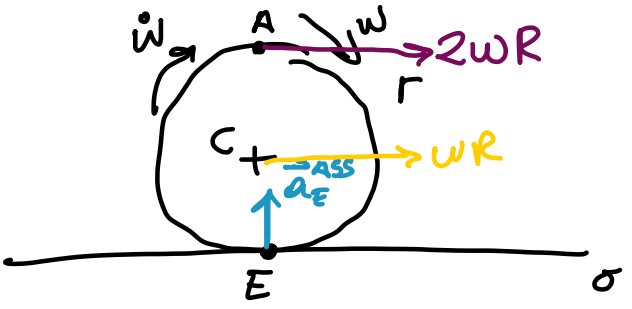
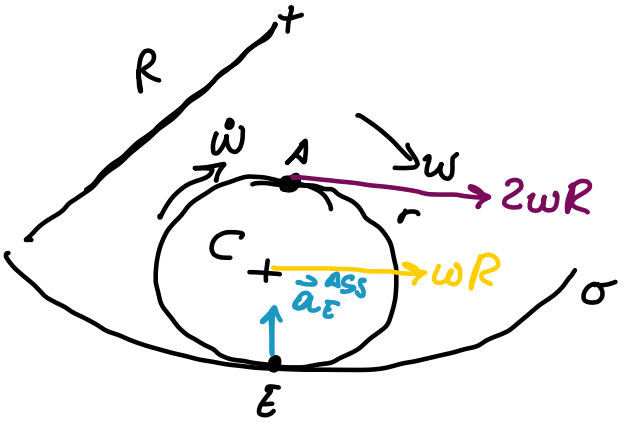
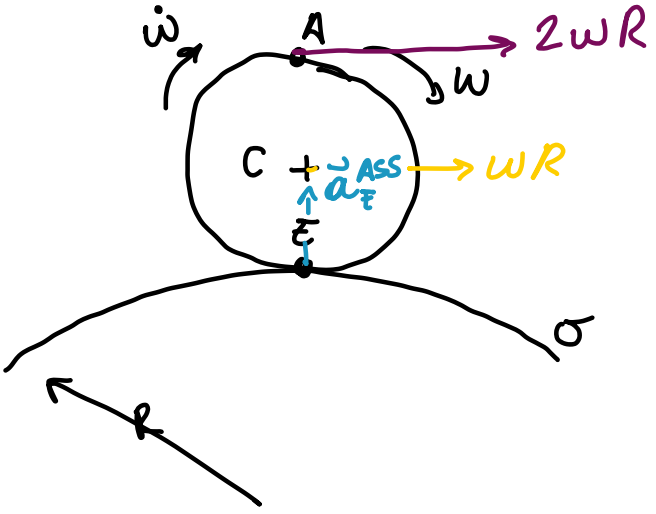
Esercitazione 5 - Rotolamento







In comune:

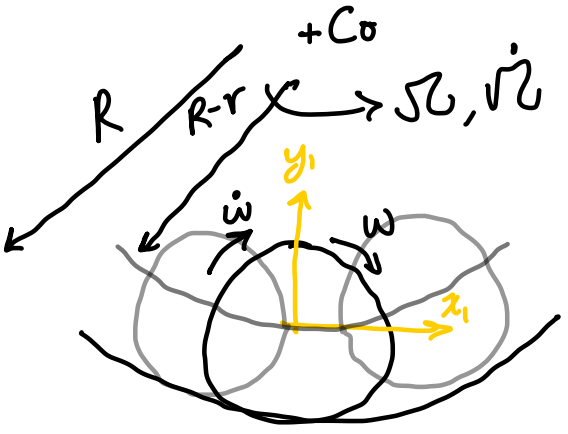
se σ è fermo $\Rightarrow \vec{v}_E = 0$ e $\vec{a}_E^{ASS}$ ha componente normale, se no tangenziale

$\vec{v}$ ad ogni punto, sono tutte uguali

$\vec{a}_E^{ASS}$ con la concava è maggiore invece con la convessa è minore

Dati: $R = 9{,}6\,m$ $\quad r = 0{,}2\,m$ $\quad \omega = 5\,\frac{rad}{s}$ $\quad \dot{\omega} = 20\,\frac{rad}{s^2}$

$\vec{a}_E^{ASS}$ rettilineo $\rightarrow$ $\vec{a}_E^{ASS} = \omega^2 r = 5\,\frac{m}{s^2}$

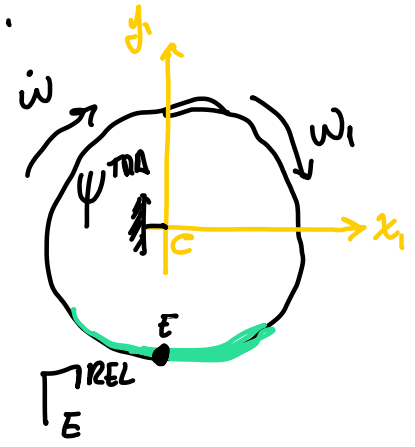


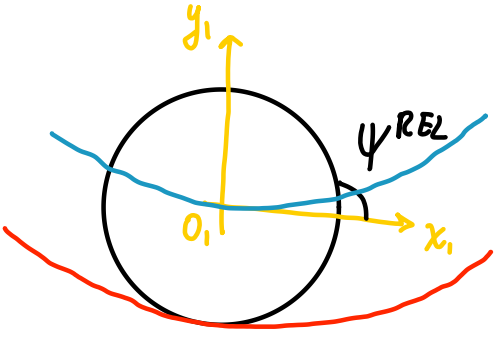
Rif. O_1, x_1, y_1 Traslante con $O_1 \equiv C$

$\Omega(R-r) = \omega r$

$\dot{\Omega}(R-r) = \dot{\omega} r$

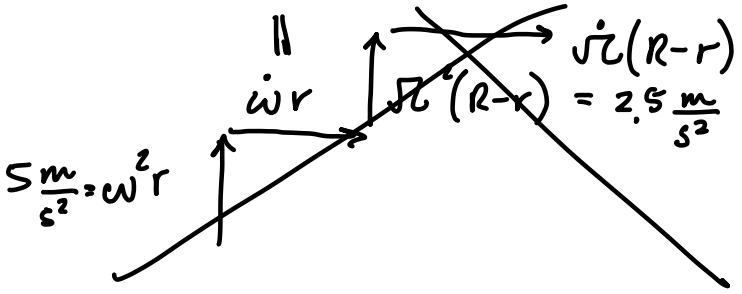
$\dot{\omega} r = \vec{a}_{ct}^{ASS}$





stesso raggio, R-r traslato

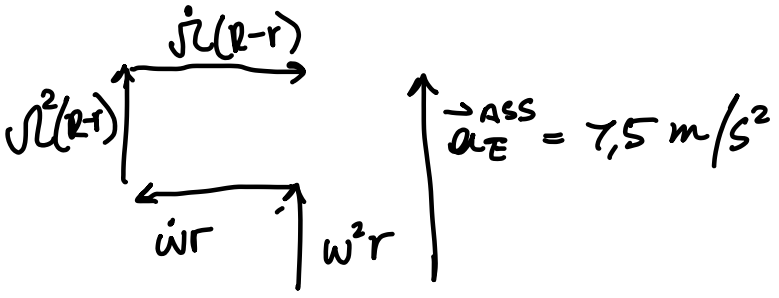
	$\vec{a}_E^{ASS}$	$= \vec{a}_{En}^{REL}$	$+ \vec{a}_{Et}^{REL}$	$+ \vec{a}_{En}^{TRA}$	$+ \vec{a}_{Et}^{TRA}$	$+ \vec{a}_E^{Co}$
M	?	$\omega^2 r$	$\dot{\omega} r$	$\Omega^2(R-r)$	$\dot{\Omega}(R-r)$	$= 0$
D	?	$\parallel EC$ $E \rightarrow C$	$\perp EC$	$\parallel C_0 E$	$\perp C_0 E$	Rif Traslante



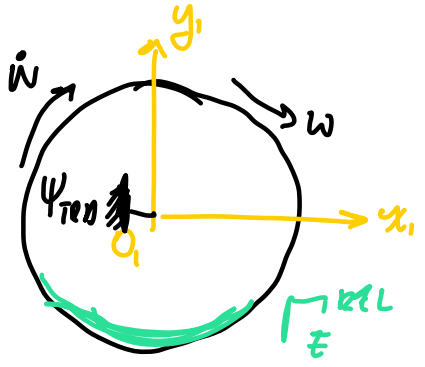
$$\Omega = \frac{\omega r}{R-r} = 2{,}5 \frac{rad}{s}$$

$$\dot{\Omega} = \frac{\dot{\omega} r}{R-r} = 10 \frac{rad}{s}$$

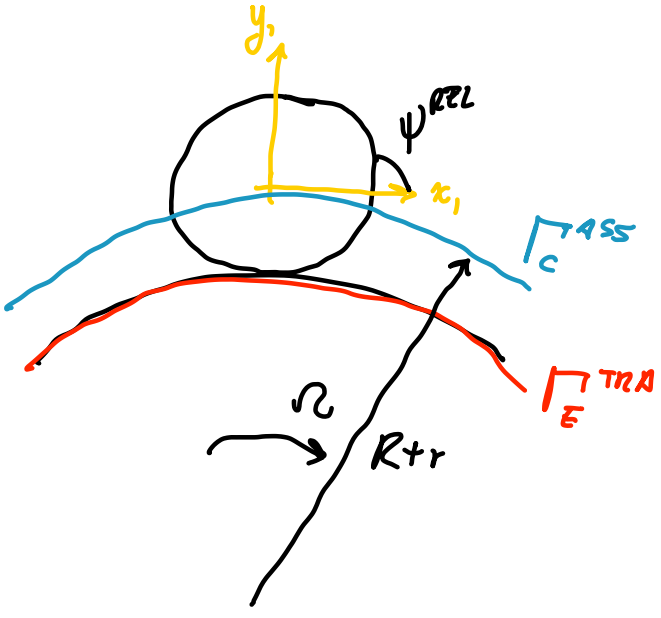
Sbagliata



Corretta



Stesso tipo di sistema di riferimento



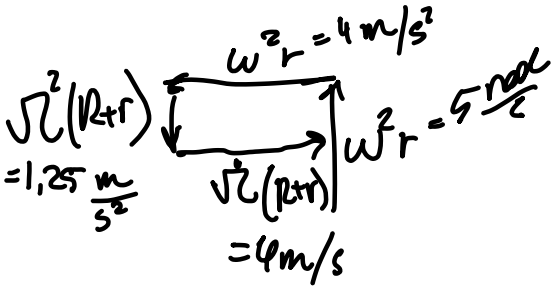
$$\Omega (R+r) = \omega r$$

$$\Omega = \omega \frac{r}{R+r}$$

$$\dot{\Omega} = \dot{\omega} \frac{r}{R+r}$$

$$\vec{a}_E^{ASS} = \vec{a}_{En}^{REL} + \vec{a}_{Et}^{REL} + \vec{a}_{En}^{TRA} + \vec{a}_{Et}^{TRA} + \vec{a}_E^{Co}$$

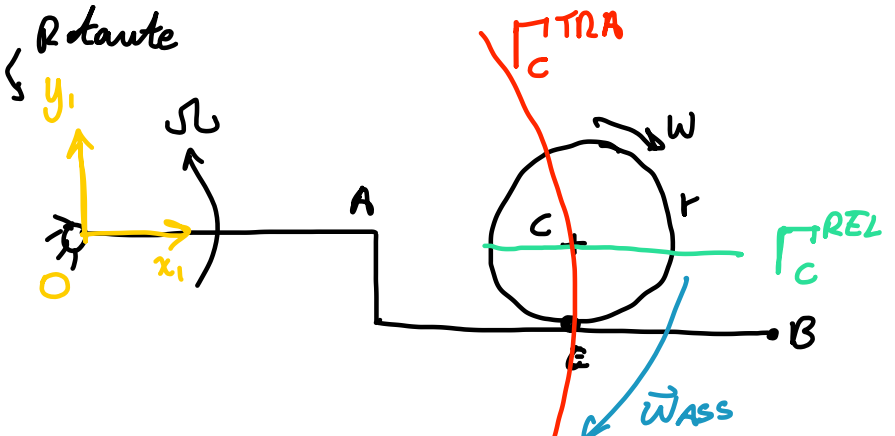
M	?	$\omega^2 r$	$\dot{\omega} r$	$\Omega^2(R+r)$	$\dot{\Omega}(R+r)$	$=0$	
D	?	$\parallel CE$ $E \to C$	$\perp CE$	$\parallel CE$ $E \to C_0$	$\perp CE$	Rif. Traslante	



$$\Omega = \omega \frac{r}{R+r} = 1{,}25\ \frac{rad}{s}$$

$$\dot{\Omega} = \dot{\omega} \frac{r}{R+r} = 5\ \frac{rad}{s}$$

$$\vec{a}_E^{ASS} \uparrow = 3{,}75\ \frac{rad}{s} \Rightarrow \vec{E}$$ più piccola la convessa che la concava.



Dati

Asta OAB

$\Omega = 5\ \frac{rad}{s}$ (cost)

Discoraggio $r = 92m$

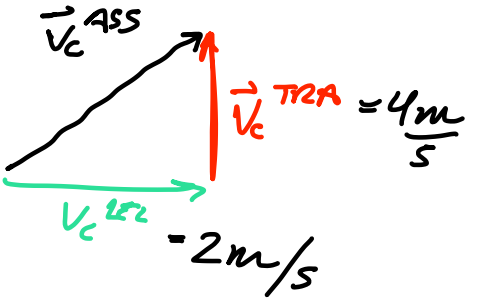
$\omega^{REL} = 10 \frac{rad}{s}$ (cost)

$\vec{V}_c^{ASS}$? $\vec{a}_c^{ASS}$? $\vec{\omega}^{ASS}$?

Contatto di puro rotolamento

→ Assoluta o relativa (relativa

	$\vec{V}_c^{ASS}$	$\vec{V}_c^{REL}$	+ $\vec{V}_c^{TRA}$
M	?	$\vec{\omega}^{REL} r$	$\Omega \cdot 4r$
D	?	$\parallel OC$	$\perp OC$



$\vec{V}_c^{ASS} = 4{,}47 \frac{m}{s}$

$\vec{a}_c^{ASS} \pm \vec{a}_{cn}^{REL} + \vec{a}_{ct}^{REL} + \vec{a}_{cn}^{TRA} + \vec{a}_{ct}^{TRA} + \vec{a}_c^{CO}$

M	?	X	$= 0$	$\Omega^2 4r$	$= 0$	$2\Omega V_c^{REL}$
D	?	Rettilinea	$\dot{\omega}^{REL} = 0$	$\parallel CO$ $C \to O$	$\dot{\Omega} = 0$	$\perp OC$

$2\Omega \cdot V_c^{REL} = 20 \frac{m}{s^2}$

$\Omega^2 \cdot 4r = 20 \frac{m}{s^2}$

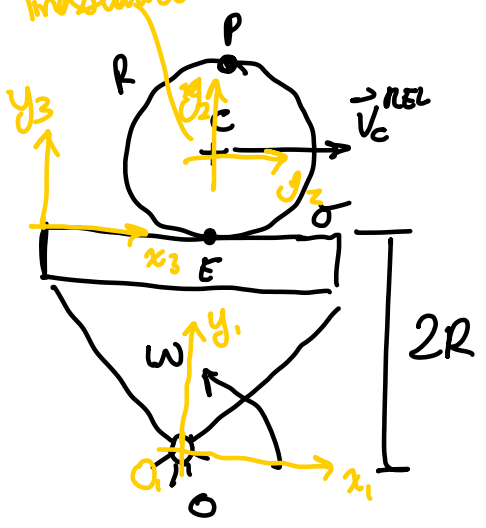
$$\vec{\omega}^{ASS} = \vec{\omega}^{REL} + \vec{\omega}^{TRA}$$

$$= -10\frac{rad}{s} + 5\frac{rad}{s} = -5\frac{rad}{s}$$

Esercizio Proposto

Traslante

Solidale a piano σ



Riferimento O_1, x_1, y_1 rotante con $O_1 \equiv O$

Dati:

$V_c^{REL} = 2\ m/s$ (cost)

$R = 0{,}1\ m$

$\omega = 10\frac{rad}{s}$ (cost)

$\vec{V}_P^{ASS}$? $\vec{a}_P^{ASS}$? $\vec{\omega}_{disco}^{ASS}$?

$$\omega_d = \frac{\vec{V}_c}{R} = \frac{2}{-1} = 20\frac{rad}{s}$$

$$V_P = 2\omega_d R = 4\frac{m}{s}$$

$$a_P = \omega^2 r = 20^2 \cdot 0{,}1 = 40\frac{m}{s^2}$$