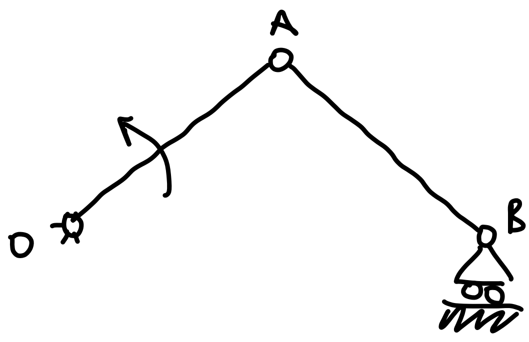
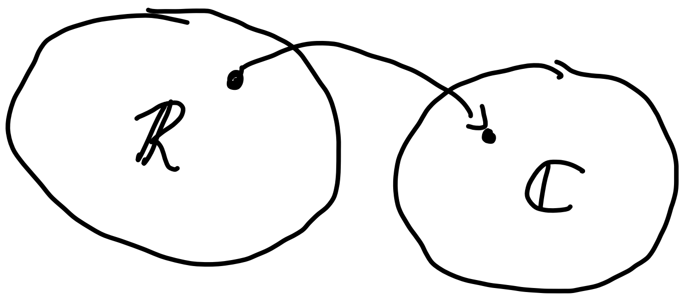
Esercitazione 10 -

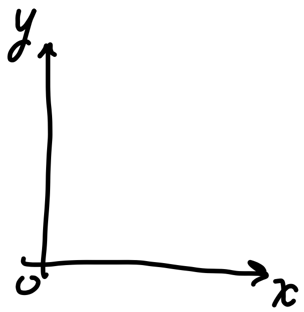


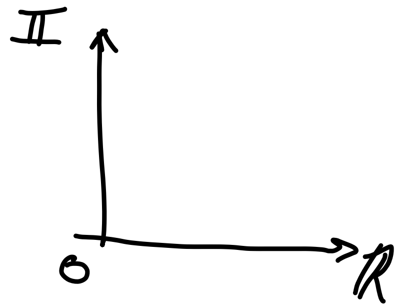
$\omega = 100 \, rad/s$

$OA = 0{,}03 \, m$

$AB = 0{,}09 \, m$





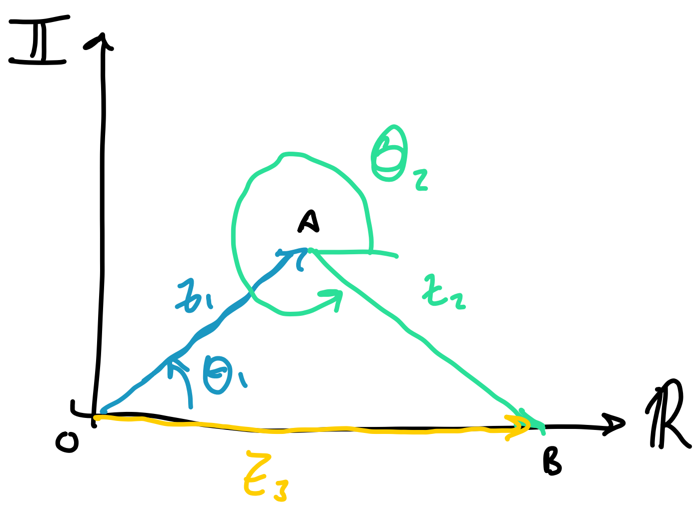


$$\bar{z} = z e^{i\theta}$$

$$\bar{z} = z \left(\cos\theta + i \sin\theta\right)$$

$y \to I$

$x \to R$



$\theta_3 = 0$

$$\vec{z}_1 + \vec{z}_2 = \vec{z}_3$$

$$z_1 e^{i\theta_1} + z_2 e^{i\theta_2} = z_3 e^{i\theta_3}$$

$$z_1 e^{i\theta_1(t)} + z_2 e^{i\theta_2(t)} = z_3(t)$$

$\dot{\theta}_1 = \omega \quad \ddot{\theta}_1 = 0$

2 incognite va bene perché
una ~~o~~ nella parte reale
una nella parte immaginaria

$$z_1(\cos\theta_1 + i\sin\theta_1) + z_2(\cos\theta_2 + i\sin\theta_2) = z_3$$

$$\begin{array}{l} \mathbb{R} \\ \mathbb{I} \end{array}\begin{cases} z_1\cos\theta_1 + z_2\cos\theta_2 = z_3 \\ z_1\sin\theta_1 + z_2\sin\theta_2 = 0 \end{cases}$$

$\rightarrow$ Possiamo trovare θ_2

$$\theta_1 \Rightarrow \theta_2 \rightarrow z_3$$

$$\sin\theta_2 = \frac{-z_1}{z_2}\sin\theta_1 \Rightarrow \theta_2 = \arcsin\left(\frac{-z_1}{z_2}\sin\theta_1\right)$$

$$\begin{cases} -z_1\sin\theta_1\dot{\theta}_1 - z_2\sin\theta_2\dot{\theta}_2 = \dot{z}_3 \\ z_1\cos\theta_1\dot{\theta}_1 + z_2\cos\theta_2\dot{\theta}_2 = 0 \end{cases}$$

Per programmi si possono usare le matrici

$$\underbrace{\begin{bmatrix} z_2\sin\dot{\theta}_2 & 1 \\ -z_2\cos\theta_2 & 0 \end{bmatrix}}_{\text{Termini Noti}} \cdot \underbrace{\begin{bmatrix} \dot{\theta}_2 \\ \dot{z}_3 \end{bmatrix}}_{\text{Termini incogniti}} = \begin{bmatrix} -z_1\sin\theta_1\dot{\theta}_1 \\ z_1\cos\theta_1\dot{\theta}_1 \end{bmatrix}$$

for $n = 1:36$

$$A = [z_2 \sin\theta_2 \ , 1 ; -z_2 \cos\theta_2 , 0]$$

$$f = [z_1 \sin\theta_1 \dot{\theta}_1 , z_2 \cos\theta_1 \dot{\theta}_1]$$

$$x = inv(A) \cdot f$$

Velo

$$\begin{cases} z_2 \sin\theta_2 \dot{\theta}_2 + \dot{z}_3 - z_1 \sin\theta_1 \dot{\theta}_1 \\ -z_2 \cos\theta_2 \dot{\theta}_2 = z_1 \cos\theta_1 \dot{\theta}_1 \end{cases}$$

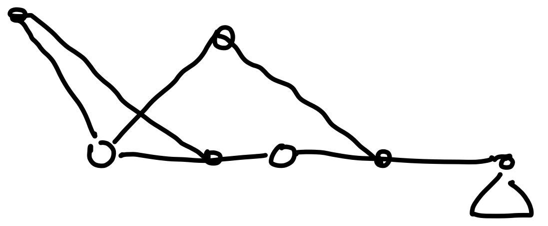
$$z_2 \cos\theta_2 \cdot \dot{\theta}_2^2 + z_2 \sin\theta_2 \ddot{\theta}_2 + \ddot{z}_3 = -z_1 \cos\theta_1 \dot{\theta}_1^2 - z_1 \sin\theta_1 \ddot{\theta}_1$$

$$z_2 \sin\theta_2 \dot{\theta}_2^2 - z_2 \cos\theta_2 \ddot{\theta}_2 = -z_1 \sin\theta_1 \dot{\theta}_1^2 + z_1 \cos\theta_1 \ddot{\theta}_1$$

$$z_2 \sin\theta_2 \ddot{\theta} + \ddot{z}_3 = -z_1 \cos\theta_1 \dot{\theta}_1^2 - z_1 \sin\theta \ddot{\theta}_1 - z_2 \cos\theta_2 \cdot \dot{\theta}_2^2$$

$$-z_2 \cos\theta_2 \ddot{\theta}_2 = -z_1 \sin\theta_1 \dot{\theta}_1^2 + z_1 \cos\theta_1 \ddot{\theta}_1 - z_2 \sin\theta_2 \dot{\theta}^2$$

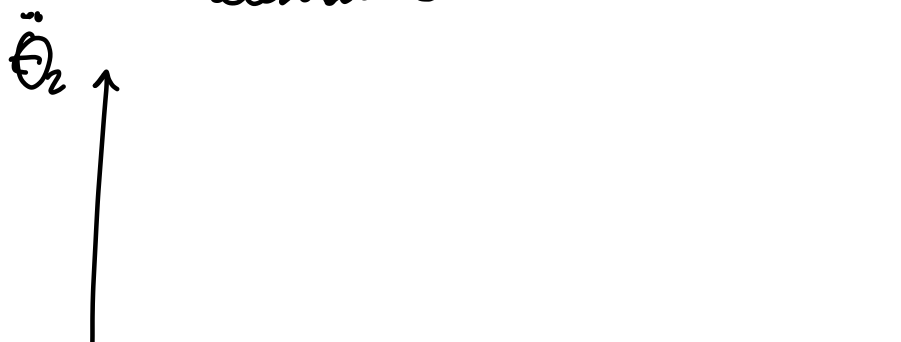
$$\underbrace{\begin{bmatrix} z_2 \sin\theta_2 & 1 \\ -z_2 \cos\theta_2 & 0 \end{bmatrix}}_{\text{Come prime}} \cdot \begin{bmatrix} \ddot{\theta}_2 \\ \ddot{z}_3 \end{bmatrix} = \begin{bmatrix} -z_1 \cos\theta_1 \dot{\theta}^2 - z_1 \sin\theta_1 \ddot{\theta}_1 - z_2 \cos\theta_2 \dot{\theta}_2^2 \\ -z_1 \sin\theta_1 \dot{\theta}_1^2 + z_1 \cos\theta_1 \ddot{\theta}_1 - z_2 \sin\theta_2 \dot{\theta}^2 \end{bmatrix}$$



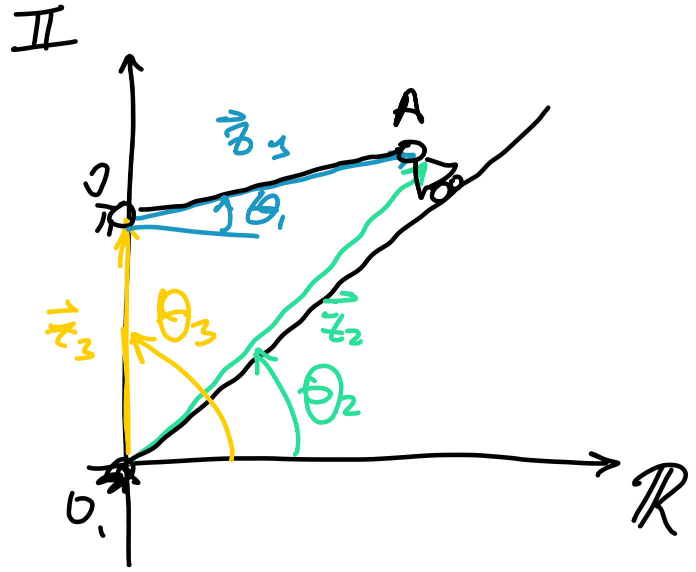
Rotazione Biella in Funzione Manovella

Velocità Biella in Funzione Manovella

Accelerazione Biella



Esercizio 2



$$\vec z_2 = \vec z_1 + \vec z_3$$

$$z_2(t)e^{i\theta_2(t)} = z_1 e^{i\theta_1(t)} + z_3 e^{i\theta_3}$$

Dati: OA, O_1O $\quad \theta_1, \dot\theta_2 = \omega_{cost}$

$$\dot\theta_1 = 0$$

$$z_2\cos\theta_2 + i z_2 \sin\theta_2 = z_2\cos\theta_1 + i z_1 \sin\theta_1 + i z_3$$

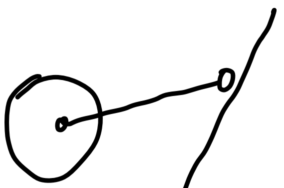
$$\begin{matrix} \Re \\ \Im \end{matrix}\begin{cases} z_2 \cos\theta_2 = z_1\cos\theta_1 \\ z_2 \sin\theta_2 = z_1 \sin\theta_1 + z_3 \end{cases}$$

$$z_2^2\cos^2\theta_2 = z_1^2\cos^2\theta_1$$

$$z_2^2\sin^2\theta_2 = z_1^2\sin^2\theta_1 + z_3^2 + 2z_1z_3\sin\theta_1$$

$$z_2^2\underbrace{(\cos^2\theta_2 + \sin^2\theta_2)}_{=1} = z_1^2\underbrace{(\cos^2\theta_1 + \sin\theta_1)}_{=1} + z_3 + 2z_1z_3\sin\theta_1$$

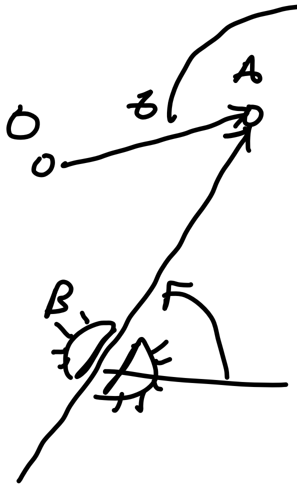
$$z_2 = \sqrt{z_1^2 + z_3^2 + 2z_1z_3\sin\theta_1} \qquad \theta_2 = \arccos\left(\frac{z_1\cos\theta_1}{z_2}\right)$$



Posizione glifo

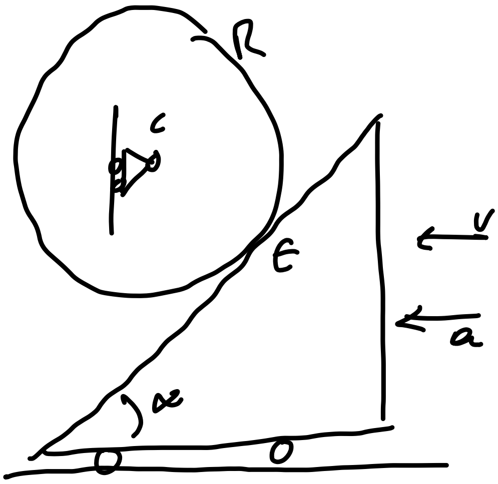
Velocità angolare glifo

Accelerazione angolare glifo

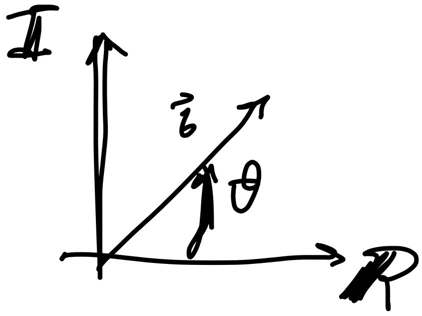


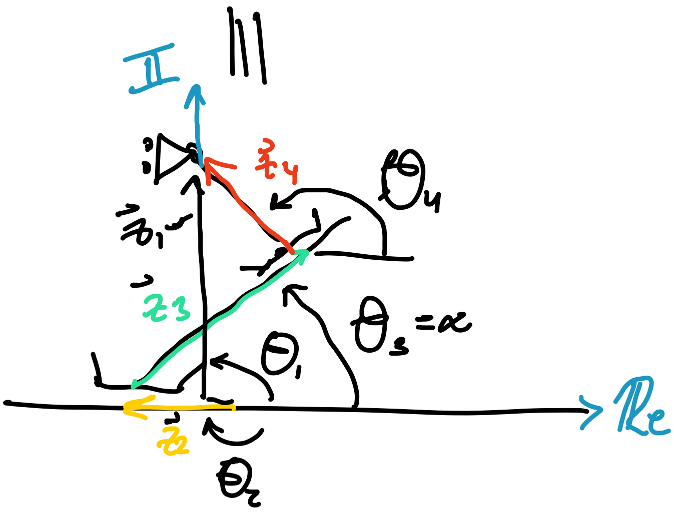
z costante con θ variabile

$$z_2 = z_2(t)\, e^{i\theta_2(t)}$$



$$\vec{z} = z e^{i\theta}$$





$$\vec{z}_1 = \vec{z}_2 + \vec{z}_3 + \vec{z}_4$$

noto

$$z_1(t)\, e^{i\frac{\pi}{2}} = z_2(t)\, e^{i\pi} + z_3(t)\, e^{i\alpha} + z_4\, e^{i\alpha+\frac{\pi}{2}}$$

perchè segue C

$\dot{z}_2 = v \qquad \ddot{z}_2 = a$

Se vogliamo trovare la velocità angolare del disco?

$$z_3(t) \rightarrow \frac{\dot{z}_3}{3} = \omega_d$$