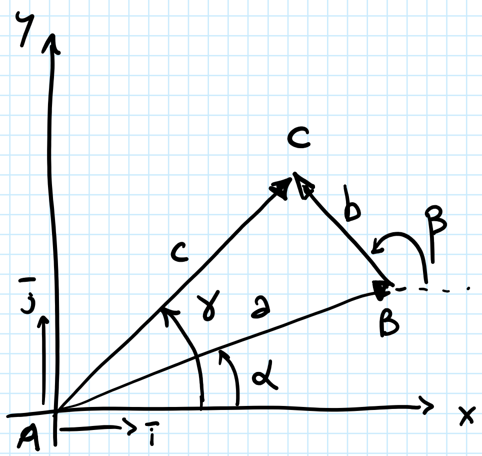



CHIUSURA VETTORIALE

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

$$(C-A)=c(\cos\gamma\,\bar{i}+\sin\gamma\,\bar{j})$$

$$(B-A)=a(\cos\alpha\,\bar{i}+\sin\alpha\,\bar{j})$$

$$(C-B)=b(\cos\beta\,\bar{i}+\sin\beta\,\bar{j})$$

NOTE : $c,\ \dot{c},\ \ddot{c},\ a,\ b,\ \alpha$

VARIABILI : $c,\ \gamma,\ \beta \rightarrow c(t),\ \gamma(t),\ \beta(t)$

INCOGNITE : $\gamma,\ \beta,\ \dot{\gamma},\ \dot{\beta},\ \ddot{\gamma},\ \ddot{\beta}$

POSIZIONE

$$c(\cos\gamma\,\bar{i}+\sin\gamma\,\bar{j}) = a(\cos\alpha\,\bar{i}+\sin\alpha\,\bar{j}) + b(\cos\beta\,\bar{i}+\sin\beta\,\bar{j})$$

$$c\cos\gamma\,\bar{i} + c\sin\gamma\,\bar{j} = a\cos\alpha\,\bar{i} + a\sin\alpha\,\bar{j} + b\cos\beta\,\bar{i} + b\sin\beta\,\bar{j}$$

$$\begin{array}{l} \bar{i} \\ \bar{j} \end{array}\left\{\begin{array}{l} c\cos\gamma = a\cos\alpha + b\cos\beta \\ c\sin\gamma = a\sin\alpha + b\sin\beta \end{array}\right.$$

2 EQ SCALARI
2 INCOGNITE

ELEVO AL QUADRATO E SOMMO

$$c^2\underbrace{(\cos^2\gamma+\sin^2\gamma)}_{1} = (a\cos\alpha + b\cos\beta)^2 + (a\sin\alpha + b\sin\beta)^2$$

$\hookrightarrow$ RICAVO $\beta$ DA $c^2 = (a\cos\alpha + \ldots)\ldots$
POI RICAVO $\gamma$

VELOCITÀ

$$\begin{array}{l} \bar{i} \\ \bar{j} \end{array}\left\{\begin{array}{l} \dot{c}\cos\gamma - c\sin\gamma\,\dot{\gamma} = -b\sin\beta\,\dot{\beta} \\ \dot{c}\sin\gamma + c\cos\gamma\,\dot{\gamma} = b\cos\beta\,\dot{\beta} \end{array}\right.$$

2 INCOGNITE $\dot{\gamma},\ \dot{\beta}$

$$c\sin\gamma\,\dot{\gamma} - b\sin\beta\,\dot{\beta} = \dot{c}\cos\gamma$$

$$-c\cos\gamma\,\dot{\gamma} + b\cos\beta\,\dot{\beta} = \dot{c}\sin\gamma$$

$$\underbrace{\begin{bmatrix} c\sin\gamma & -b\sin\beta \\ -c\cos\gamma & b\cos\beta \end{bmatrix}}_{\bar{\bar{A}}}\begin{Bmatrix} \dot{\gamma} \\ \dot{\beta} \end{Bmatrix} = \begin{Bmatrix} \dot{c}\cos\gamma \\ \dot{c}\sin\gamma \end{Bmatrix} \Rightarrow [A]^{-1}\begin{Bmatrix} \dot{c}\cos\gamma \\ \dot{c}\sin\gamma \end{Bmatrix} = \begin{Bmatrix} \dot{\gamma} \\ \dot{\beta} \end{Bmatrix}$$

ACCELERAZIONI

$$\bar{i}\ \Big\{\ \dot{c}\sin\gamma\,\dot{\gamma} + c\cos\gamma\,\dot{\gamma}^2 + c\sin\gamma\,\ddot{\gamma} - b\cos\beta\,\dot{\beta}^2 - b\sin\beta\,\ddot{\beta} = \ddot{c}\cos\gamma - \dot{c}\sin\gamma\,\dot{\gamma}$$

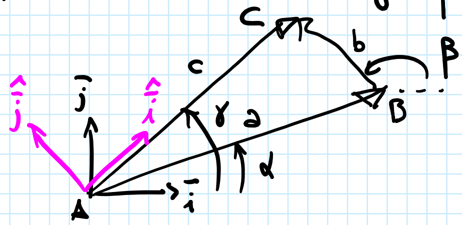
$$\begin{cases} \cdot\,\bar i \quad \dot c\sin\gamma\,\dot\gamma + c\cos\gamma\,\dot\gamma^2 + c\sin\gamma\,\ddot\gamma - b\cos\beta\,\dot\beta^2 - b\sin\beta\,\ddot\beta = \ddot c\cos\gamma - \dot c\sin\gamma\,\dot\gamma \\ \cdot\,\bar j \quad -\dot c\cos\gamma\,\dot\gamma + c\sin\gamma\,\dot\gamma^2 - c\cos\gamma\,\ddot\gamma - b\sin\beta\,\dot\beta^2 + b\cos\beta\,\ddot\beta = \ddot c\sin\gamma + \dot c\cos\gamma\,\dot\gamma \end{cases}$$

$$\begin{bmatrix} & A_{cc} & \end{bmatrix} \begin{Bmatrix} \ddot\gamma \\ \ddot\beta \end{Bmatrix} + \underbrace{\begin{bmatrix} & & \end{bmatrix} \begin{Bmatrix} \dot\gamma \\ \dot\beta \end{Bmatrix} = \begin{Bmatrix} \ddot c\cos\gamma - \dot c\sin\gamma\,\dot\gamma \\ -\ddot c\sin\gamma - \dot c\,\dot\gamma\cos\gamma \end{Bmatrix}}_{\text{NOTO}}$$

$$\begin{Bmatrix} \ddot\gamma \\ \ddot\beta \end{Bmatrix} = \begin{bmatrix} & A_{cc} & \end{bmatrix}^{-1} \cdot \begin{Bmatrix} \text{NOTO} \end{Bmatrix}$$

VELOCITÀ CON TH. MOTI RELATIVI

Posizioni NOTE $\quad \gamma$ e $\beta$ = NOTI $\quad \dot\gamma$ e $\dot\beta$ = INCOGNITI




$$\bar V_C = \underbrace{\cancel{\bar V_B}}_{=0} + \bar\omega_{BC}\wedge(C-B)$$

TERNA ROTANTE IN A

CON $\hat i \,//\, (C-A)$

$$\hat i = \cos\gamma\,\bar i + \sin\gamma\,\bar j$$
$$\hat j = -\sin\gamma\,\bar i + \cos\gamma\,\bar j$$

$$\bar V_C = \bar\omega_{BC}\wedge(C-B) = \dot\beta\,\bar k \wedge b(\cos\beta\,\bar i + \sin\beta\,\bar j) = \dot\beta b(-\sin\beta\,\bar i + \cos\beta\,\bar j)$$

$$\bar V_C = \underbrace{\bar V_{TR}}_{\bar\omega_{CA}\wedge(C-A)} + \underbrace{\bar V_{REL}}_{\dot c\,\hat j}$$

$$\bar V_{TR} = \dot\gamma\,\bar k \wedge c(\cos\gamma\,\bar i + \sin\gamma\,\bar j) = \dot\gamma c(\cos\gamma\,\bar j - \sin\gamma\,\bar i)$$

$$\bar V_{REL} = \dot c\,\hat j = \dot c(\cos\gamma\,\bar i + \sin\gamma\,\bar j)$$

$$\dot\beta b(-\sin\beta\,\bar i+\cos\beta\,\bar j)=\dot\gamma c(-\sin\gamma\,\bar i+\cos\gamma\,\bar j)+\dot c(\cos\gamma\,\bar i+\sin\gamma\,\bar j)$$

SCRIVO LE EQ. LUNGO $\bar i$ e $\bar j$

$$\begin{aligned} \bar i &\left\{ \dot c\cos\gamma - c\dot\gamma\sin\gamma = -b\dot\beta\sin\beta \right. \\ \bar j &\left\{ \dot c\sin\gamma + c\dot\gamma\cos\gamma = b\dot\beta\cos\beta \right. \end{aligned}$$

COME PRIMA

ACC. CON TH. MOTI RELATIVI (A CASA)

$$\bar a_C = \bar a_{TR} + \bar a_{REL} + \boxed{\bar a_{CORIOLIS}}$$