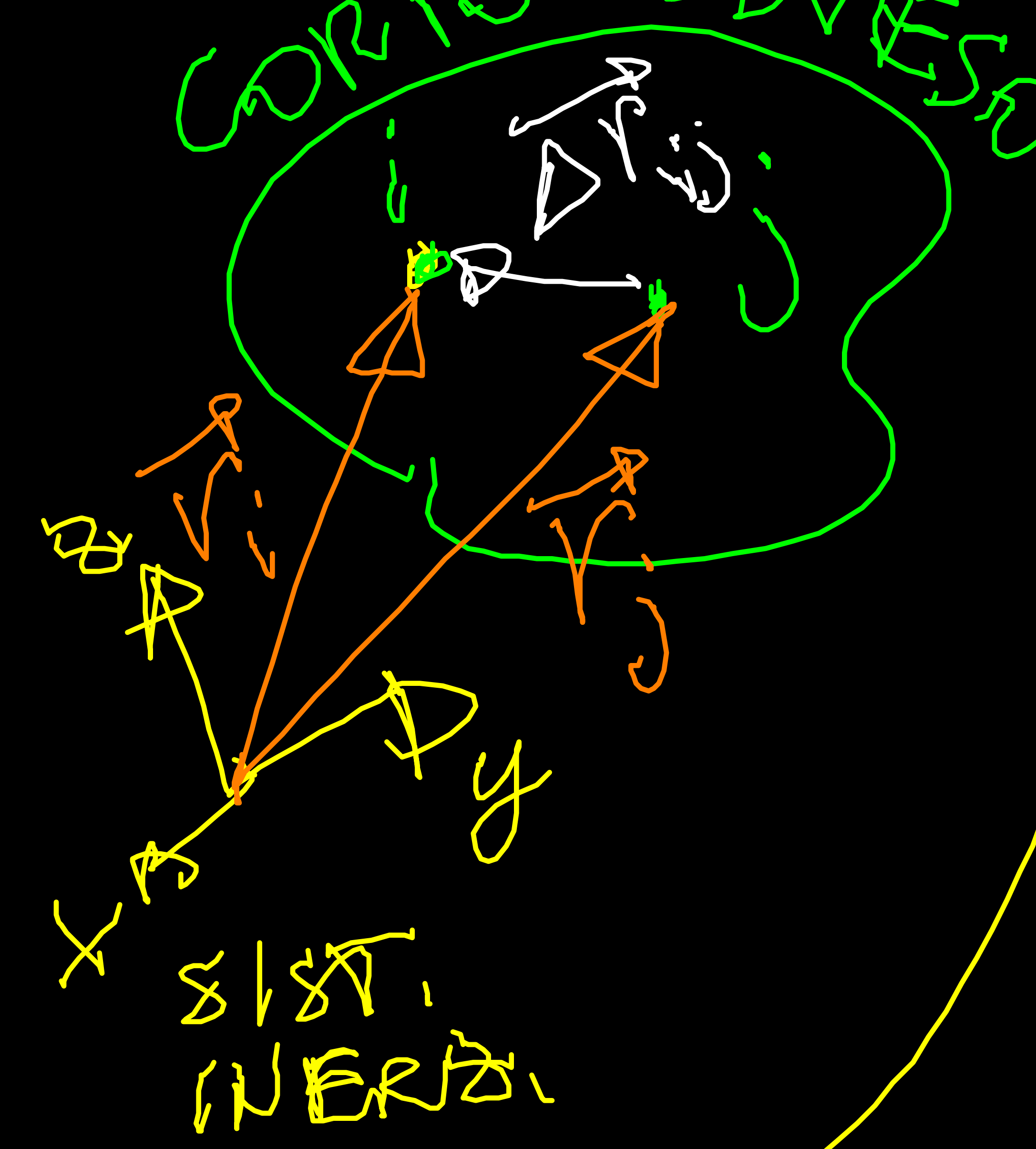
EQUILIBRIO STATICO

$\Downarrow$

$$\vec{r}_i(t) = \text{costante} \quad \forall i$$

$$(\Rightarrow \vec{v}_i(t), \vec{a}_i(t) = 0)$$

CORPO ESTESO



IL CORPO È RIGIDO SE

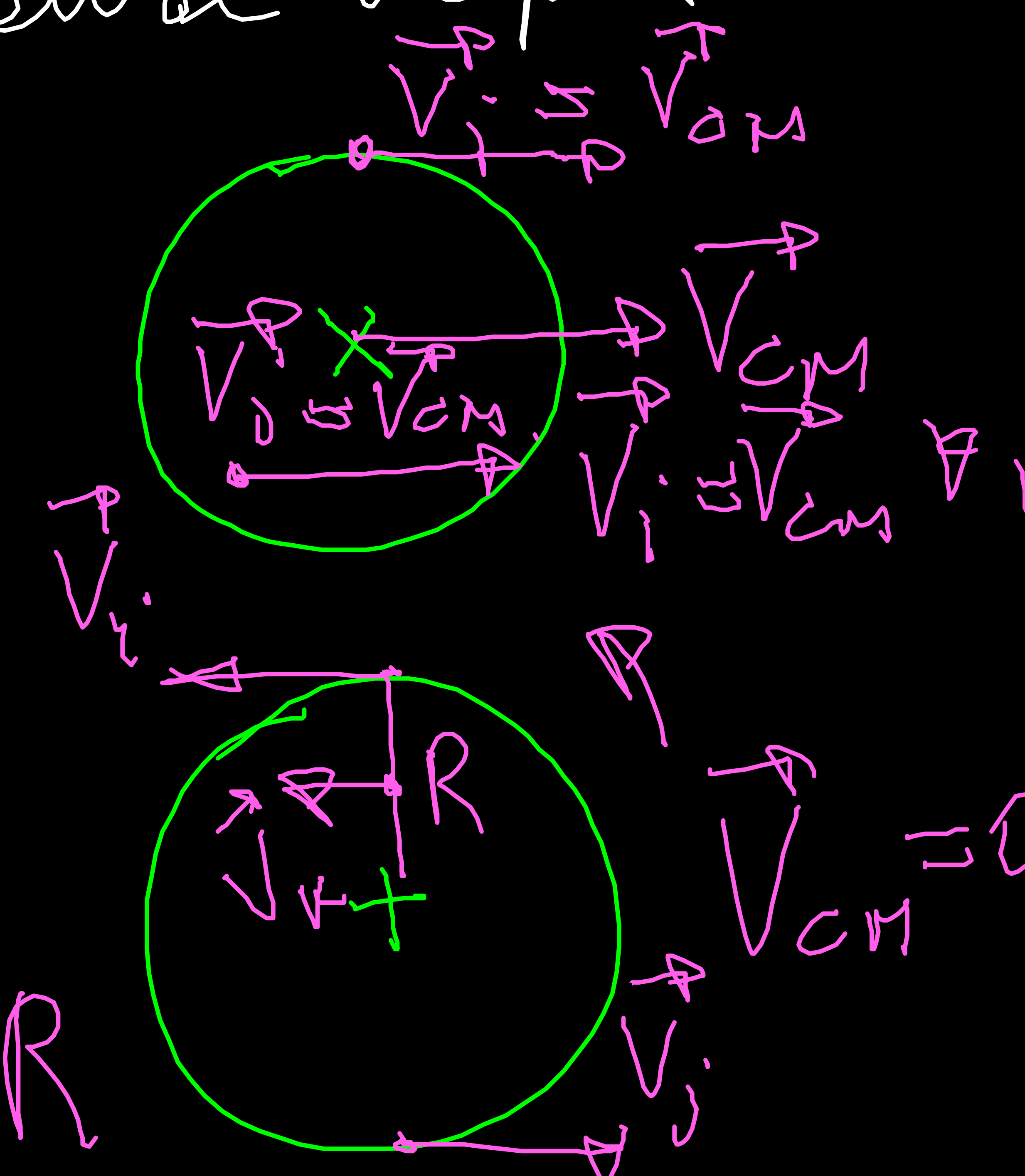
$$|\Delta \vec{r}_{ij}| = |\vec{r}_i - \vec{r}_j| = \text{costante} \quad \forall i,j$$

(distanze tra punti costanti)

MOTO ROTOTR.

MOTO TRASLATORIO PURO

MOTO ROTATORIO PURO $|\vec{v}_i| \propto R$



Se $\boxed{\sum \vec{F}_{est} = 0} \Rightarrow \vec{a}_{cm} = 0 \Rightarrow \vec{V}_{cm} = \text{costante}$

COND. DI EQ. TRASLATORIO PER UN CORPO RIGIDO

possiamo trovare un S.d.R. inerziale in cui $\vec{V}_{cm} = 0$ (quiete)

Se il corpo è rigido in moto <u>TRASLATORIO</u> ($\vec{V}_i = \vec{V}_{cm}\ \forall i$)

$\Rightarrow \vec{V}_i = 0\ \forall i$

$\Rightarrow$ è realizzata la cond. di EQ. STATICO

NECESSARIA MA NON SUFFICIENTE

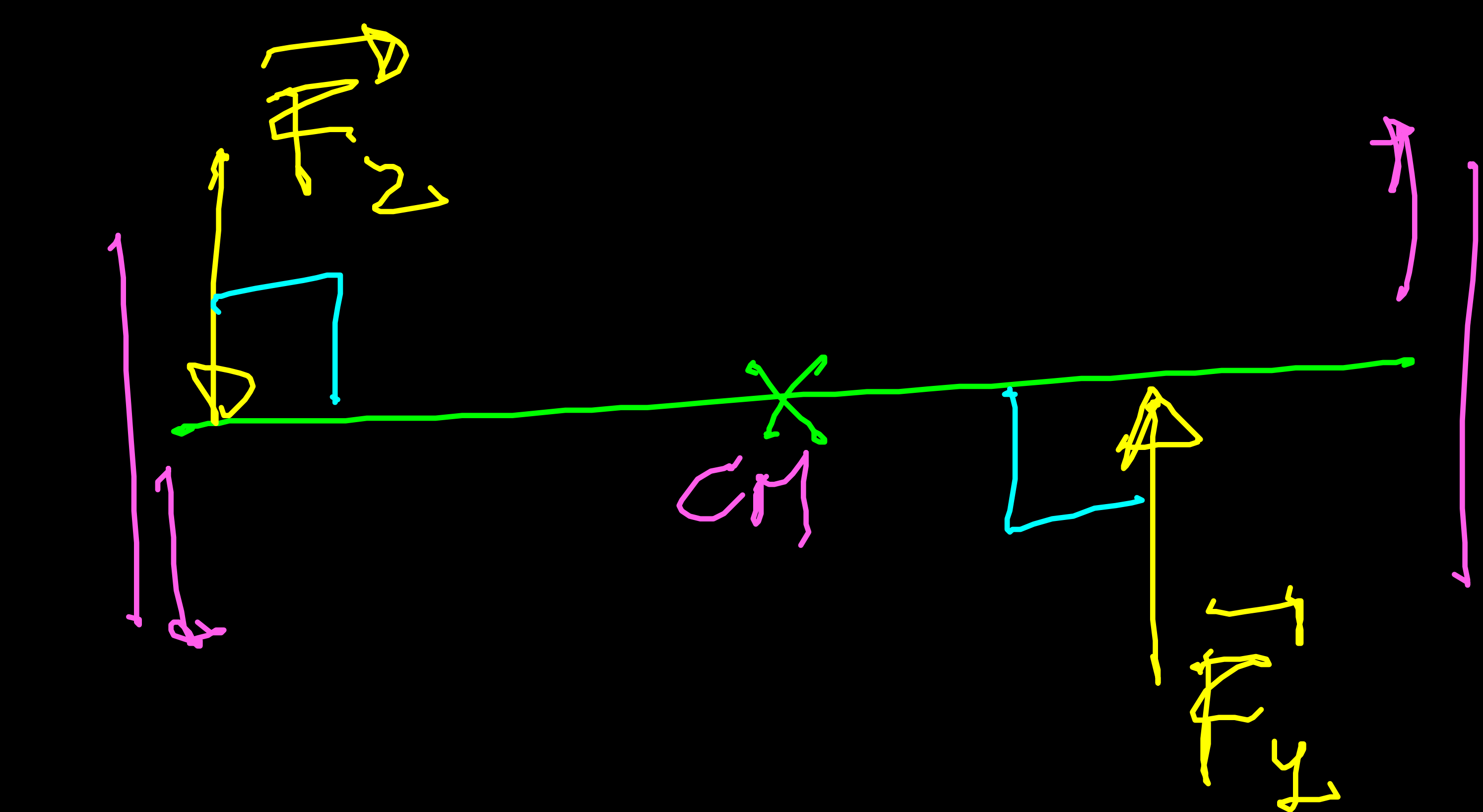
$\vec{N} + m\vec{g} = \sum \vec{F}_{est} = 0$

$\Rightarrow \vec{a}_{cm} = 0,\ \vec{V}_{cm} = 0$

ma $\vec{V}_i \neq \vec{V}_{cm}\ \forall i$

esempio: ruota sospesa

PORTA GIREVOLE



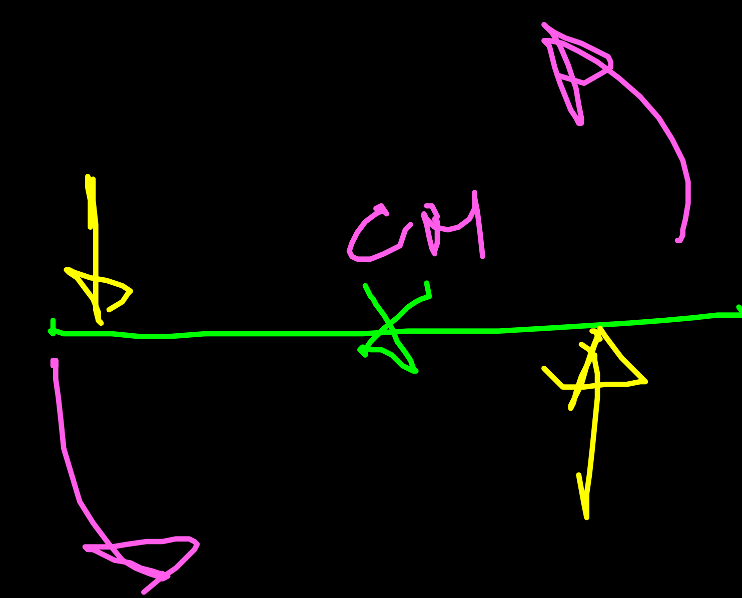
CM → asse di rotazione

$$|\vec F_1| = |\vec F_2|$$

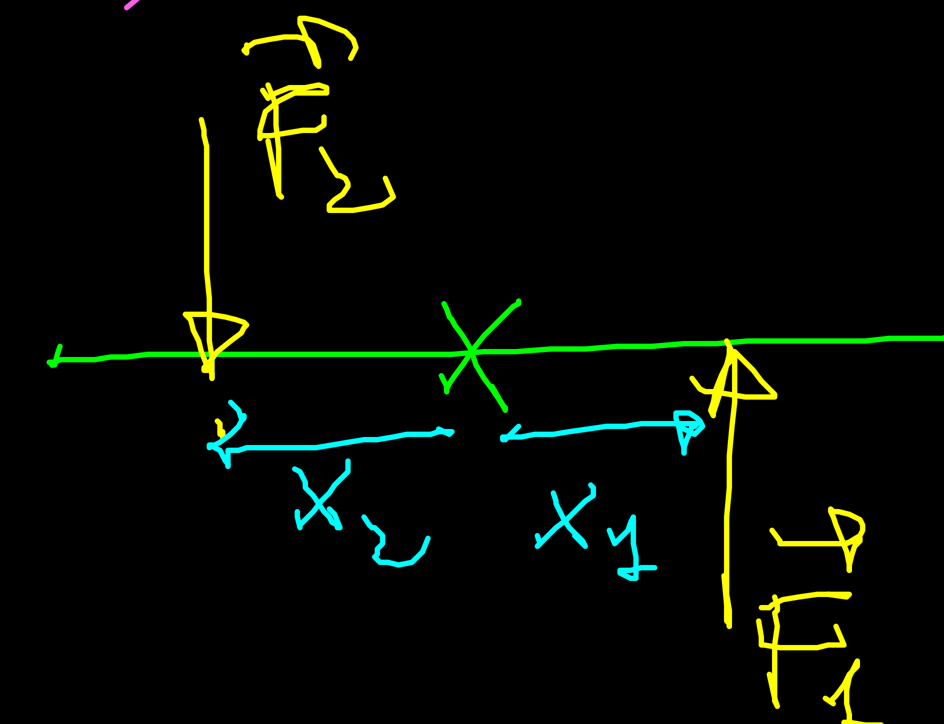
$$\vec F_1 + \vec F_2 = 0 = \sum \vec F_{est}$$

⇒ la porta è in eq. traslatorio

La porta non è in eq. statico



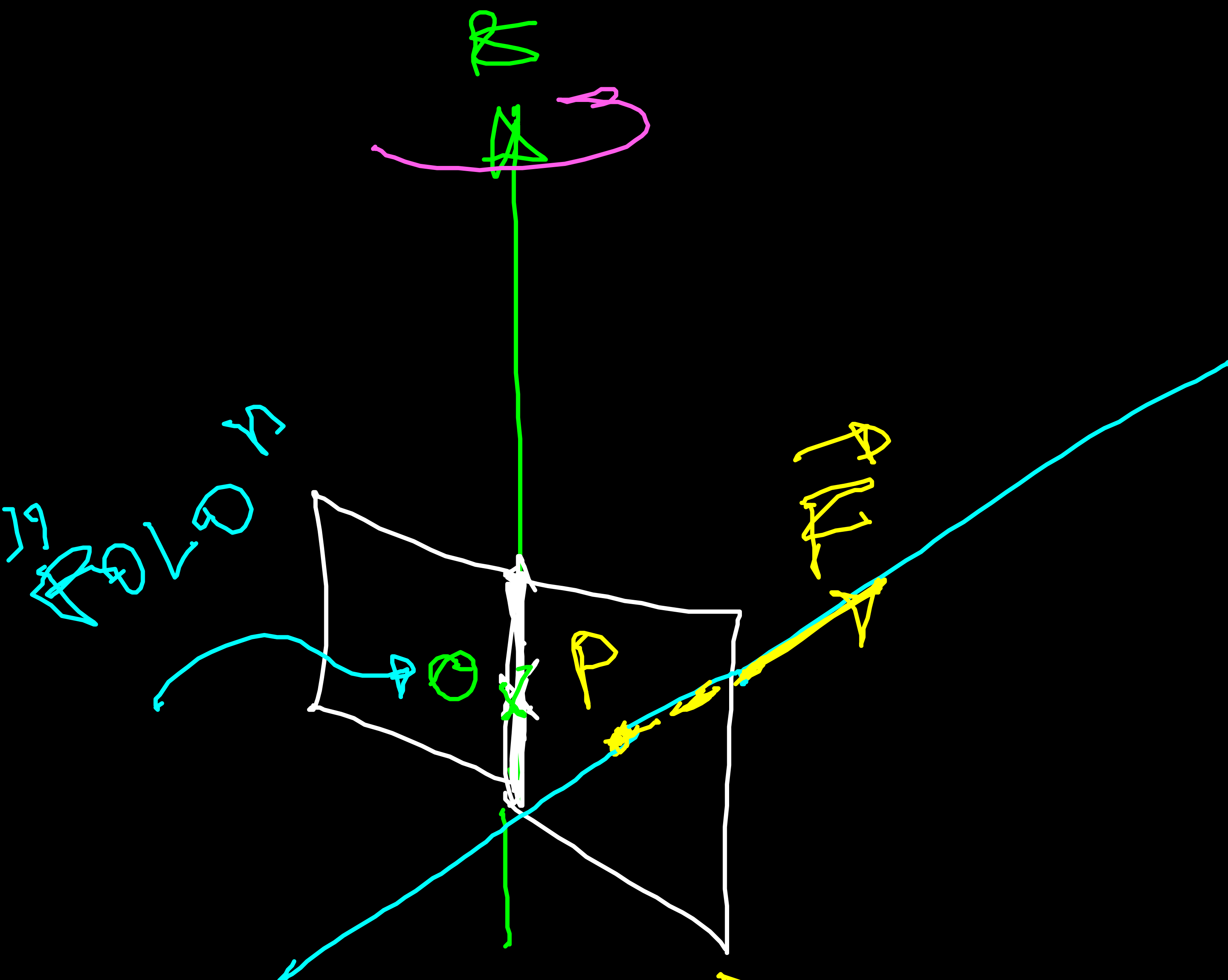
La porta ruota intorno a CM

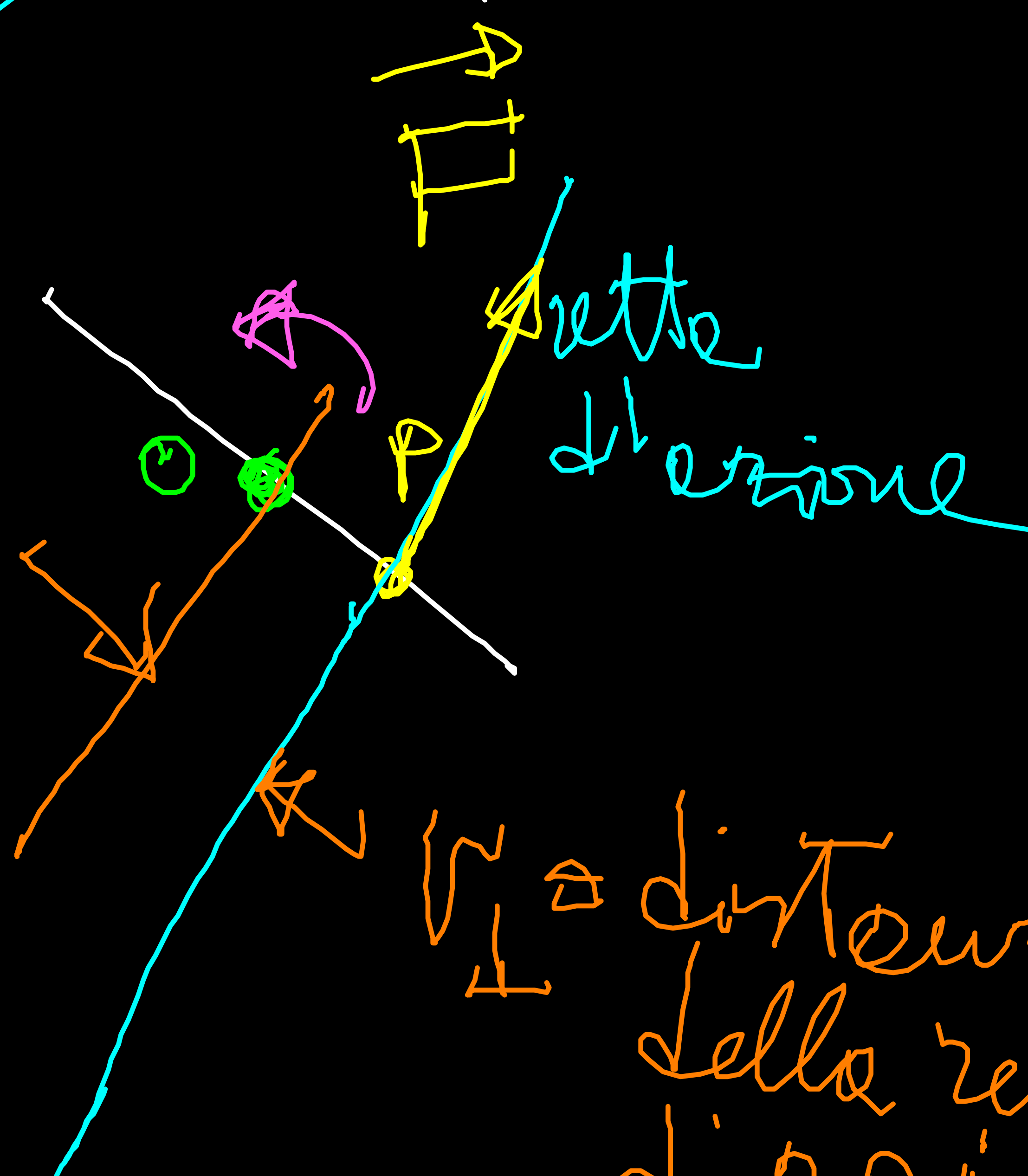


Si verifica sperimentalmente che la porta NON ruota se

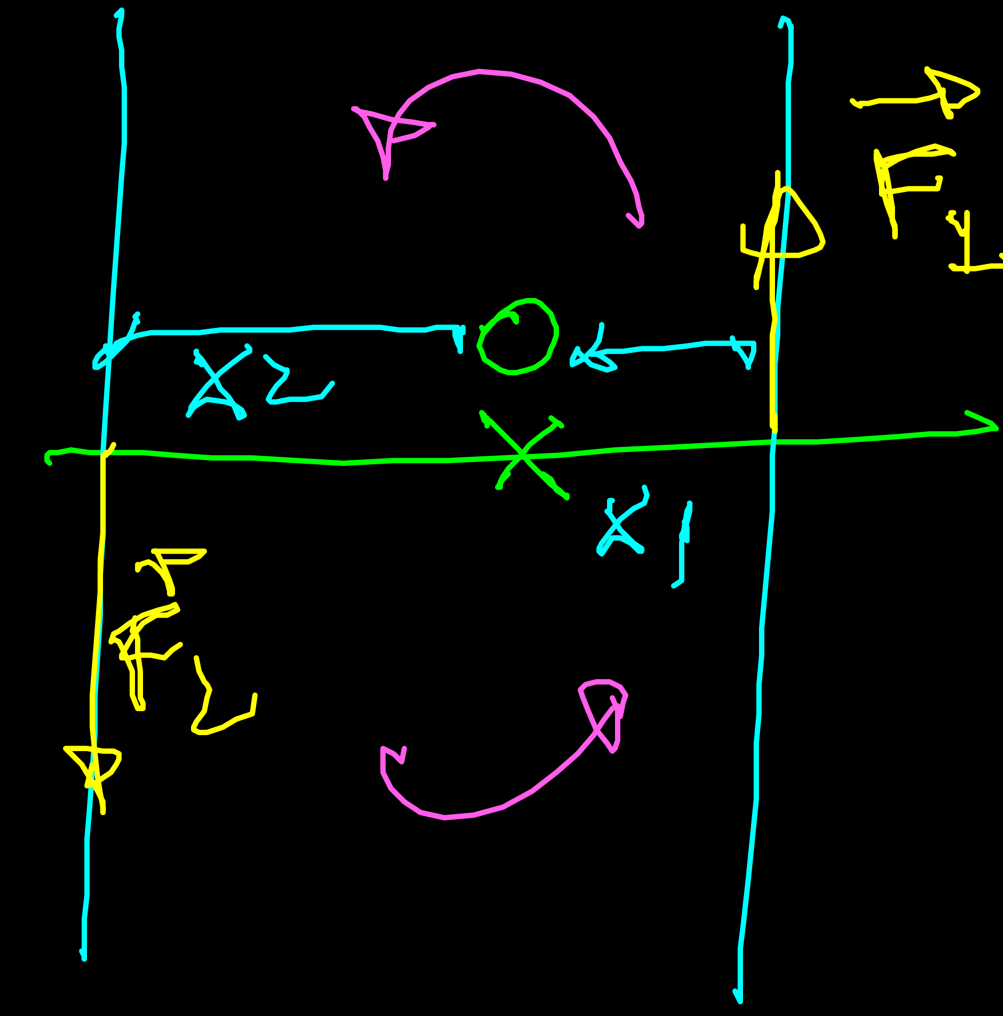
$$\frac{|\vec F_1|}{|\vec F_2|} = \frac{x_2}{x_1}$$

$$\boxed{|\vec F_1|\, x_1 - |\vec F_2|\, x_2 = 0}$$





$r_\perp$ = distanza della retta d'azione del punto O



$\vec{F}_1 = -\vec{F}_2$

$\Rightarrow$ Ruota

$\vec{F}_1 + \vec{F}_2 = 0$

$x_1 = r_{1\perp}$

$x_2 = r_{2\perp}$

$x_1 = r_{1\perp}$

$x_2 \; r_{2\perp}$

NON RUOTA

SE

$r_{2\perp} F_2 - r_{1\perp} F_1 = 0 \Rightarrow F_1 \neq F_2$

se $r_{1\perp} \neq r_{2\perp}$

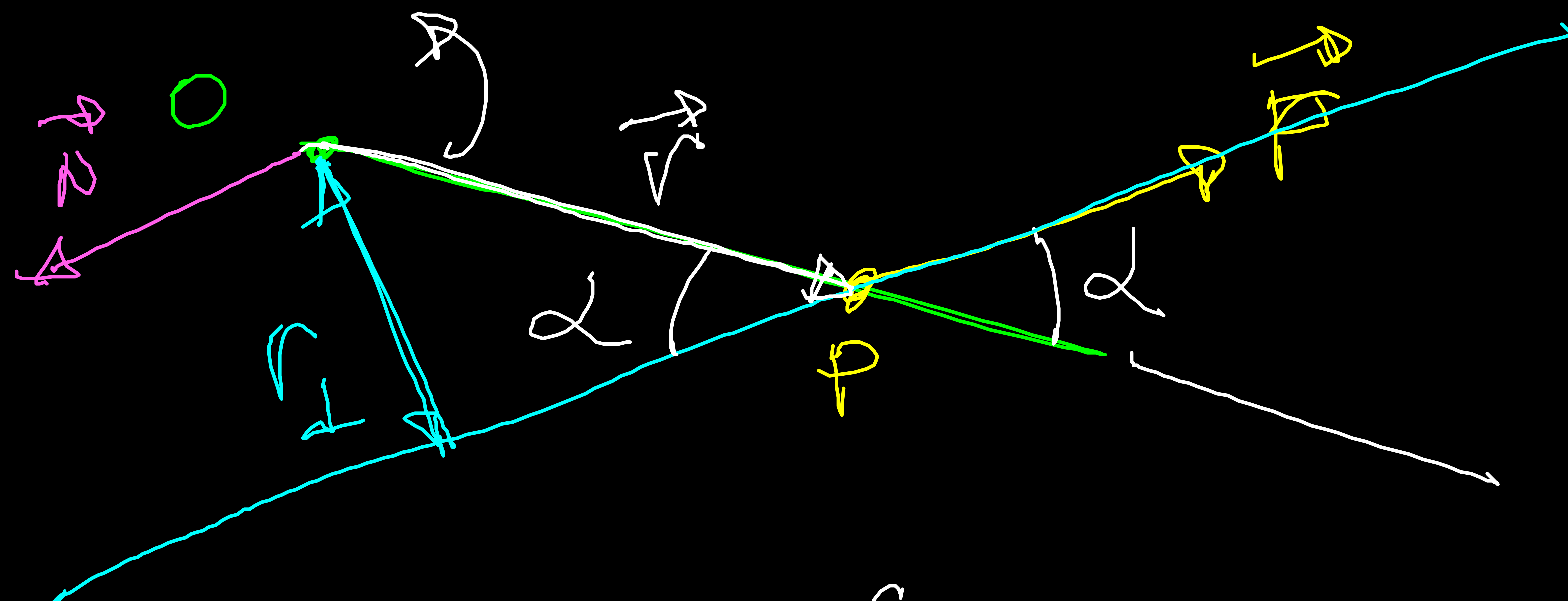
$\boxed{r_{1\perp} F_1} \rightarrow$ INTENSITA' DEL MOMENTO DI $\vec{F}_1$ RISPETTO AL POLO O

"BRACCIO"

PER EQ TRASL.

$\vec{F}_1 + \vec{F}_2 + \vec{N} = 0$

$\vec{N} \parallel \vec{F}$
$|\vec{N}| = |\vec{F}|$ $\Big\} \Rightarrow$ EQ. TRASL.



retta d'azione di $\vec{F}$

$$r_\perp = r \sin\alpha$$

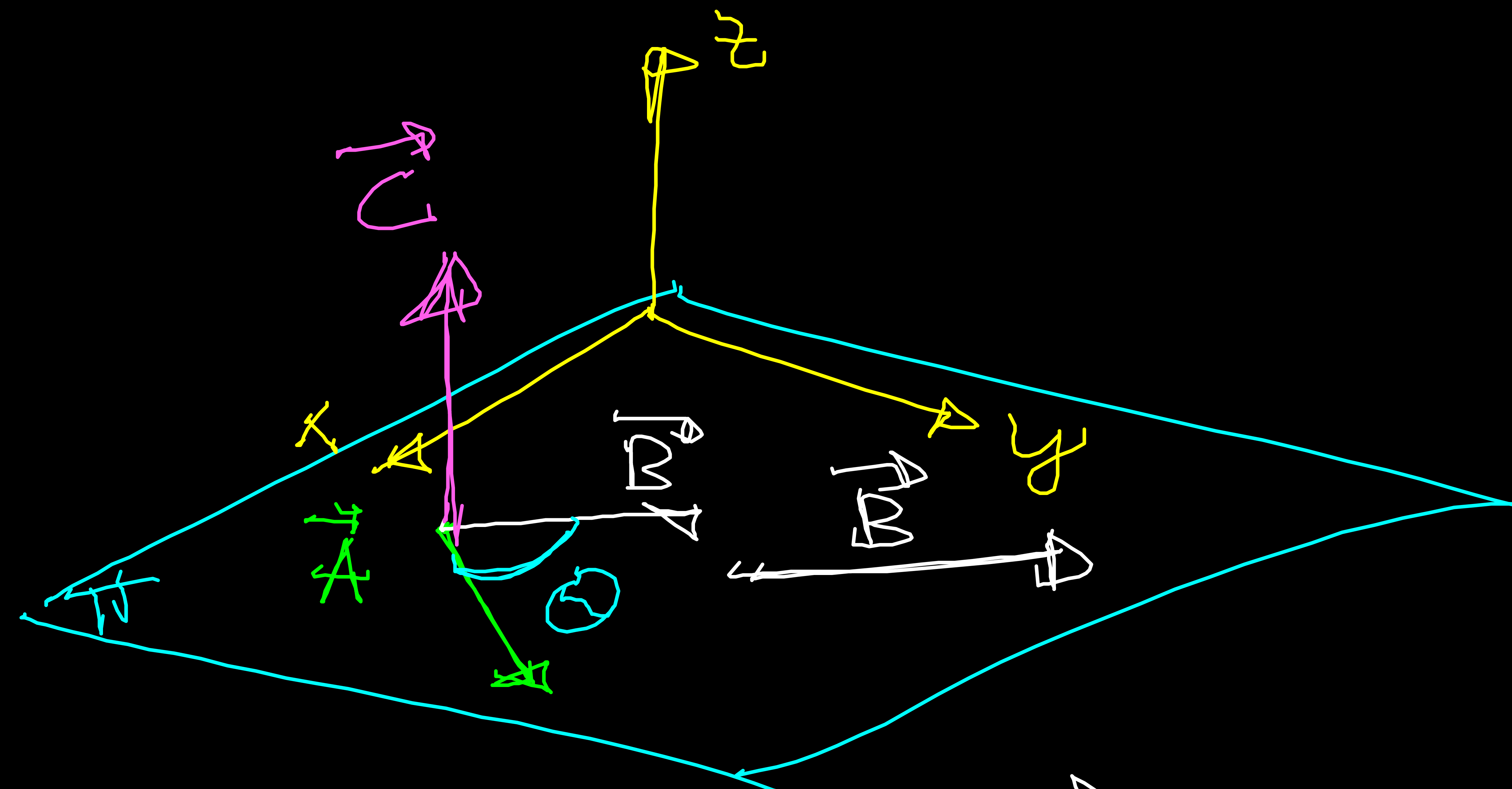
$$\underbrace{r_\perp F}_{} = r F \sin\alpha$$

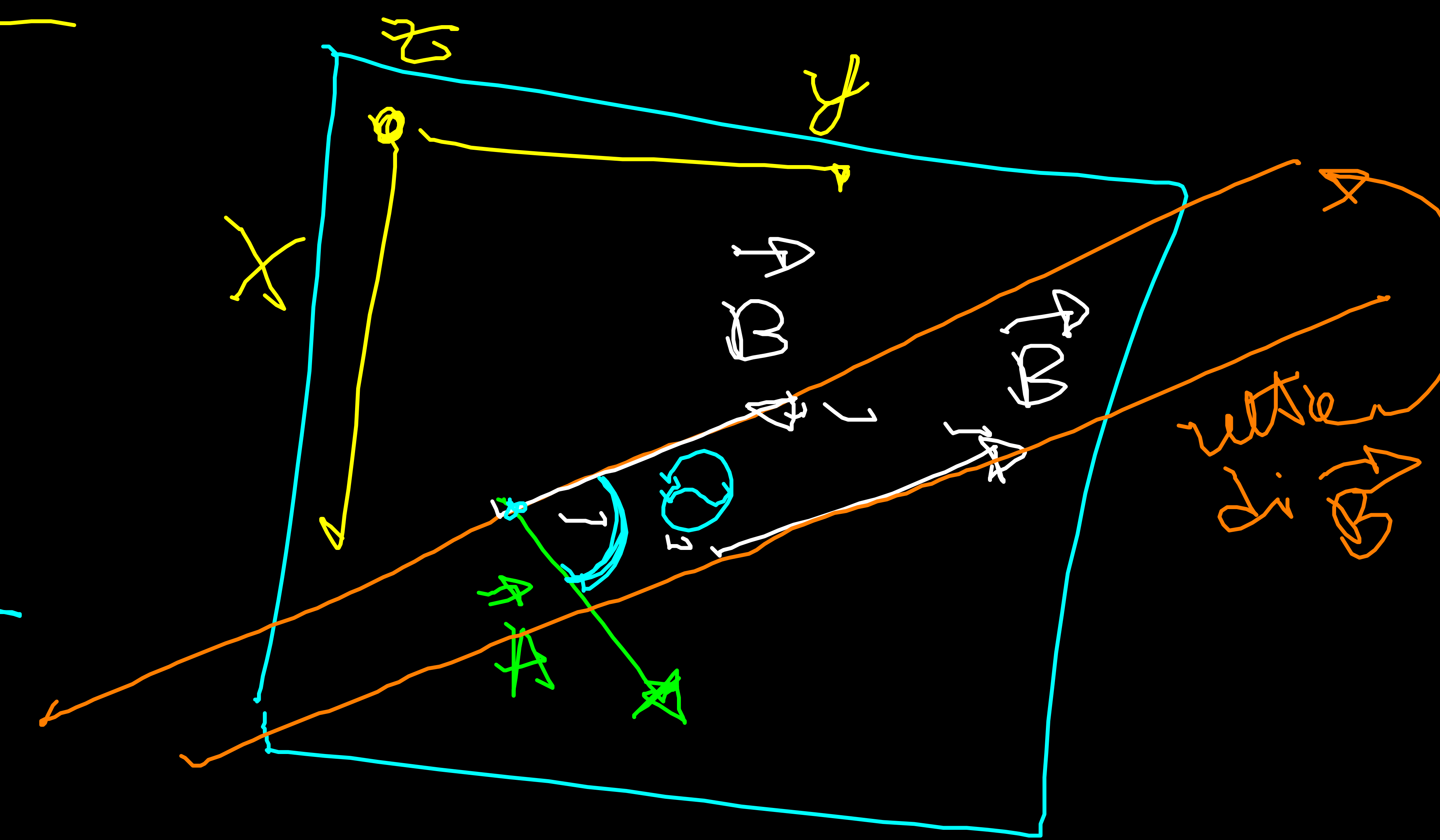
$\Rightarrow$ intensità del momento di $\vec{F}$

Se $\alpha = 0$ la porta non ruota indip. da $\vec{F}$

$\vec{r}$ congiunge O e P $\Rightarrow$ $\vec{r}$ è il "braccio"

PRODOTTO VETTORIALE

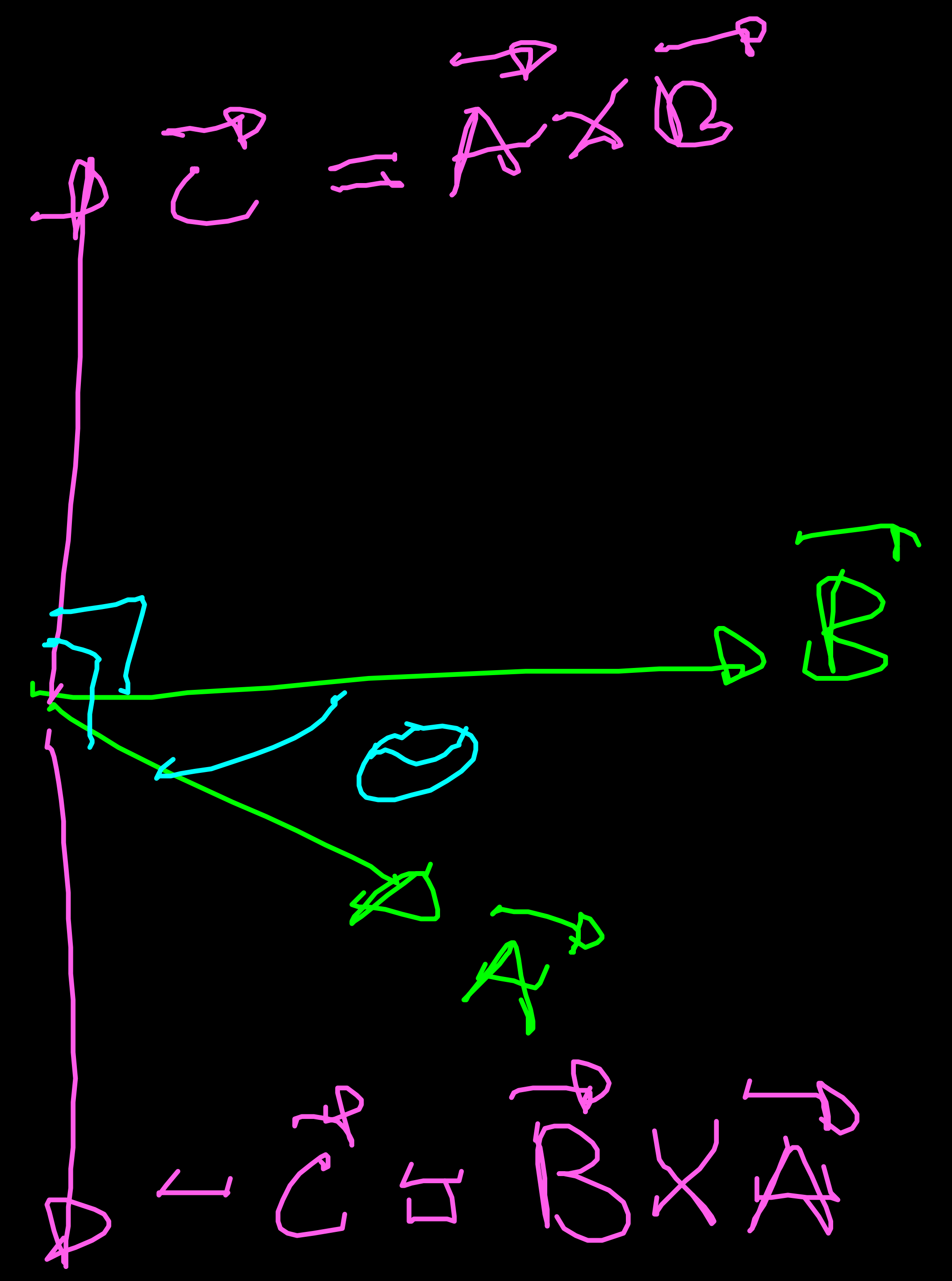




Definisco $\vec{C} = \vec{A} \times \vec{B}$ "PRODOTTO VETTORIALE DI $\vec{A}$ E $\vec{B}$"

$$|\vec{C}| = |\vec{A}||\vec{B}| \sin\theta$$

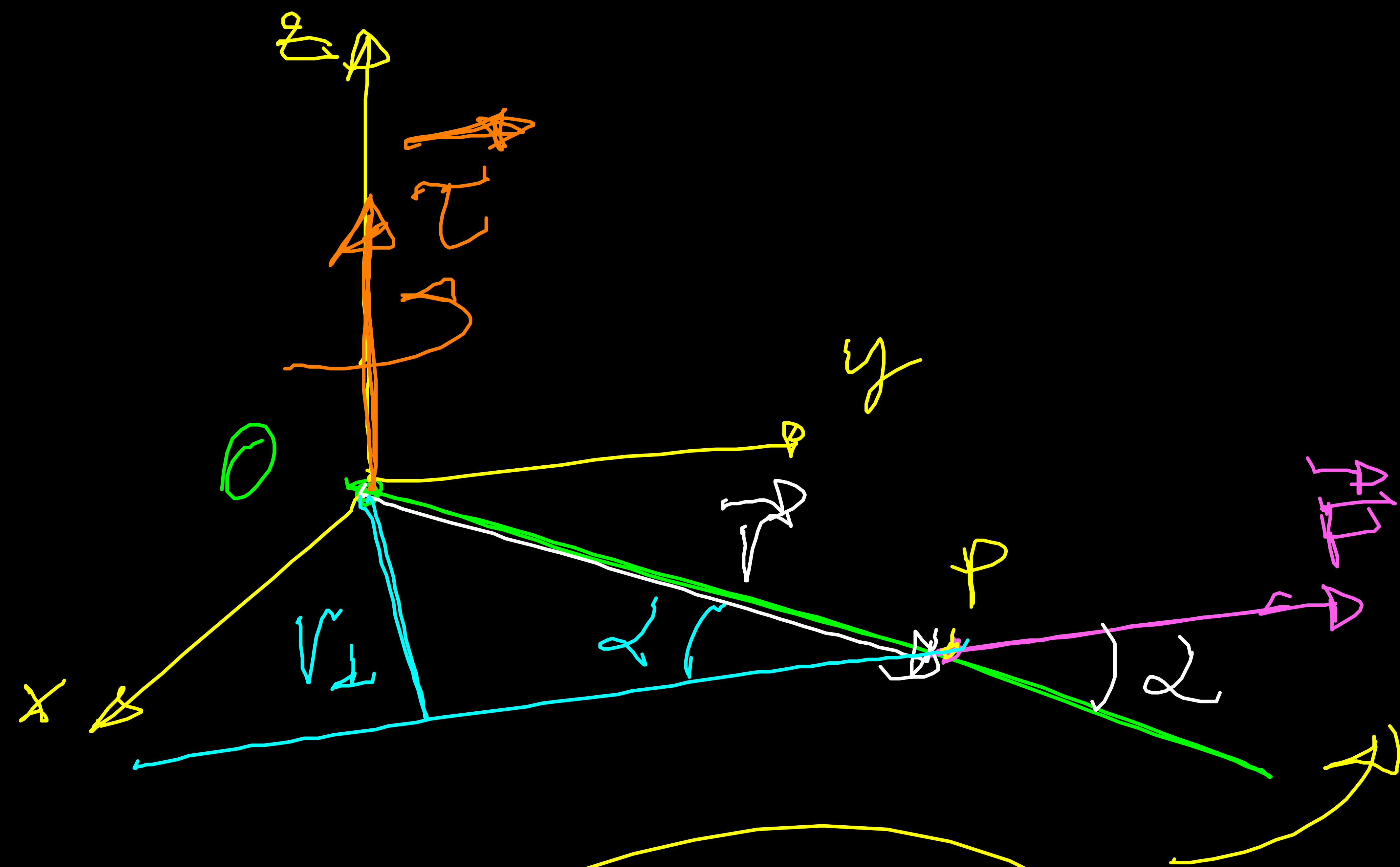
$\vec{C}$ ha direzione $\perp$ a $\vec{A}$ e $\vec{B}$ e verso secondo la regola della mano destra



N.B.

IL PRODOTTO VETTORE NON È COMMUTATIVO

$$\vec{A} \times \vec{B} = -\vec{B} \times \vec{A}$$



BRACCIO

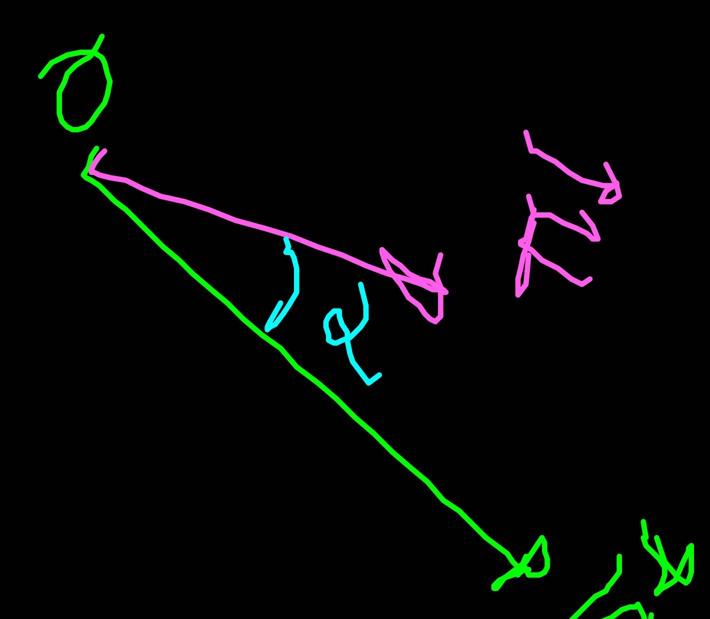
$$\boxed{\vec{\tau} = \vec{r} \times \vec{F}}$$

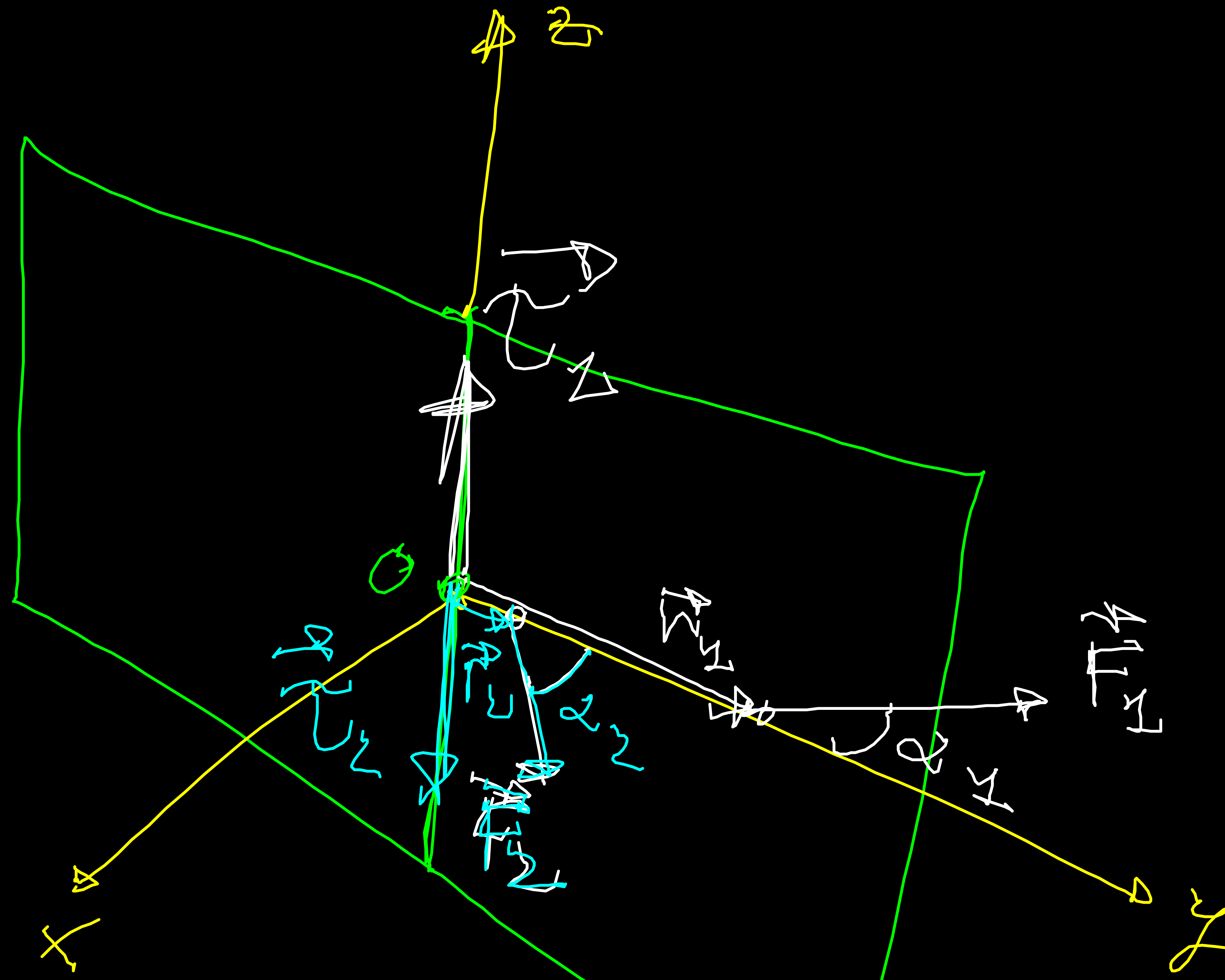
MOMENTO DI $\vec{F}$ RISPETTO AL POLO "O"

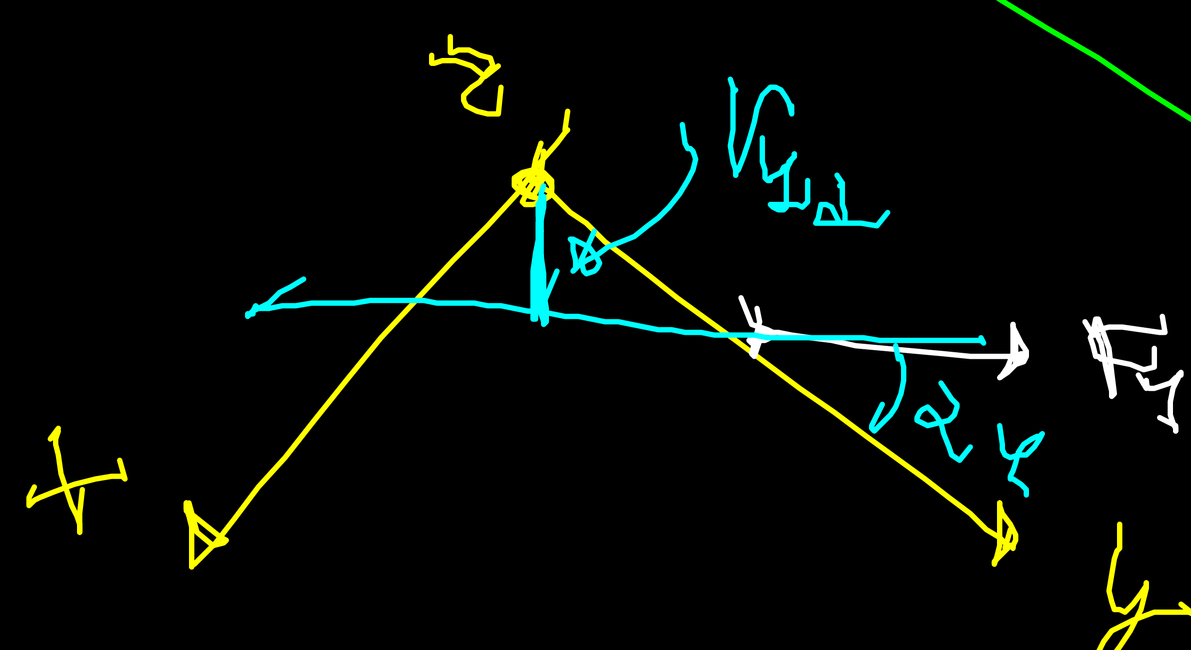
$$r_\perp F = r F \sin\alpha$$

INTENSITÀ

$$|\vec{\tau}| = r F \sin\alpha = r_\perp F$$







$$\vec{\tau}_1 = \vec{r}_1 \times \vec{F}_1$$

$$|\vec{\tau}_1| = r_1 F_1 \sin\alpha_1$$
$$= r_{1\perp} F_1$$

$$\vec{\tau}_2 = \vec{r}_2 \times \vec{F}_2$$

$$|\vec{\tau}_2| = r_2 F_2 \sin\alpha$$
$$= r_{2\perp} F_2$$

La roata nu rotește

se $\vec{\tau}_1 + \vec{\tau}_2 = 0$