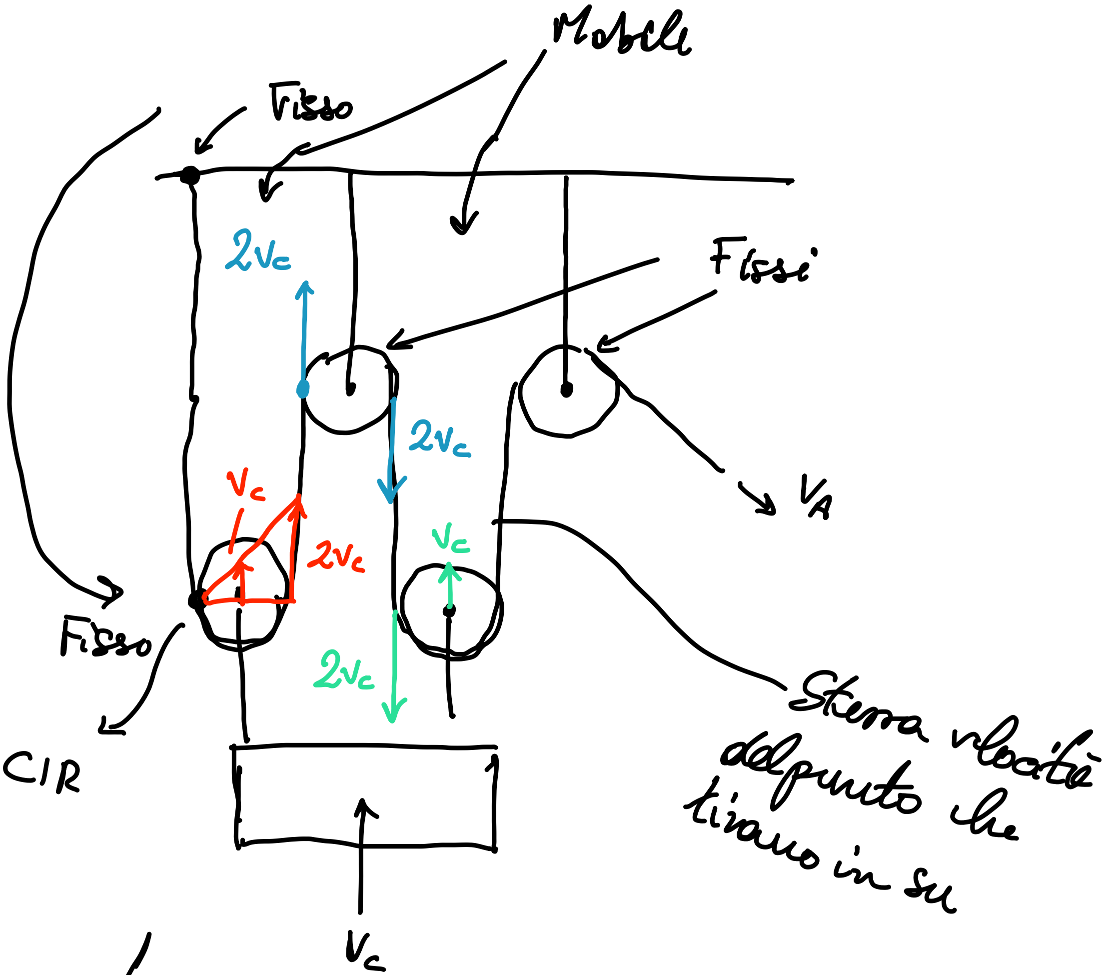
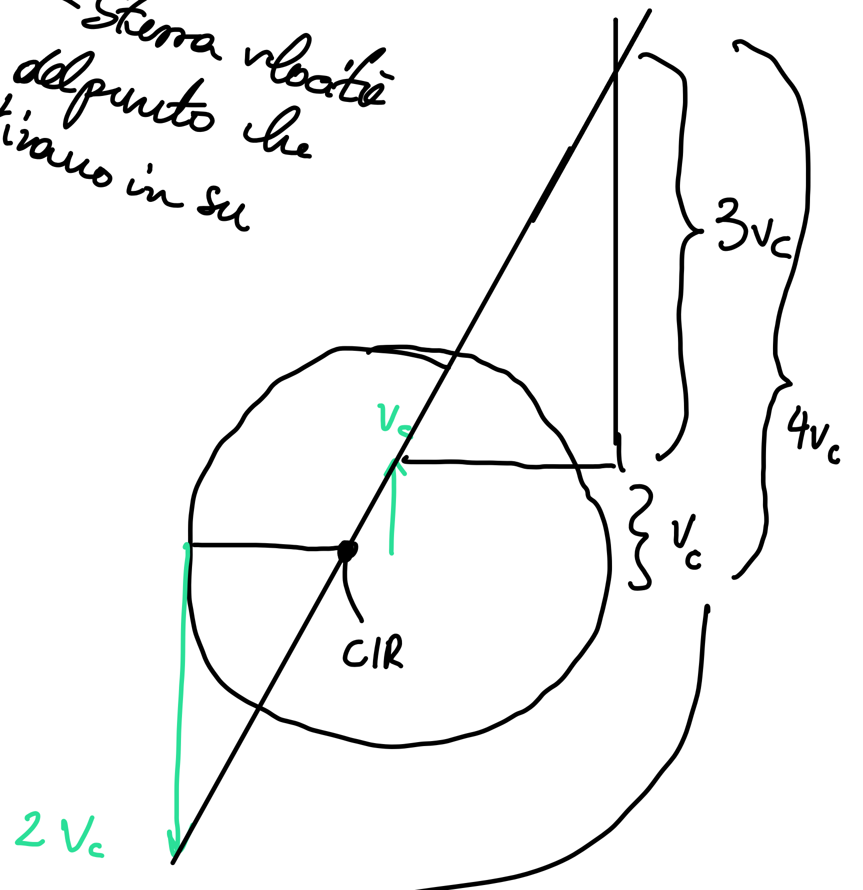
Lezione 5 - Sistemi Funi, Cinghie, Pulegge





taglia → coppia di pulegge fisso-mobile

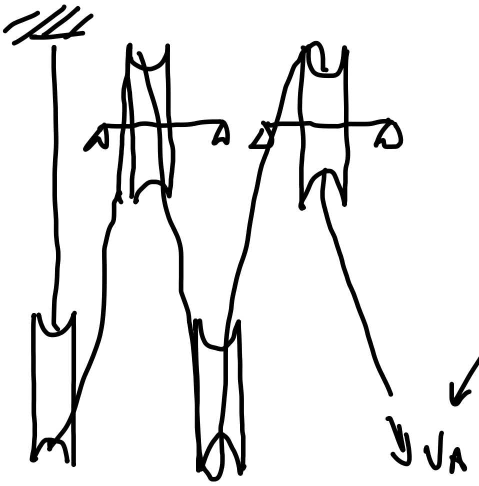
$\Rightarrow V_A = 4V_c$

$V_c = \frac{V_A}{4}$

in generale $v_C = \frac{v_A}{2 n_t}$

→ Molto ingombrante quindi altro modo per orientare è

ω per ogni puleggia è diversa



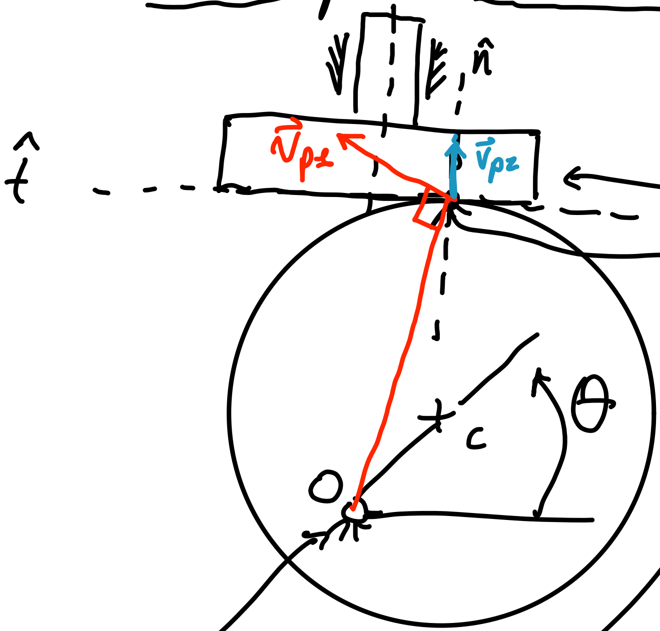
Velocità argano

Potenze

$$F_A \cdot v_A = F_C \cdot v_C$$

$$F_A = F_C \cdot \frac{v_C}{v_A} = \frac{F_C}{2 n_T}$$

2° esempio – Meccanismo a camma



Piattello (Cedente) 2

Vincolo di contatto

Camma (movente) 1

Punto di rotazione della camma, non centrale

velocità lungo la normale devono esser uguali

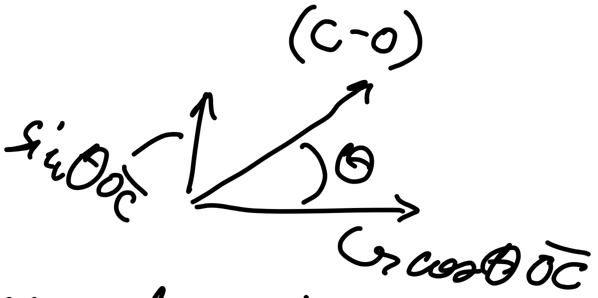
Studio mediante vincolo di contatto (poi mediante Teo. Moti Relativi)

$$\vec{V}_{P1} \cdot \hat{n} = \vec{V}_{P2} \cdot \hat{n} \Rightarrow \left[\vec{w} \times (P-O)\right] \cdot \hat{n} = V_{P2} \cdot \hat{j}$$

effettivamente è la velocità di tutto il corpo 2

Espandiamo:

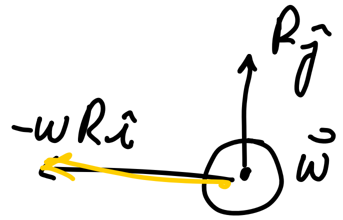
$$\left[\vec{w} \times \left(\underbrace{(P-C)+(C-O)}_{\text{Più facile capire come funziona e risolvere}}\right)\right] \cdot \hat{n} = V_2 \hat{j}$$



modulo sempre uguale raggio

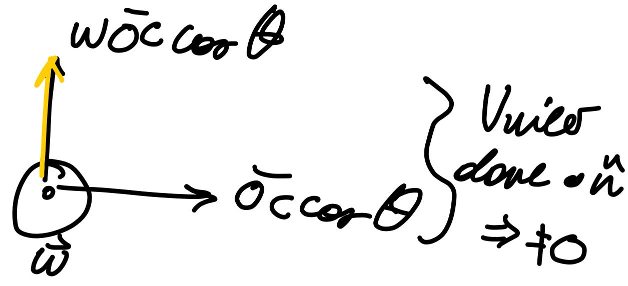
$$\vec{w} \times \left(R\hat{j} + \overline{OC}\cdot\cos\theta\,\hat{i} + \overline{OC}\sin\theta\,\hat{j} \right) \cdot \hat{n} = V_2 \hat{j}$$

Rimane sempre uguale

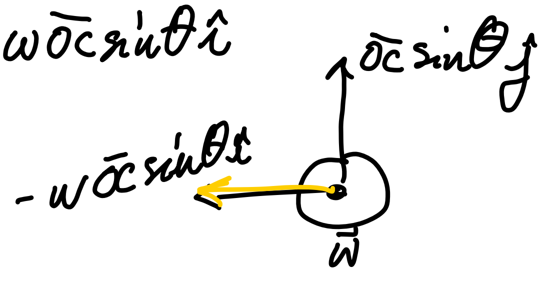


$$\vec{w} \times R\hat{j} = -wR\hat{i}$$

$$\vec{w} \times \overline{OC}\cos\theta\,\hat{i} = w\overline{OC}\cos\theta\,\hat{j}$$

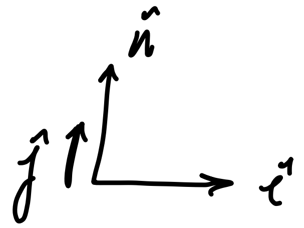


$$\vec{w} \times \overline{OC}\sin\theta\,\hat{j} = -w\overline{OC}\sin\theta\,\hat{i}$$



$$\hat{i}\cdot\hat{n}=0$$

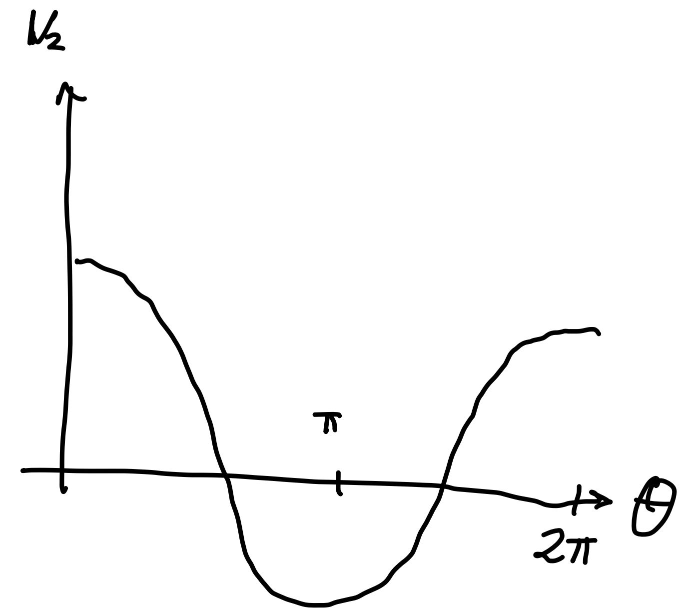
$$\hat{j}\cdot\hat{n}=1$$



modulo di $\vec{\omega}$

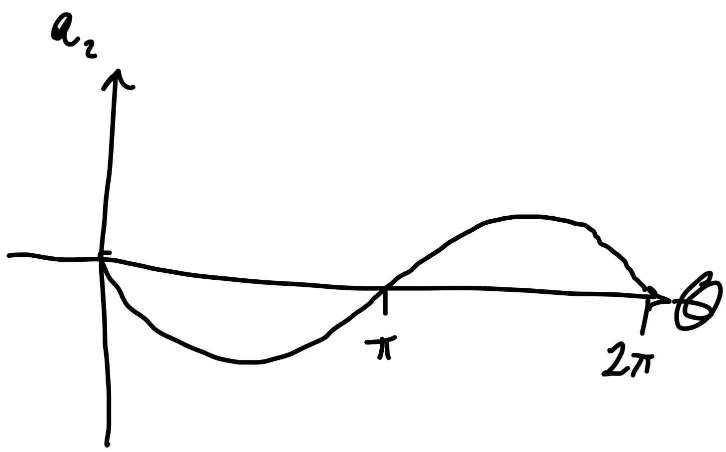
$$\dot{\theta}\,\overline{OC}\cos\cancel{\hat{j}} = v_2\cancel{\hat{j}}$$

$$\boxed{\dot{\theta}\,\overline{OC}\cos\theta = v_2}$$

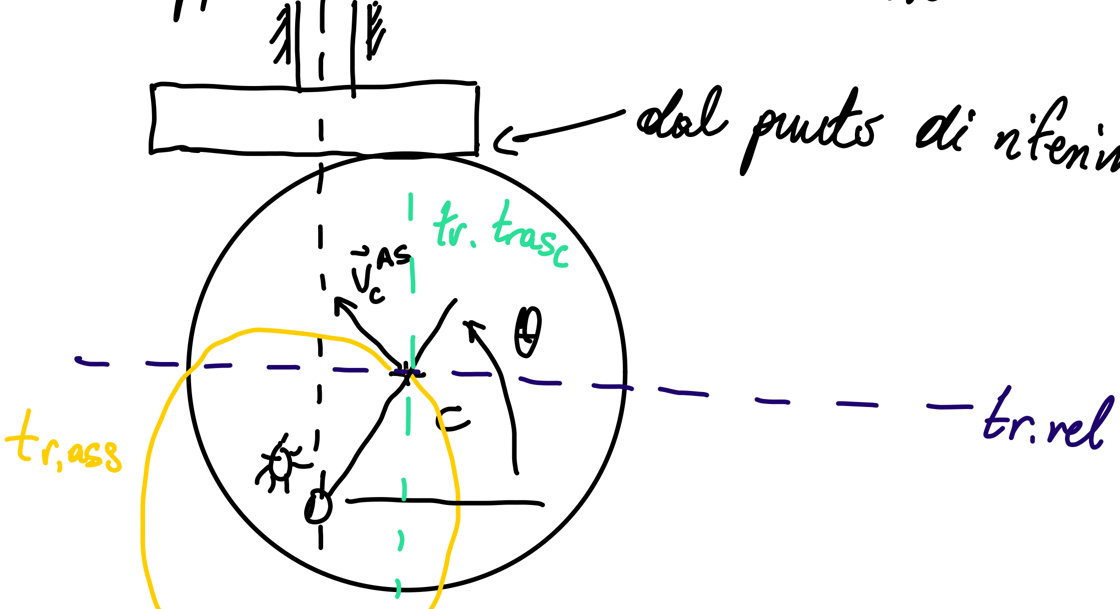


Derivando

$$a_2 = -\dot{\theta}^2\,\overline{OC}\sin\theta$$



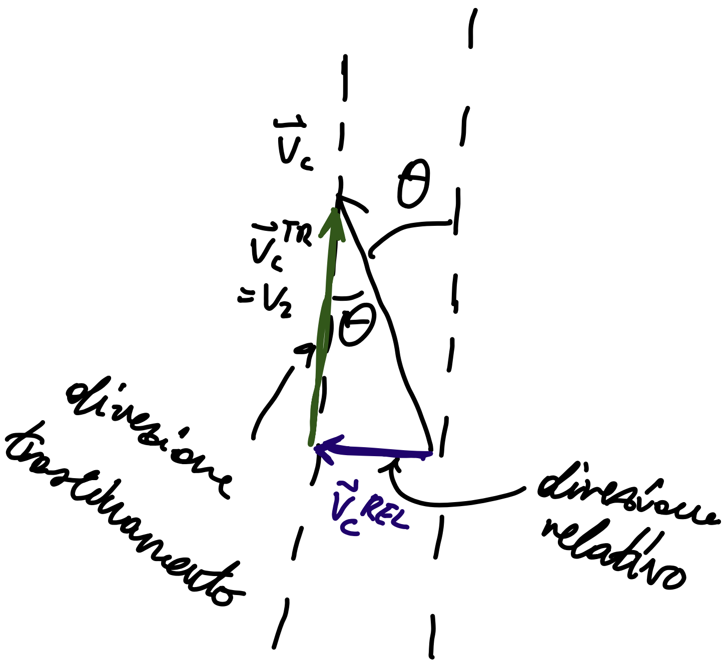
Approccio Teorema Moti Relativi



dal punto di riferimento di 2

$$\vec{V}_c^{AS} = \vec{V}_c^{TR} + \vec{V}_c^{REL}$$

M	$\omega \overline{OC}$	V_2 ?	V_c^{REL} ?
D	$\perp OC$	$// y$	$// x$



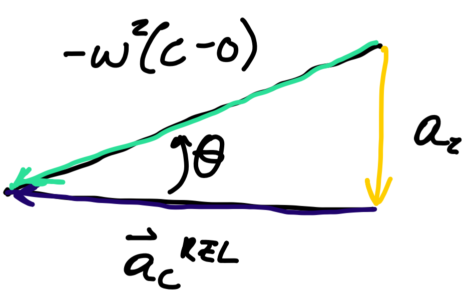
$$V_2 = \dot{\theta}\, \overline{OC} \cos\theta$$

Accelerazione stesso approccio

$$\vec{a}_c^{AS} = \vec{a}_c^{TR} + \vec{a}_c^{REL}$$

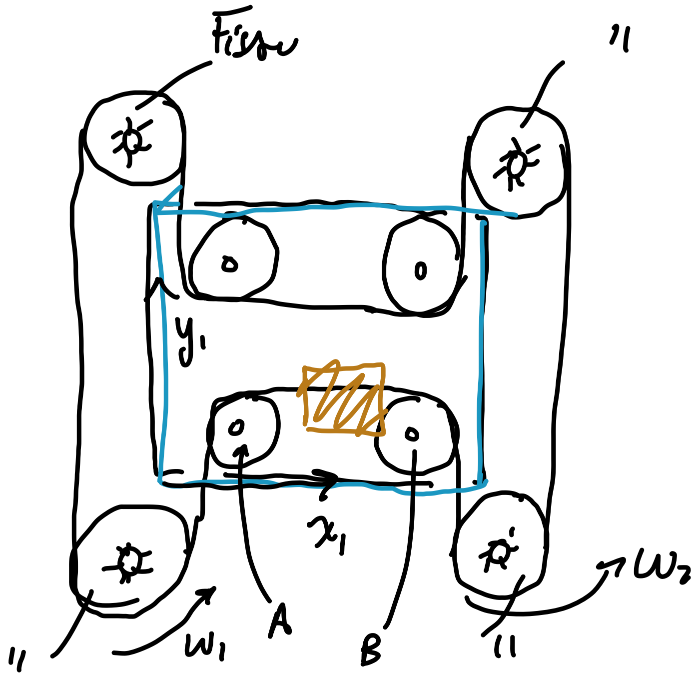
$\dot{\theta} = cost$

M	$\omega^2 \overline{OC}$	? a_2	a_2^{REL}
D	$C \to O$	$// y$	$// x$



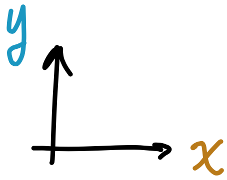
$$\vec{a}_2 = -\dot{\theta}^2\, \overline{OC} \sin\theta\, \hat{j}$$

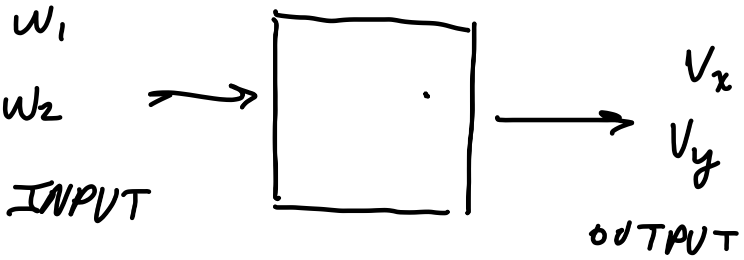
Esame di M-Gantry

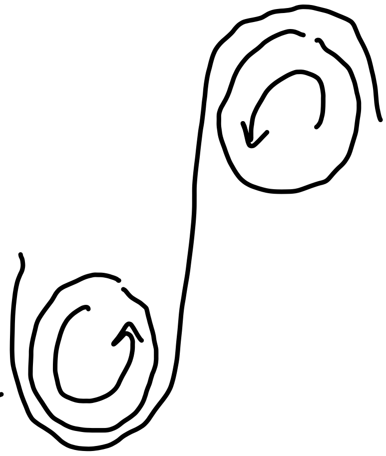


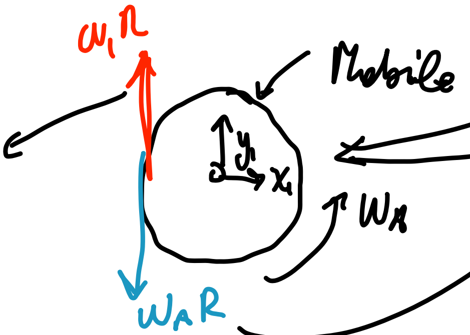
Telaio Verticalmente Mobile

→ Telaio che muove orizzontalmente



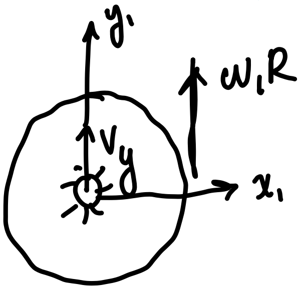






Movimento Assoluto importato

Movimento Relativo

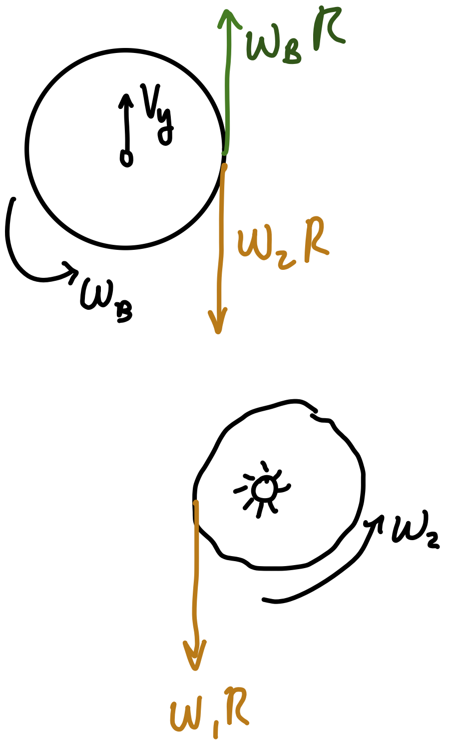


$$\vec{V}_A^{ASS} = \vec{V}_A^{TRA} + \vec{V}_A^{REL}$$

$$\omega_1 R \hat{j} = V_y \hat{j} - \omega_A R \hat{j}$$

$$\omega_1 R = V_y - \omega_A R$$

Seconda Coppia



$$\vec{V}_B^{AS} = \vec{V}_B^{TR} + \vec{V}_B^{REL}$$

$$-\omega_2 R\hat{j} = V_y\hat{j} + \omega_B R\hat{j}$$

$$-\omega_2 R = V_y + \omega_B R$$

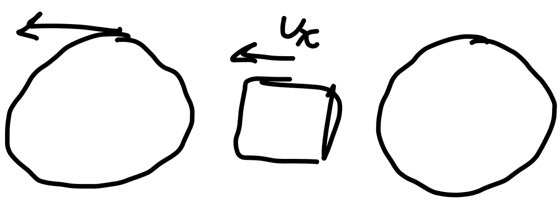
A e B non possono avere velocità diverse, sono limitate dalla loro velocità comune

Nel riferimento mobile x_1, y_1

$$\boxed{\omega_A R = \omega_B R = -V_x}$$

$$-\omega_A R = V_y$$

$$\begin{cases} \omega_1 R = V_y + V_x & (1) \\ -\omega_2 R = V_y - V_x & (2) \end{cases}$$



↳ stessa velocità da puleggia attaccata

$$① - ② \quad \omega_1 R + \omega_2 R = 2 V_x$$

$$① + ② \quad \omega_1 R - \omega_2 R = 2 V_y$$

$$V_x = \frac{R}{2}(\omega_1 + \omega_2)$$

$$V_y = \frac{R}{2}(\omega_1 - \omega_2)$$

$$\begin{Bmatrix} V_x \\ V_y \end{Bmatrix} = \frac{R}{2} \begin{bmatrix} 1 & 1 \\ 1 & -1 \end{bmatrix} \begin{Bmatrix} \omega_1 \\ \omega_2 \end{Bmatrix}$$

<u>Caso $\omega_1 = \omega_2 = \omega$</u>

$$V_x = R\omega$$

$$V_y = 0$$

2 ingressi e

2 uscite

↳ ⇒ 2 gdl

<u>Caso $\omega_1 \neq 0$ e $\omega_2 = 0$</u>

$$V_x = \frac{\omega R}{2}$$

$$V_y = \frac{\omega R}{2}$$