$J\dot{x} + A\dot{q} = 0$

CONF. SINGOLARE

q_1

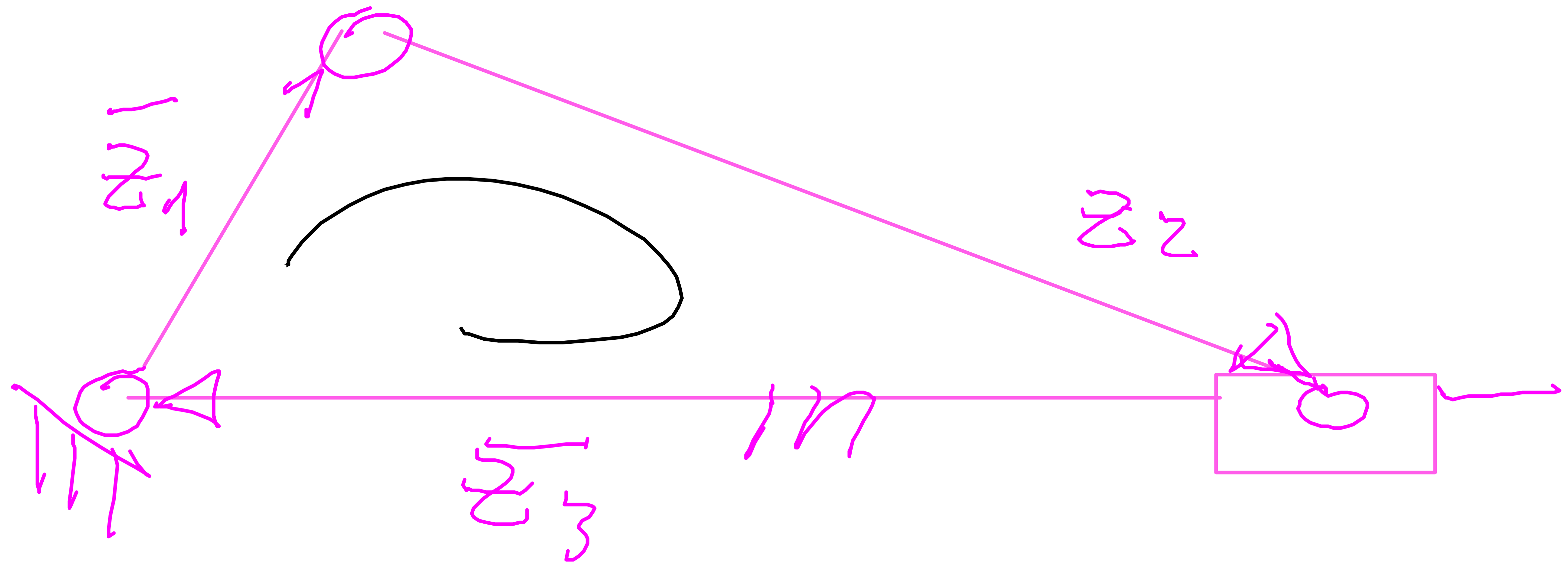
$\det(J) = 0$

$\rightarrow \cancel{J^{-1}} \rightarrow \cancel{\dot{x}}$

$\boxed{\dot{x}} = -J^{-1}A\dot{q}$

$\rightarrow$ Rango diminuisce $\Rightarrow$ # inc. > # equazioni

$J(q)$



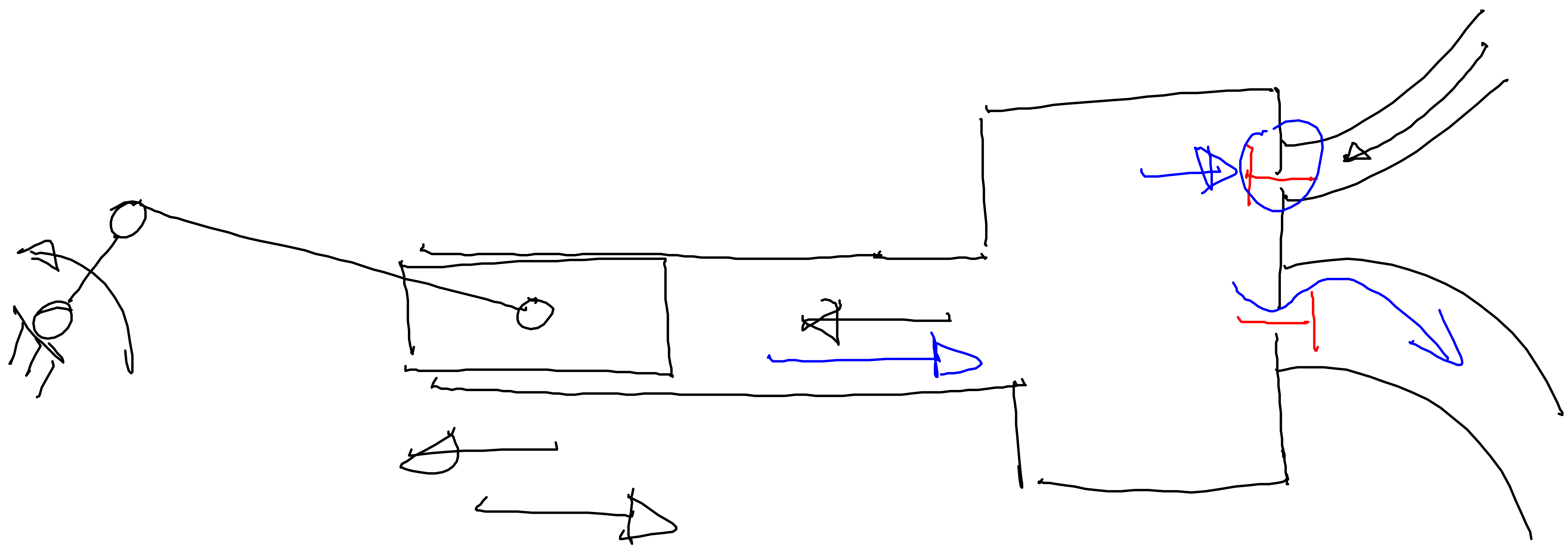
coord. indip $\left\{ \begin{array}{l} \varphi_1 \\ z_3 \end{array} \right.$

$$\bar{z}_1 + \bar{z}_2 + \bar{z}_3 = 0$$

$$\begin{cases} -z_1 s\varphi_1 \dot{\varphi}_1 - z_2 s\varphi_2 \dot{\varphi}_2 - \dot{z}_3 = 0 \\ z_1 c\varphi_1 \dot{\varphi}_1 + z_2 c\varphi_2 \dot{\varphi}_2 = 0 \end{cases}$$

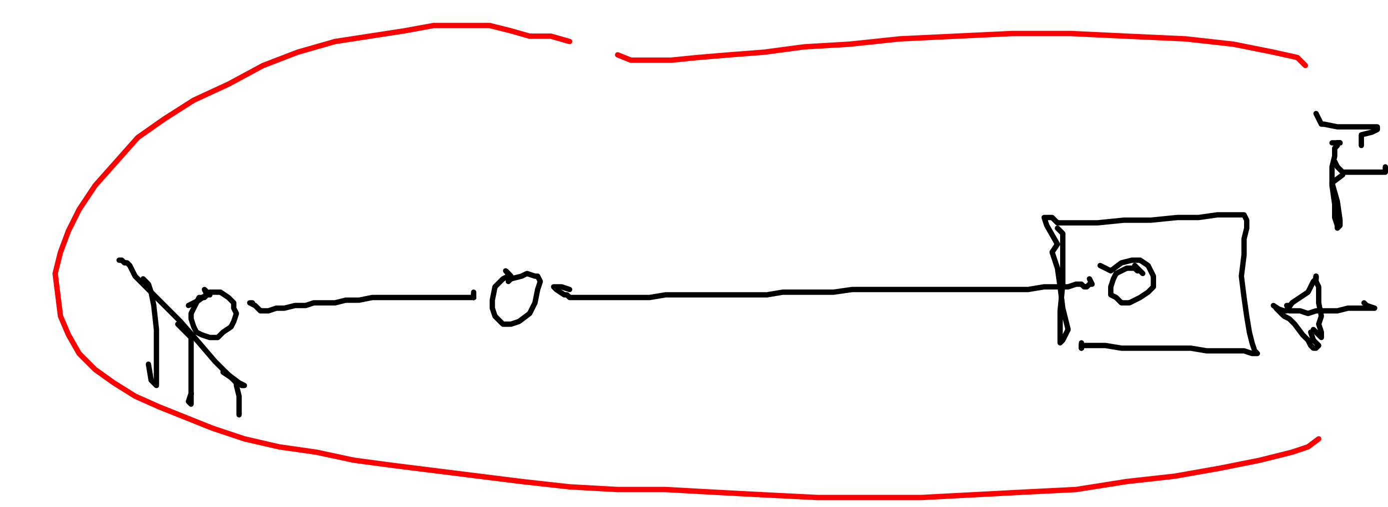
$$\boxed{\begin{array}{c} q = z_3 \\ \dot{\varphi}_1 , \dot{\varphi}_2 \end{array}}$$

$$\bar{J} = \begin{bmatrix} -z_1 s\varphi_1 & -z_2 s\varphi_2 \\ z_1 c\varphi_1 & z_2 c\varphi_2 \end{bmatrix}$$



$$\det(J) = -z_1 z_2 \underbrace{\left(s\varphi_1 c\varphi_2 + s\varphi_2 c\varphi_1\right)}_{s(\varphi_2 - \varphi_1)} = 0$$

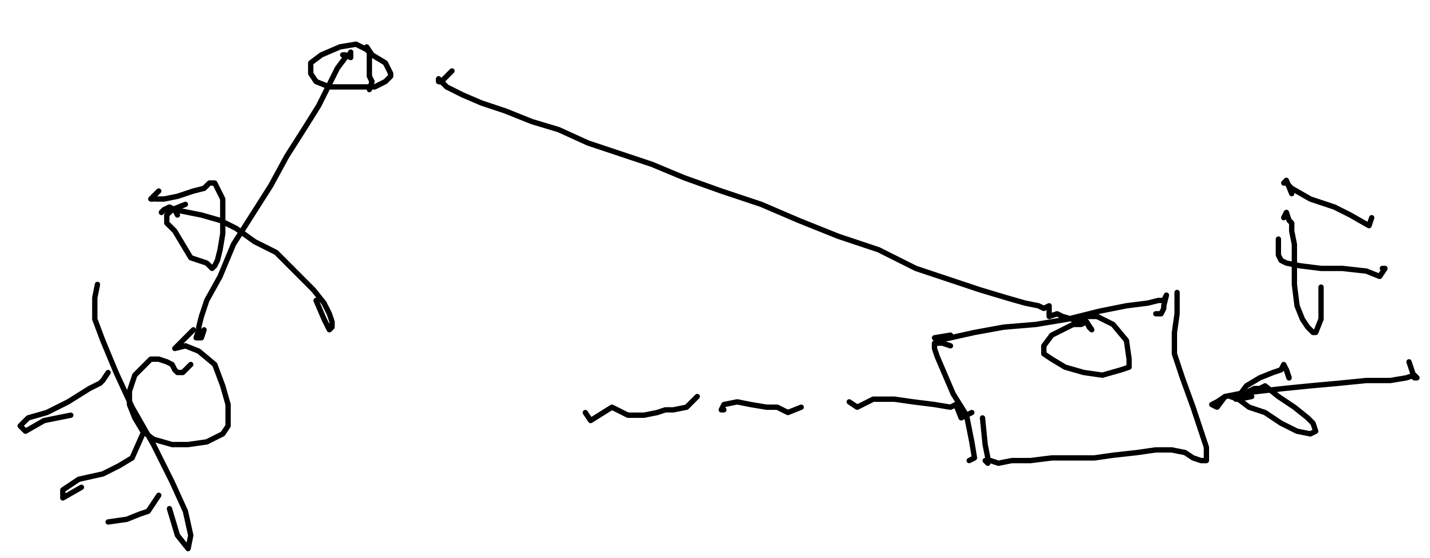
PMS



$$\varphi_2 - \varphi_1 = 0 \qquad \varphi_1 = \varphi_2$$

$$\varphi_2 - \varphi_1 = \pi \qquad \varphi_2 = \pi - \varphi_1$$

PMI

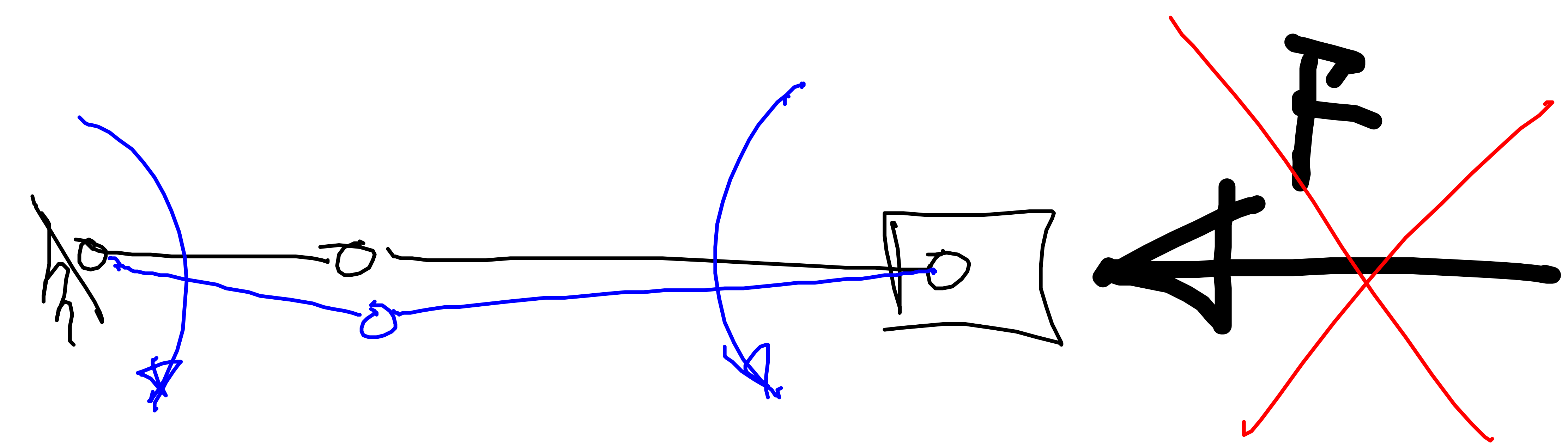


$$z_3 = 0 \implies \varphi_1 = \varphi_2 = 0$$

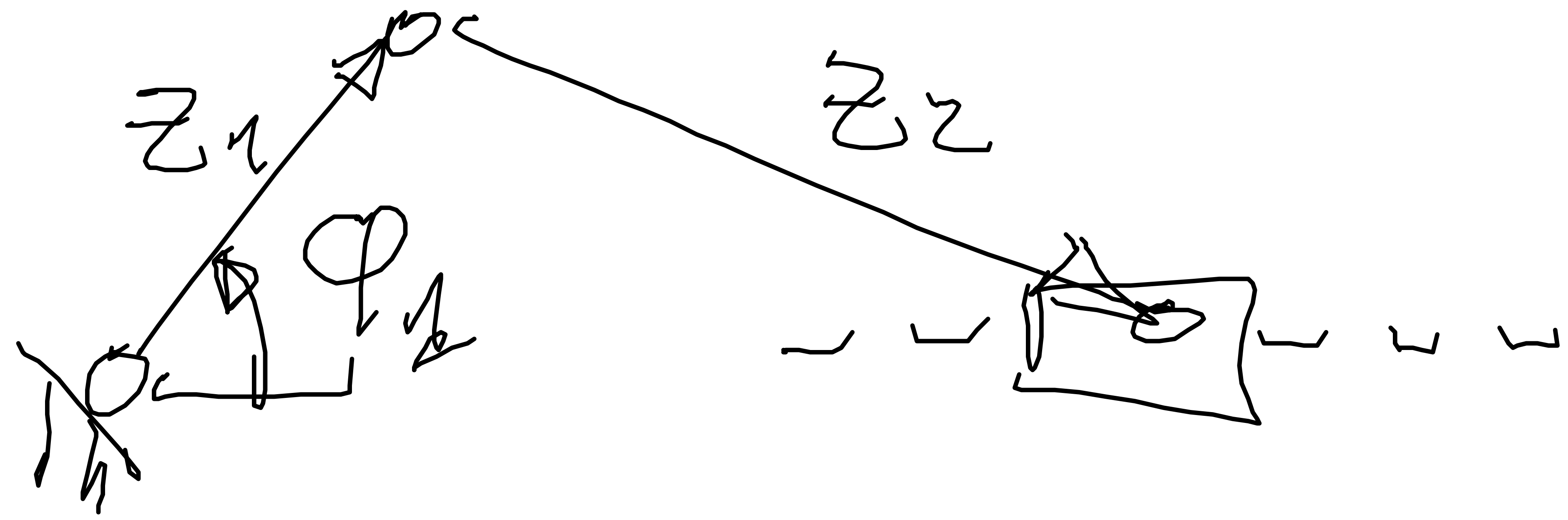
$$\det(J) = 0$$

$$\begin{cases} \dot{z}_3 = 0 \\ z_1 \dot{\varphi}_1 + z_2 \dot{\varphi}_2 = 0 \end{cases}$$

$$\dot{\varphi}_1 = -\frac{z_2}{z_1} \dot{\varphi}_2$$



$$q = \varphi_1 \Rightarrow \begin{pmatrix} z_3 \\ \varphi_2 \end{pmatrix}$$

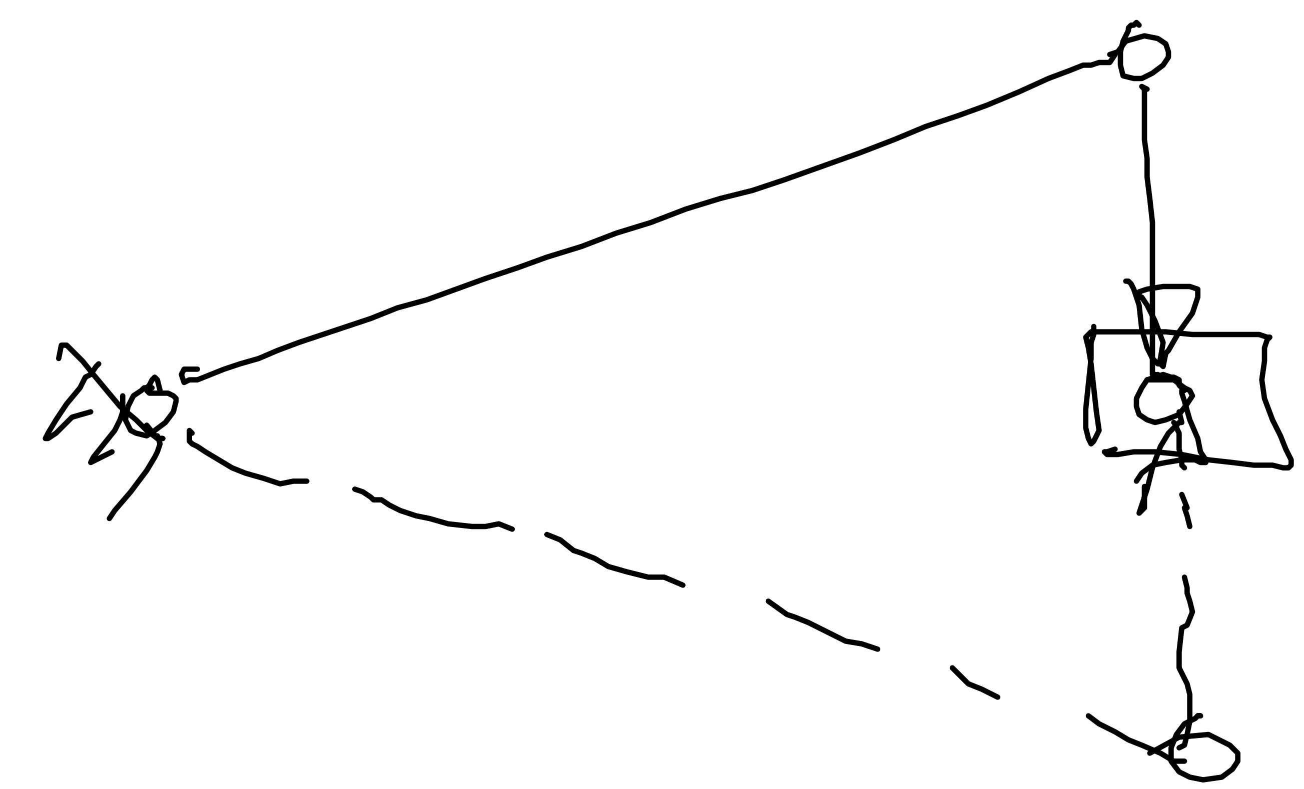


$$J = \begin{bmatrix} -1 & -z_2 s\varphi_2 \\ 0 & z_2 c\varphi_2 \end{bmatrix}$$

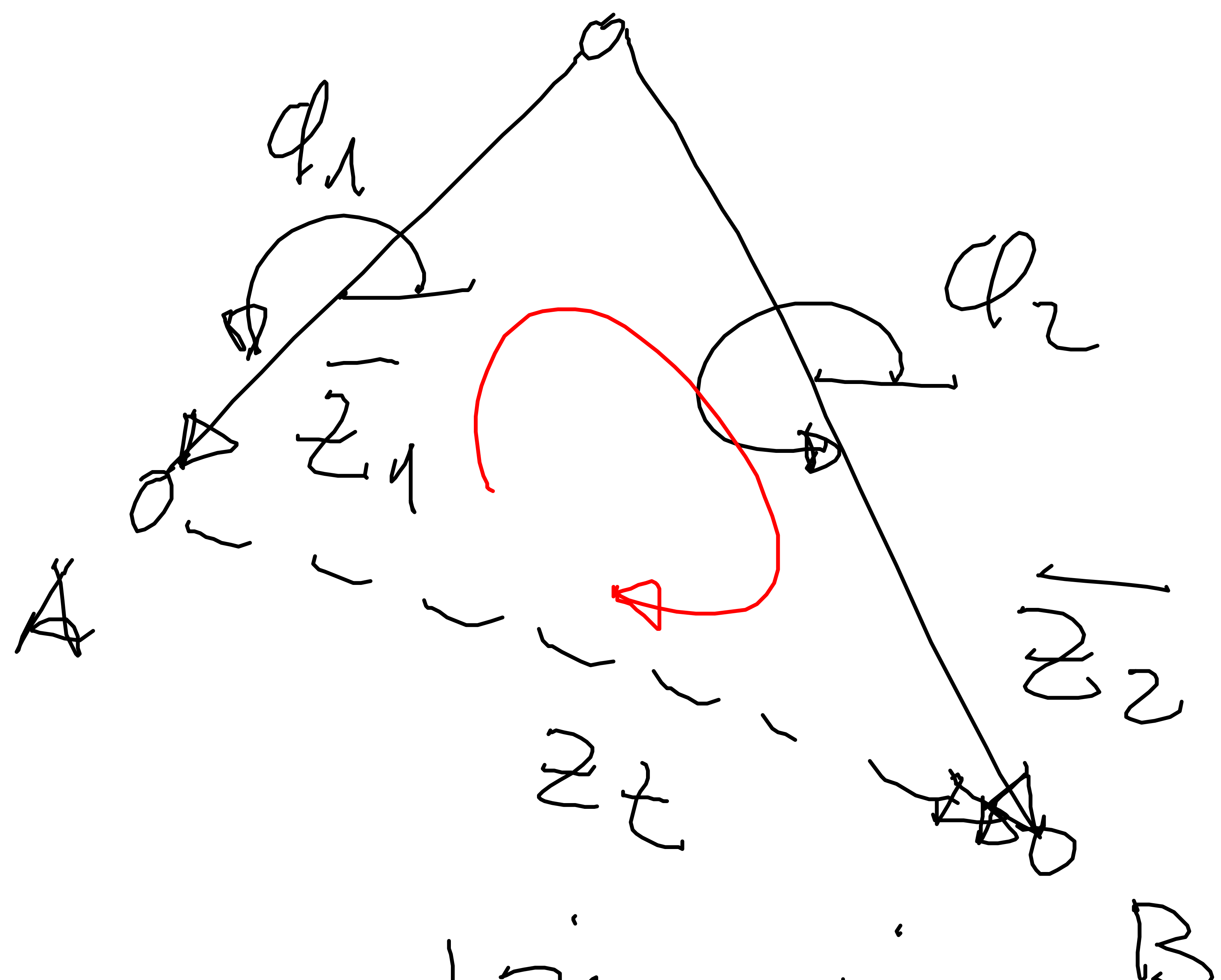
$$\det(J) = 0 \Rightarrow$$

$$z_2 c\varphi_2 = 0$$

$$\varphi_2 = \pm \cancel{\frac{\pi}{2}}$$



RRR



Dati geometrici : z_1, z_2

" noti : A, B

$\dot{A}, \dot{B}$

Dati calcolati : φ_1, φ_2

(an. cinem. velocità)

Inc. : $\dot{\varphi}_1, \dot{\varphi}_2$

$$\dot{\bar{z}}_t = \begin{Bmatrix} \dot{x}_B - \dot{x}_A \\ \dot{y}_B - \dot{y}_A \end{Bmatrix}$$

$$\begin{bmatrix} -z_1 s\varphi_1 & z_2 s\varphi_2 \\ z_1 c\varphi_1 & -z_2 c\varphi_2 \end{bmatrix} \begin{Bmatrix} \dot{\varphi}_1 \\ \dot{\varphi}_2 \end{Bmatrix} = -\dot{z}_t$$