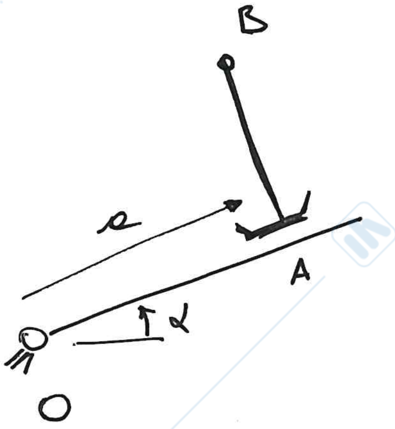
Cinematica Sistemi Corpi Rigidi



Catena cinematica aperta

2 corpi rigidi → 2 × 3 gdl

1 cerniera (O) → 2 gdv

1 pattino (A) → 2 gdv

2 gdl residui

$$\alpha(t),\ a(t)$$

$$(B-O) = (A-O) + (B-A)$$

$$B_x \vec{i} + B_y \vec{j} = a e^{i\alpha} + b e^{i\beta}$$

$$\left.\begin{aligned} a &= a(t) \\ \alpha &= \alpha(t) \end{aligned}\right\}$$ variabili indipendenti

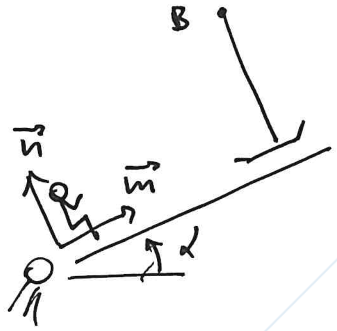
b fisso e noto

$\beta = \alpha + \pi/2$ (pattino fissa la rotazione relativa)

$$(B-O) = a e^{i\alpha} + b e^{i(\alpha + \pi/2)}$$

$$\vec{v}_B = \frac{d(B-O)}{dt} = \dot{a} e^{i\alpha} + a \dot{\alpha} e^{i(\alpha+\pi/2)} +$$
$$+ b \dot{\alpha} e^{i(\alpha+\pi)}$$

$\cancel{\vec v_B = \vec v_A + \vec v_{BA}}$



Prendo una terna rotante in O che ruota come l'asta (α)

$$\vec v_B = \vec v_{trasc} + \vec v_{rel}$$

$$\vec v_{trasc} = \vec \omega \wedge (B - O)$$ ovvero v_B se blocco il moto relativo

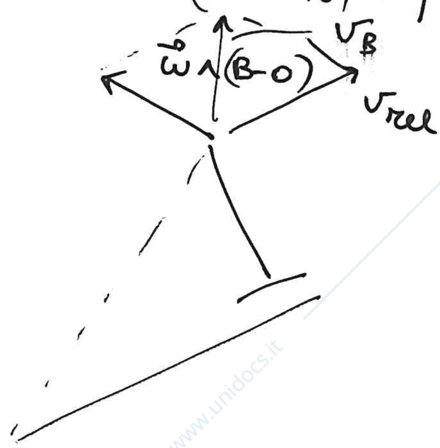
$$= \dot\alpha \vec k \wedge (B_x \vec i + B_y \vec j)$$

$\alpha + \pi/2$

$$= \dot\alpha \vec k \wedge (s e^{i\alpha} + b e^{i\beta})$$

$$= \dot\alpha (s e^{i(\alpha + \pi/2)} + b e^{i(\beta + \pi/2)})$$

$$= \omega \vec k \wedge \left(s\cos\alpha\, \vec i + s\sin\alpha\, \vec j + b\cos(\alpha + \pi/2)\, \vec i + b\sin(\alpha + \pi/2)\, \vec j \right)$$



$$\vec v_{rel} = v_{rel} \vec m$$

$$= \dot s e^{i\alpha}$$

$$\vec{a}_B = \frac{d\vec{v}_B}{dt} = \overbrace{\ddot{\rho}\, e^{i\alpha}}^{a_{rel}} + \overbrace{\dot{\rho}\dot{\alpha}\, e^{i(\alpha+\pi/2)} + \dot{\rho}\dot{\alpha}\, e^{i(\alpha+\pi/2)}}^{a_{cor}} +$$

$$+ \underbrace{\rho\ddot{\alpha}\, e^{i(\alpha+\pi/2)} + b\ddot{\alpha}\, e^{i(\alpha+\pi)}}_{\dot{\vec{\omega}} \wedge (B-O)} + \underbrace{\rho\dot{\alpha}^2 e^{i(\alpha+\pi)} + b\dot{\alpha}^2 e^{i(\alpha+\frac{3}{2}\pi)}}_{-\omega^2 (B-O)}$$

$$\vec{a}_B = \vec{a}_{tr} + \vec{a}_{rel} + \vec{a}_{cor}$$

$$\vec{a}_{tr} = \vec{a}_{tr}^{(t)} + a_{tr}^{(n)}$$

$$= \dot{\vec{\omega}} \wedge (B-O) - \omega^2 (B-O)$$

$\vec{a}_{rel} = a_{rel}\,\vec{u}$ il moto relativo è rettilineo

$$\vec{a}_{cor} = 2\vec{\omega} \wedge \vec{v}_{rel}$$