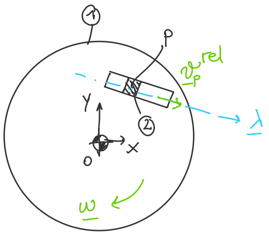
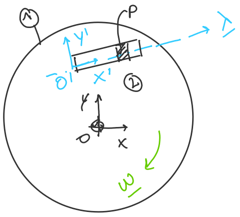
Moto relativi - moti composti

martedì 26 novembre 2024 09:38



$t = t_1$



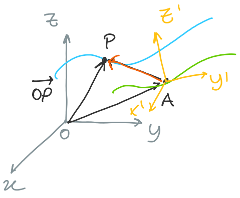
$t = t_2$

$\Sigma_F = \{O; x, y\}$

MOTO DI P ASSOLUTO ⇒ MOTO COMPOSTO ⇒

$\Sigma_F = \{O; x, y, z\}$

$\Sigma_M = \{A; x', y', z'\}$ → ORIGINE TRASLA ORIENTAMENTO COST.



$$\vec{OP} = \vec{OA} + \vec{AP}$$

$\downarrow d/dt$

$$v_P = v_A + v_{PA}$$

$$a_P = a_A + a_{PA}$$

|| MOTO ASSOLUTO = || MOTO TRASCINAMENTO DI A ⊕ MOTO RELATIVO DI P RISPETTO AD A ||

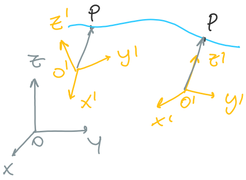
$$\boxed{\underline{v}_P^{ass} = \underline{v}_P^{tr} + \underline{v}_P^{rel}}$$

vel ASSOLUTA DI P = vel di Σ_M + vel di P rispetto alla terna mobile

$$\boxed{\underline{a}_P^{ass} = \underline{a}_P^{tr} + \underline{a}_P^{rel}}$$

$t=t_1$

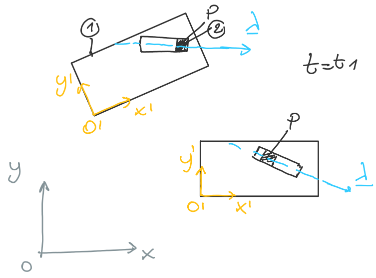
$t=t_2$



⇒

$t=t_2$

$t=t_1$



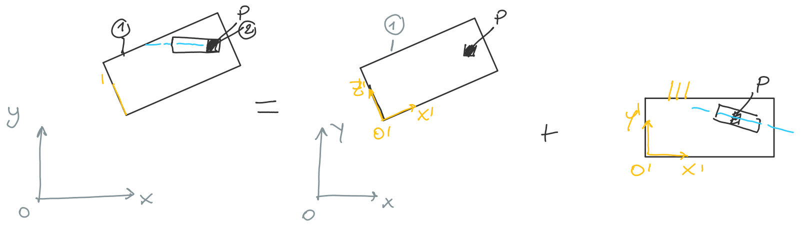
$\Sigma_F = \{O; x', y', z'\}$

$\Sigma_M = \{O'; x', y', z'\}$ ⇒ ROTO - TRASLA ⇒ e' solidale al corpo ①

MOTO ASSOLUTO DI P ⇒ MOTO TRASCINAM. di Σ_M rispetto Σ_F ⊕ MOTO RELATIVO MOTO DI P RISPETTO A Σ_M

|| v^{ass} v^{tr} v^{rel} || TEOREMA DI COMPOSIZIONE

$$\| \quad \underline{v}_P = \underline{v}_P + \underline{v}_P \quad \|$$ DELLE VELOCITA' LINEARI



MOTO DI P
CONSIDERATO ∈ ①
⇓
FISSO RISPETTO ALLA
Σ_M

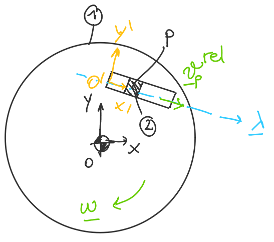
MOTO D'P
RISPETTO ALLA Σ_M

$$\| \quad \underline{a}_P^{ass} = \underline{a}_P^{tr} + \underline{a}_P^{rel} + \underline{a}_P^{cor} \quad \|$$ TEOREMA DI COMPOSIZIONE DELLE ACCELERAZIONI

$\underline{a}_P^{cor}$: $(2\,\underline{\omega}^{tr} \wedge \underline{v}_P^{rel})$

$\underline{\omega}^{tr}$: $\underline{\omega}$ della Σ_M

ESEMPIO



$t = t_1$

NOTA : $\underline{\omega}$, $\underline{v}_P^{rel}$

$\Sigma_F = \{O \; ; \; x, y\}$

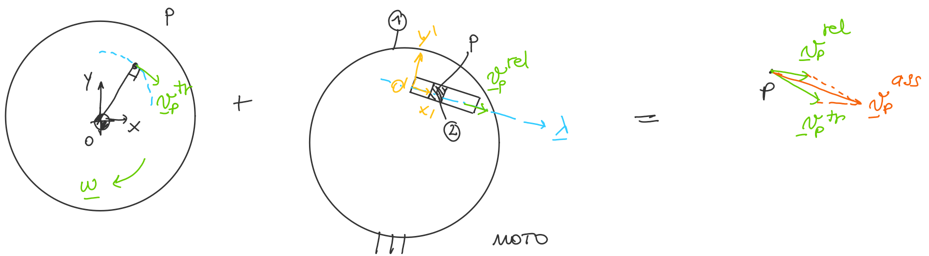
$\Sigma_M = \{O' \; ; \; x', y'\}$

TROVARE : $\underline{v}_P^{ass}$, $\underline{a}_P^{ass}$ con il TCV, TCA

$$\rightarrow \quad \underline{v}_P^{ass} = \underline{v}_P^{tr} + \underline{v}_P^{rel} = \underline{\omega} \wedge \vec{OP} + \dot{s}\,\underline{\lambda} =$$

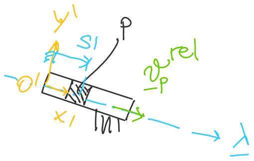
$\underline{v}_P^{tr}$: $\underline{v}_{P\in①} = \underline{\omega} \wedge \vec{OP}$

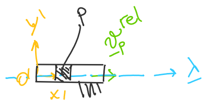
$\underline{v}_P^{rel}$: $\dot{s}\,\underline{\lambda}$



MOTO
ROTATORIO

MOTO
TRASLATORIO





$$\underline{a}_P^{ass} = \underline{a}_P^{tr} + \underline{a}_P^{rel} + \underline{a}_P^{cor}$$

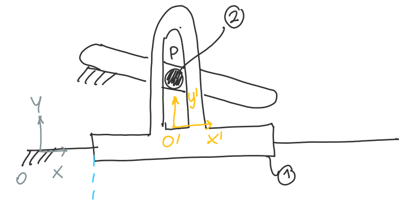
$$\underline{a}_P^{cor} = 2\,\underline{\omega}^{tr} \wedge \underline{v}_P^{rel} = 2\,\underline{\omega} \wedge \dot{s}\,\underline{\lambda}$$

$$\underline{a}_P^{rel} = \ddot{s}\,\underline{\lambda}$$

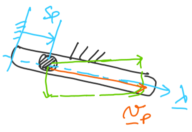
$$\underline{a}_P^{tr} = \underline{a}_{P①} = \underline{\dot{\omega}} \wedge \vec{OP} - \omega^2 \vec{OP}$$

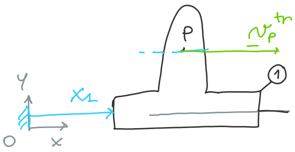
$$\Rightarrow \quad \underline{a}_P^{ass} = \underline{\dot{\omega}} \wedge \vec{OP} - \omega^2 \vec{OP} + \ddot{s}\,\underline{\lambda} + 2\,\underline{\omega} \wedge \dot{s}\,\underline{\lambda}$$

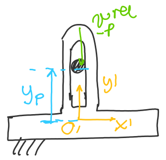
ESEMPIO



MOTO ASSOLUTO = MOTO TRASC. + MOTO RELAT.







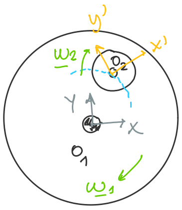
$$\underline{v}_P^{ass} = \underline{v}_P^{tr} + \underline{v}_P^{rel} = \dot{s}_P\,\underline{\lambda}$$

$$\underline{v}_P^{tr} = \dot{x}_1\,\underline{i} \qquad \underline{v}_P^{rel} = \dot{y}_P\,\underline{j}$$

$$\underline{a}_P^{ass} = \underline{a}_P^{tr} + \underline{a}_P^{rel} + \underline{a}^{cor} = \ddot{x}_1\,\underline{i} + \ddot{y}_P\,\underline{j} = \ddot{s}\,\underline{\lambda}$$

$$\ddot{x}_1\,\underline{i} + \ddot{y}_P\,\underline{j} + 2\,\underline{\omega}^{tr} \wedge \underline{v}^{rel}$$

$$\underline{\omega}^{tr} = \cancel{\underline{\omega}_1}$$



$$\underline{\omega}_{21}^{rel} = \underline{\omega}_2^{ass} - \underline{\omega}_1^{ass}$$

$$\underline{\omega}_2^{ass} = \underline{\omega}_{21}^{rel} - \underline{\omega}_1^{ass}$$

$\underline{\omega}_2 = 1 \text{ rpm } \underline{k}$

$\underline{\omega}_1 = 2 \text{ rpm } \underline{k}$

$$\underline{\omega}_{21} = (\underline{\omega}_2 - \underline{\omega}_1) \overset{!}{=} (1-2)\,\underline{k} \text{ rpm} \overset{!}{=} -1\,\underline{k} \text{ rpm}$$

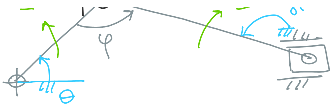
TEO.
COMPOSIZIONE
DELLE VELOCITA'
ANGOLARI

$$\underline{\omega}^{ass} = \underline{\omega}^{rel} + \underline{\omega}^{tr}$$

$\underline{\omega}^{rel}$: della Σ_M rispetto Σ_F

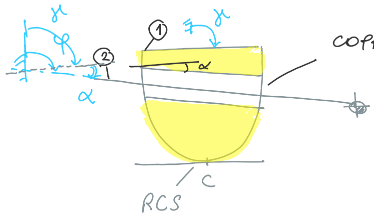
$\underline{\omega}^{tr}$: della Σ_M

$$\underline{\omega}_1 = \omega_1\,\underline{k} = \dot{\theta}\,\underline{k}$$



$\underline{\omega}_2 = -\dot{\gamma}\,\underline{K}$

$$\boxed{\Sigma_{①}} \quad \underline{\omega}_2^{rel} = \underline{\omega}_2^{ass} - \underline{\omega}_2^{tr} = \underline{\omega}_2 - \underline{\omega}_1 = \underline{\omega}_{21} \overset{!}{=} -\dot{\gamma}\underline{K} - \dot{\theta}\,\underline{K} = -(\dot{\gamma}+\dot{\theta})\,\underline{K} \overset{!}{=} -\dot{\varphi}\,\underline{K}$$



COPPIA PRISMATICA
MOBILE

$\Downarrow$ $\quad \underline{\omega}_1$? $\underline{\omega}_2$

MOTO RELATIVO ②-①

$\downarrow$

TRASLATORIO

$\underline{\omega}_{21} = -\underline{\omega}_{12} = \underline{0}$

$$\Sigma_{①} \quad \underline{\omega}_2^{ass} = \cancel{\underline{\omega}_2^{rel}} + \underline{\omega}_2^{tr} = \underline{\omega}_1$$

$\overset{!}{=} \underline{\omega}_1$

φ e γ

$\varphi = \gamma + \alpha$

$\downarrow d/dt$

$\dot{\varphi} = \dot{\gamma}$

$\ddot{\varphi} = \ddot{\gamma}$