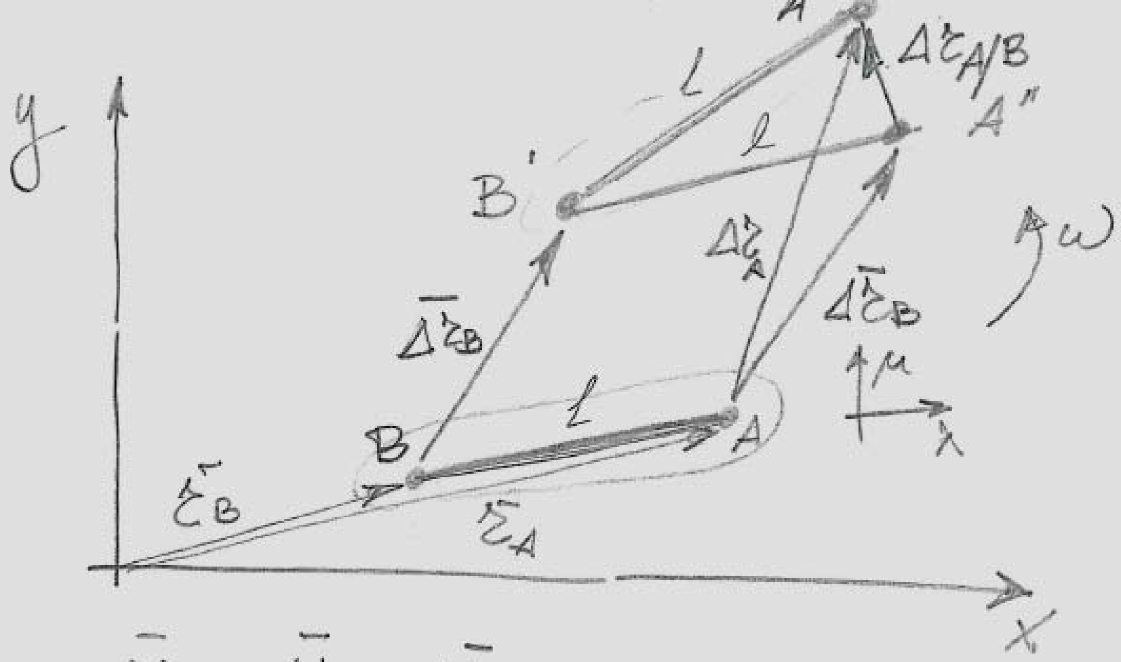
FONDAMENTI DI MECCANICA E BIOMECCANICA [IN/0165]

Lezione del 05 ottobre 2017.

Titolo:
Cinematica del corpo esteso rigido, moto piano generico.

Contenuti:
Moto piano generico del corpo rigido esteo.
Formula fondamentale della cinematica o di Galileo.
Teorema di Rivals.
Centro di istantanea rotazione.
Accoppiamenti cinematica e di forza.
Ruota in moto su pista.

Riferimento:
Ferraresi C., Raparelli T. "Meccanica applicata - Terza edizione", CLUT, 2007.
Cap. 1 - Elementi di cinematica.
Pagg. 11 – 19



$$\Delta \vec{r}_A = \Delta \vec{r}_B + \Delta \vec{r}_{A/B}$$

$$\bar{V}_A = \frac{\Delta \bar{r}_A}{\Delta t} = \frac{\Delta \bar{r}_B}{\Delta t} + \frac{\Delta \bar{r}_{A/B}}{\Delta t} = \bar{V}_B + \bar{V}_{A/B}$$

FORMULA FONDAMENTALE
CINEMATICA
GALILEO

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

$$\vec{a}_A = \vec{a}_B + \vec{a}_{A/B}$$

$$\vec{a}_{A/B} = \vec{a}_{A/B})_m + \bar{a}_{A/B})_t$$

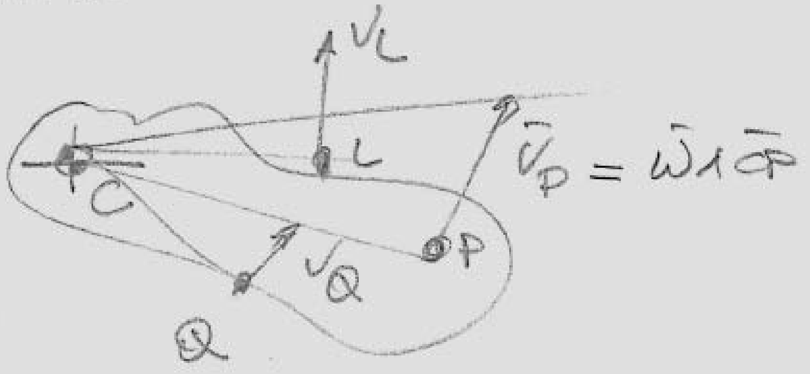
TEOREMA DI RIVALS

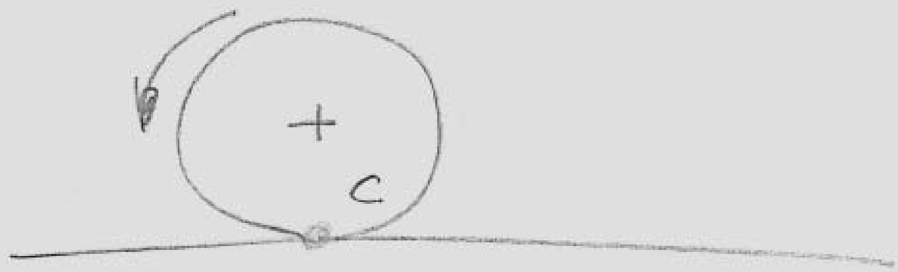
$$\bar{a}_{A/B})_m = \omega^2 \ell (-\bar{\lambda})$$

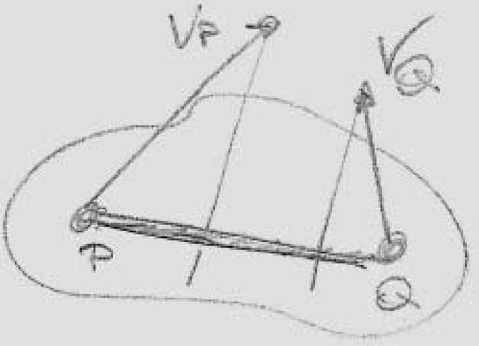
$$\bar{a}_{A/B})_t = \dot{\omega} \ell (\bar{\mu})$$

CENTRO DI ISTANTANEA
ROTAZIONE C

$$\bar{V}_C = \bar{0}$$

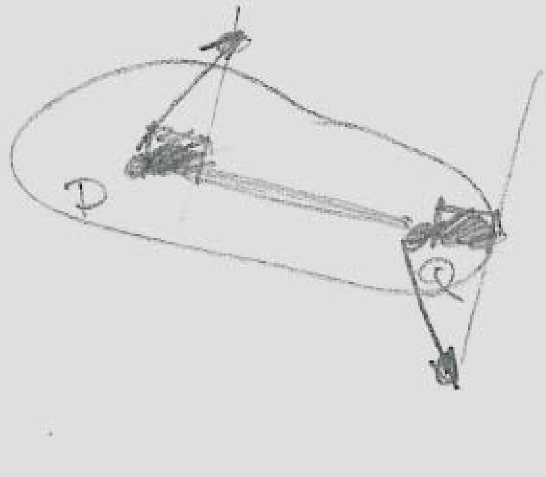




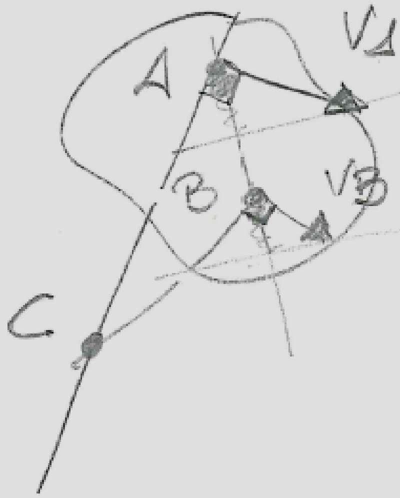


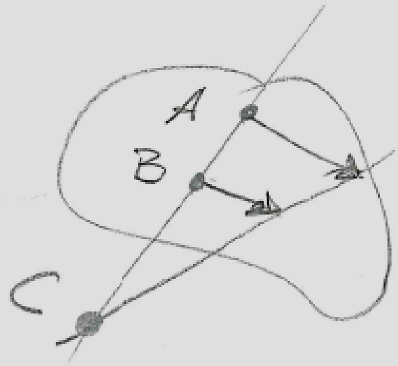
? CORPO RIGIDO ?

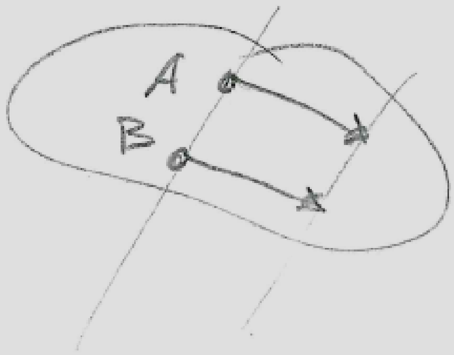
NO



SI







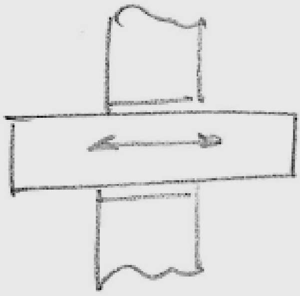
$$\bar{V}_A = \bar{V}_B$$

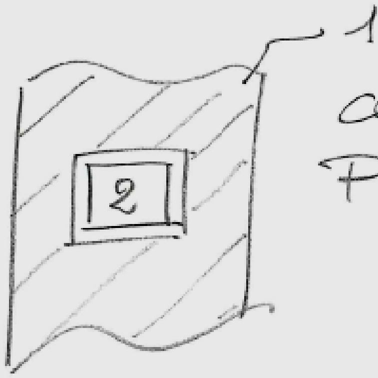
$$\bar{V}_A = \bar{\omega} \wedge \overline{CA}$$

$$\bar{\omega} = \bar{0}$$

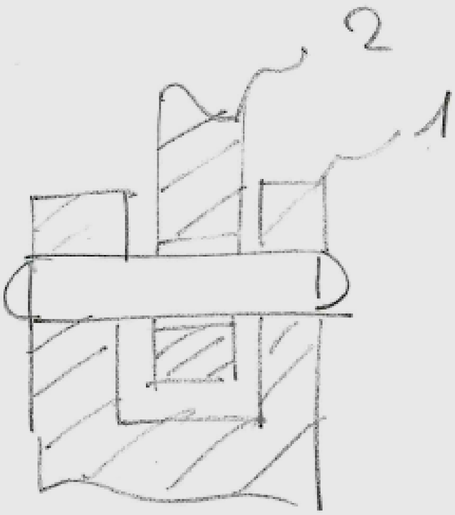
1 Accoppiamento Cinematico
2 " Di Forza

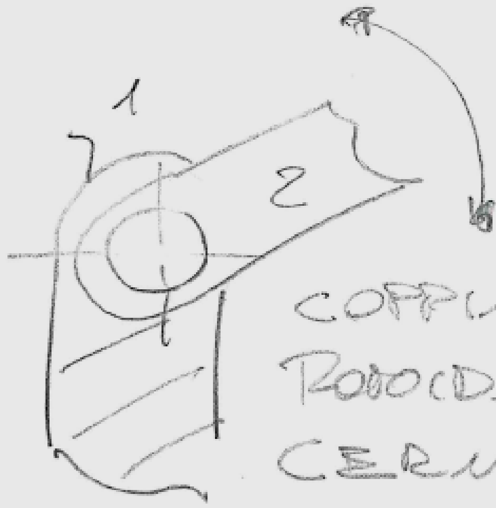
1 <u>Acc. Cin</u>



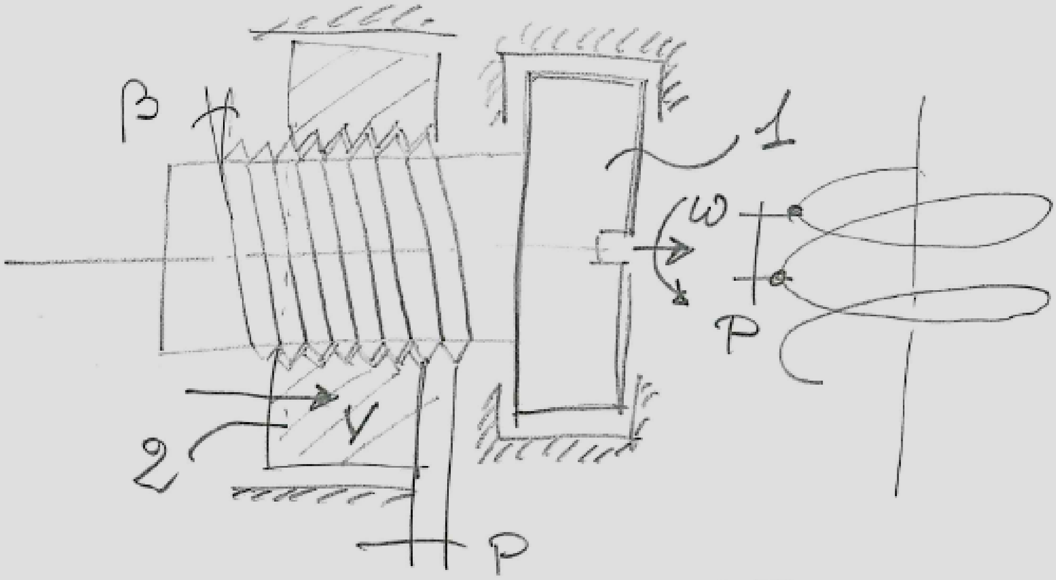


COPPIA
PRISMATICA





COPPIA
ROTOIDALE
CERNIERA

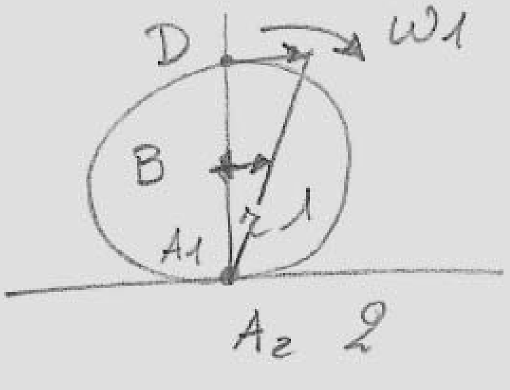


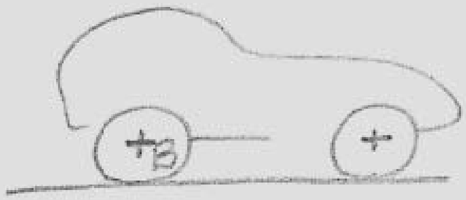
$$V = \frac{P}{t} \qquad \omega = \frac{2\pi}{t}$$

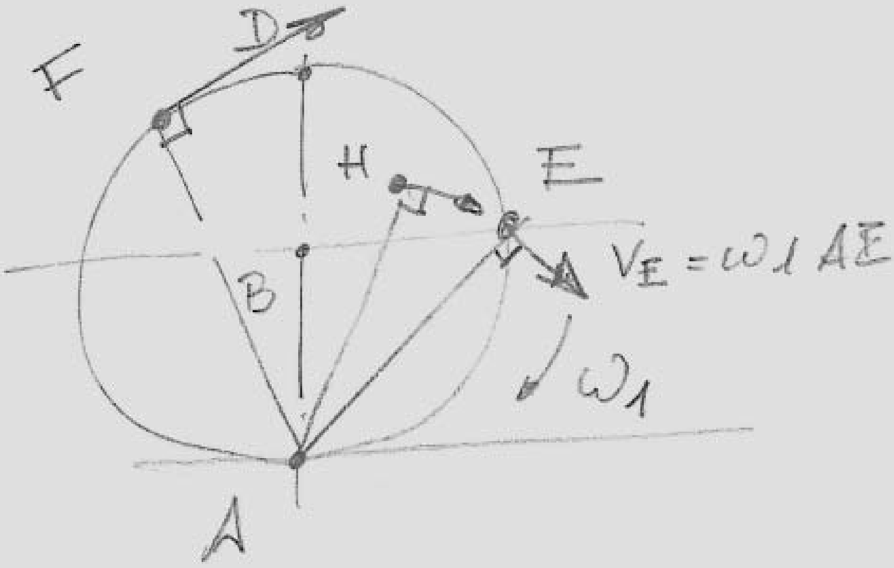
$$t = \frac{P}{V} = \frac{2\pi}{\omega}$$

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

ACC. DI FORZA

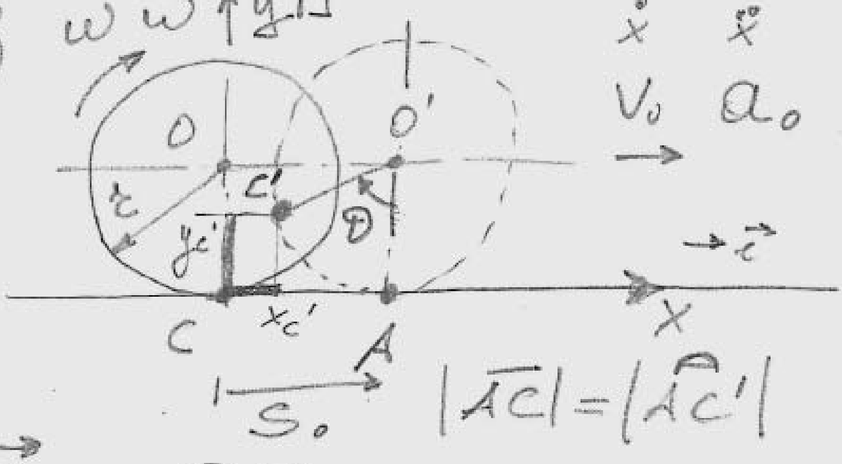






$\vartheta\ \dot{\vartheta}\ \ddot{\vartheta}$ $\omega\ \dot{\omega}$ $\dot{x}\ \ddot{x}$

$V_0\ a_0$



$$|\overline{AC}| = |\widehat{AC'}|$$

$$\vec{S}_0 = r\vartheta\,\vec{i}$$

$$\vec{V}_0 = \frac{d\vec{S}_0}{dt} = r\dot{\vartheta}\,\vec{i} = r\omega\,\vec{i}$$

$$\vec{a}_0 = \frac{d\vec{V}_0}{dt} = r\ddot{\vartheta}\,\vec{i} = r\dot{\omega}\,\vec{i}$$

$$\begin{cases} x_{c'} = S_0 - r\sin\vartheta = r\vartheta - r\sin\vartheta = r(\vartheta - \sin\vartheta) \\ \dot{x}_{c'} = r(\dot{\vartheta} - \dot{\vartheta}\cos\vartheta) = r\dot{\vartheta}(1-\cos\vartheta) \\ \ddot{x}_{c'} = r\ddot{\vartheta}(1-\cos\vartheta) + r\dot{\vartheta}^2\sin\vartheta \end{cases}$$

$$\begin{cases} y_{c'} = r - r\cos\vartheta = r(1-\cos\vartheta) \\ \dot{y}_{c'} = r\dot{\vartheta}\sin\vartheta \\ \ddot{y}_{c'} = r\ddot{\vartheta}\sin\vartheta + r\dot{\vartheta}^2\cos\vartheta \end{cases}$$

SE $\vartheta = 0$ $C \equiv C'$

$x_c = 0$ $y_c = 0$

$\dot{x}_c = 0$ $\dot{y}_c = 0$ C È CENTRO ISTANTANEO ROTAZIONE

$\ddot{x}_c = 0$ $\ddot{y}_c = r\dot{\vartheta}^2$