

RPY

$$z \rightarrow y \rightarrow x$$

$$\underline{x} \rightarrow \underline{y} \rightarrow \underline{z}$$

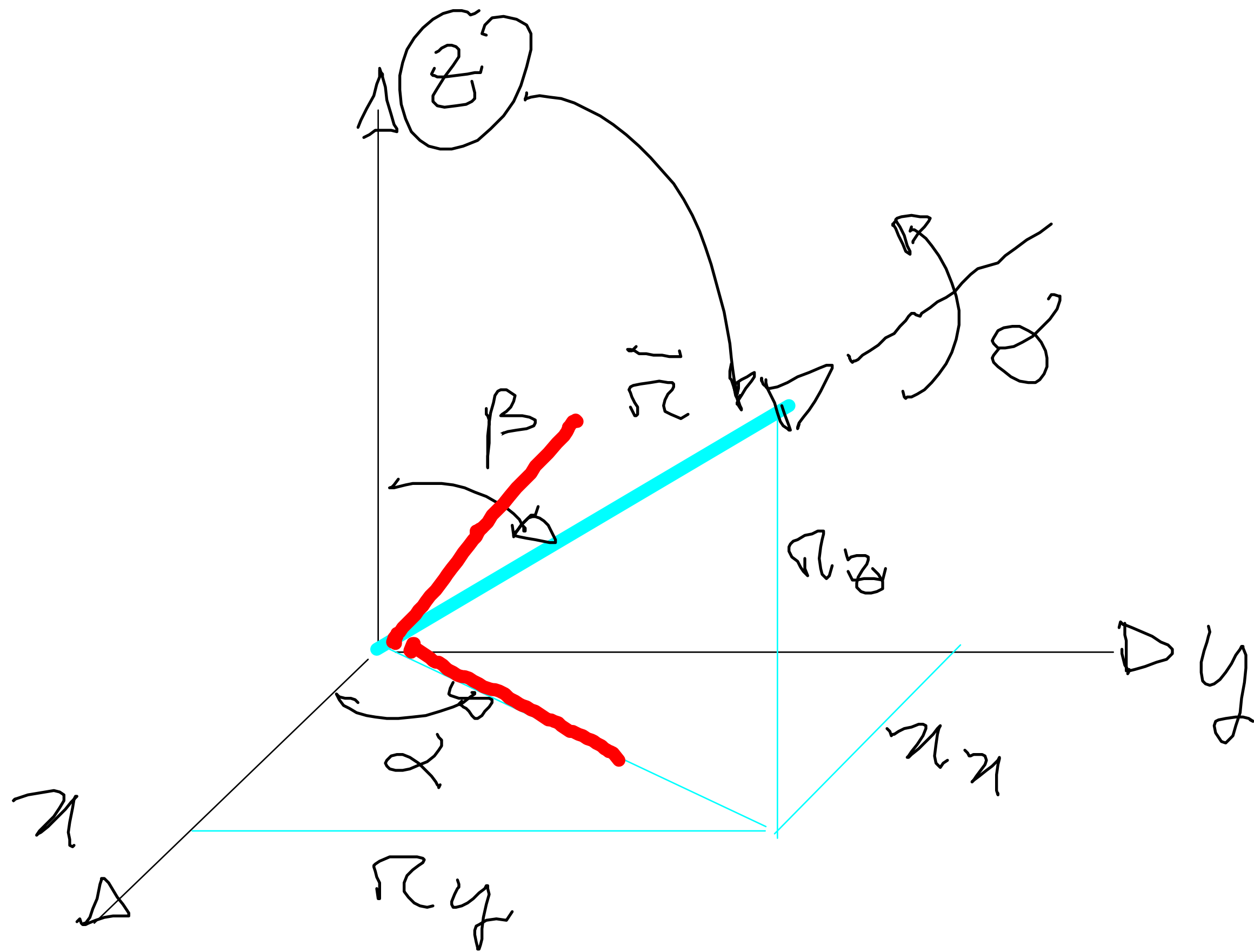
motazioni minime

$$\underline{z} \quad x \quad \underline{z}$$

$$R(\alpha) \quad R_x(\beta) \quad R_\delta(\gamma)$$

$$\begin{array}{l}
 \textcircled{R} = R_x(\alpha) R_y(\beta) R_z(\gamma) \rightarrow \alpha, \beta, \gamma \\
 \textcircled{R} = R_y(\beta) R_x(\alpha) R_z(\gamma) \rightarrow \alpha, \beta, \gamma
 \end{array}$$


Notazione asse-angolo



$$R(\delta, \frac{\pi}{2}) = R_z(\alpha) R_y(\beta) R_z(\delta) R_y(-\beta) R_z(-\alpha)$$

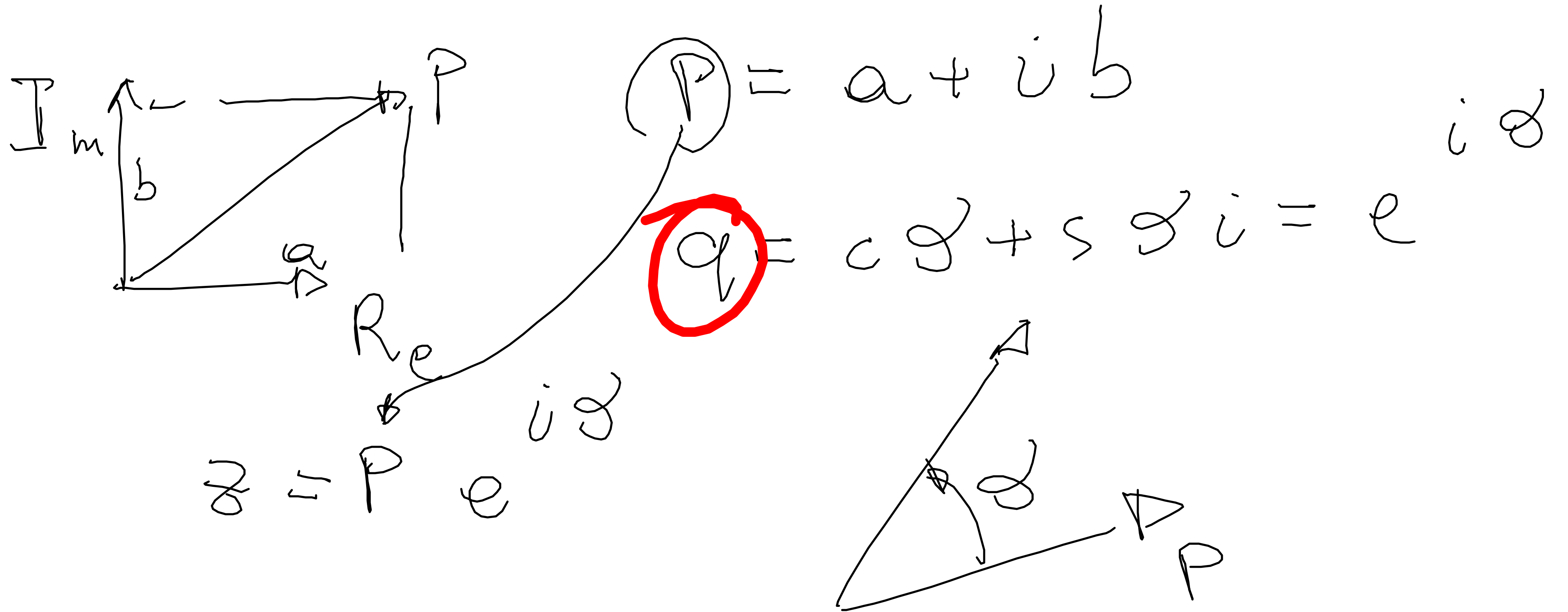
UR 10

$\mathcal{S}, \pi_x, \pi_y, \pi_z$



$\pi_x \mathcal{S}, \pi_y \mathcal{S}, \pi_z \mathcal{S}$

QUATERNIONI



$$z = a + \underline{i}b$$

$$i^2 = -1$$

• no commutative

$$ij = k$$

$$ji = -k$$

$$q = q_0 + q_1 \underline{i} + q_2 \underline{j} + q_3 \underline{k}$$

4 param.

$$i^2 = j^2 = k^2 = ijk = -1$$

	1	i	j	k
1	1	i	j	k
i	i	-1	k	-j
j	j	-k	-1	i
k	k	i	-i	-1

Algoritmi di rotazione

x, y, z



$x \cos \frac{\alpha}{2}, x \sin \frac{\alpha}{2}, y \sin \frac{\alpha}{2}, z, \frac{\alpha}{2}$

q_0

q_1

q_2

q_3

else x

$$X = 1$$

$$Y = Z = 0$$

$$q = c \frac{\partial}{\partial z} + s \frac{\partial}{\partial \bar{z}} \underline{z}$$

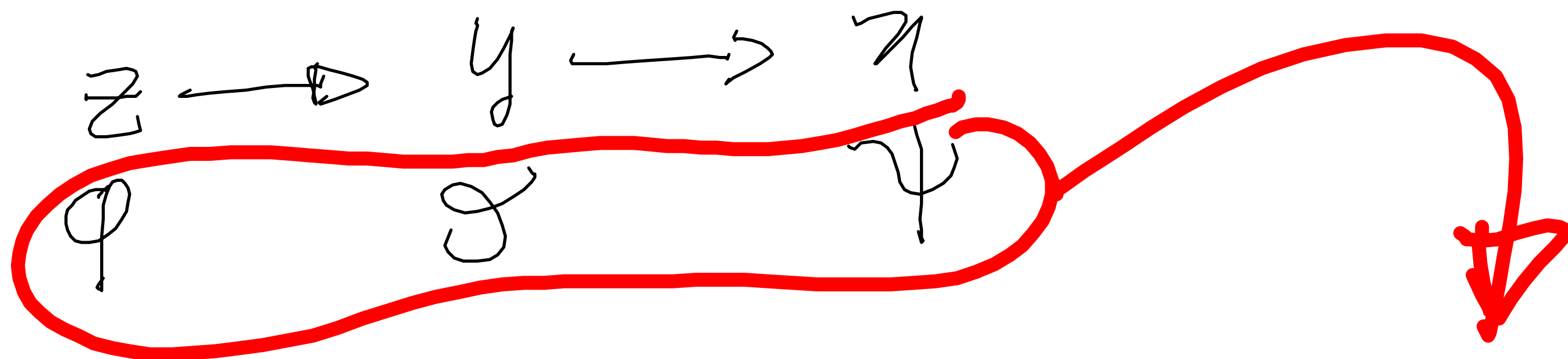
Y

$$q = c \frac{\partial}{\partial z} + s \frac{\partial}{\partial \bar{z}} \underline{z}$$

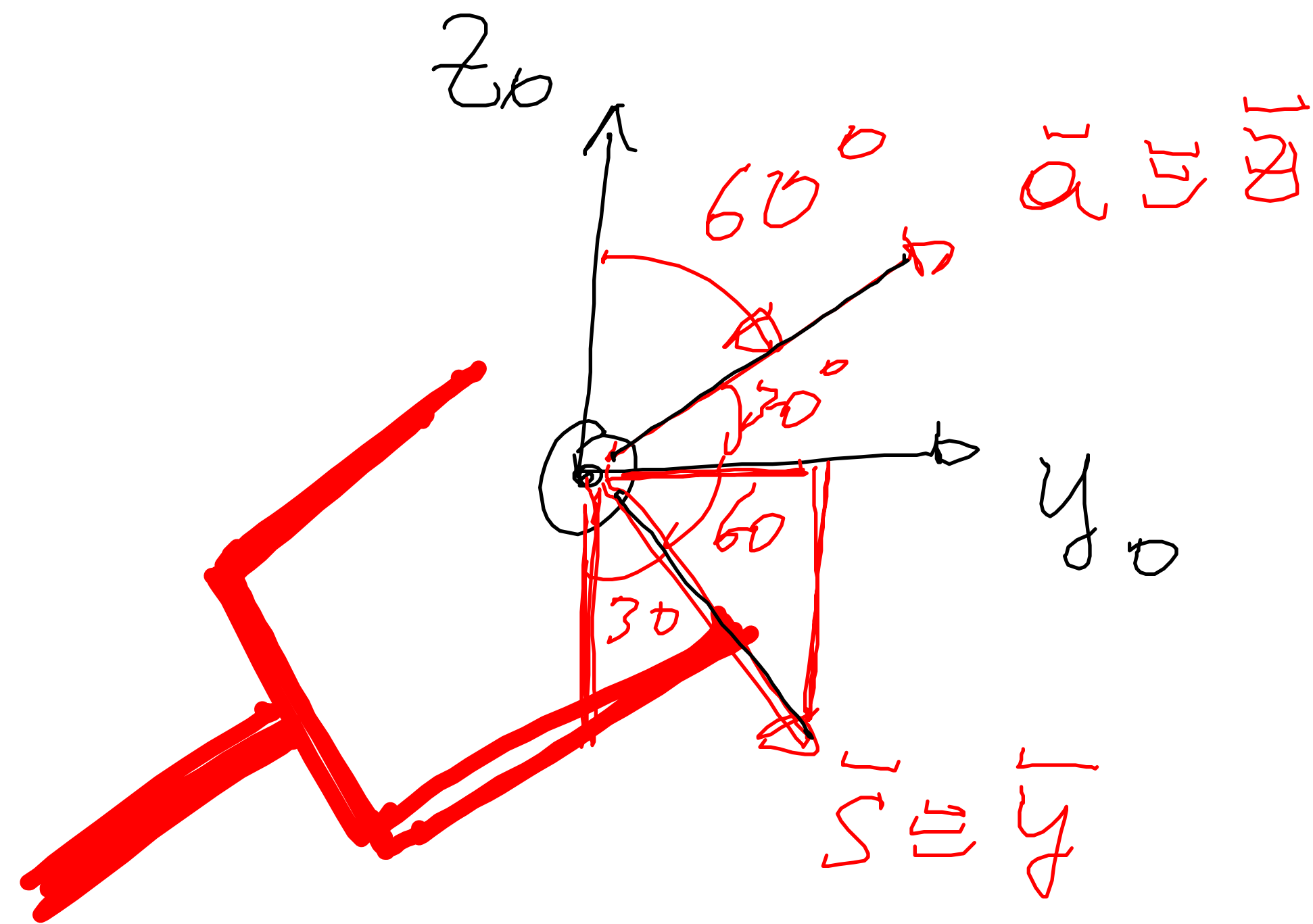
Z

$$q = c \frac{\partial}{\partial z} + s \frac{\partial}{\partial \bar{z}} \underline{z}$$

RPY



$$\begin{pmatrix} c \frac{\phi}{2} + s \frac{\phi}{2} k \\ c \frac{\phi}{2} - s \frac{\phi}{2} k \\ 1 \end{pmatrix} \begin{pmatrix} c \frac{\alpha}{2} + s \frac{\alpha}{2} j \\ c \frac{\alpha}{2} - s \frac{\alpha}{2} j \\ 1 \end{pmatrix} \begin{pmatrix} c \frac{\psi}{2} + s \frac{\psi}{2} i \\ c \frac{\psi}{2} - s \frac{\psi}{2} i \\ 1 \end{pmatrix}$$



1) RPY $\varphi = 0$ $\vartheta = 0$
 $\psi = -60^\circ$

$$2) R = \begin{bmatrix} 1 & 0 & 0 \\ 0 & c60^\circ & s30^\circ \\ 0 & -s60^\circ & c30^\circ \end{bmatrix}$$

$$3) q_x(\varphi) = c\left(\frac{0^\circ}{2}\right) + s\left(\frac{0^\circ}{2}\right) \underline{k} = 1$$

$$q_y(\vartheta) = 1$$

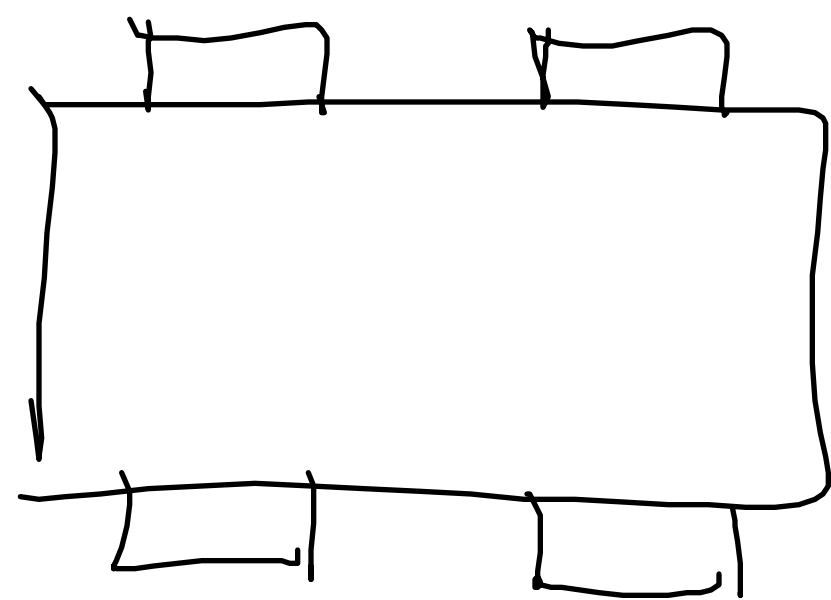
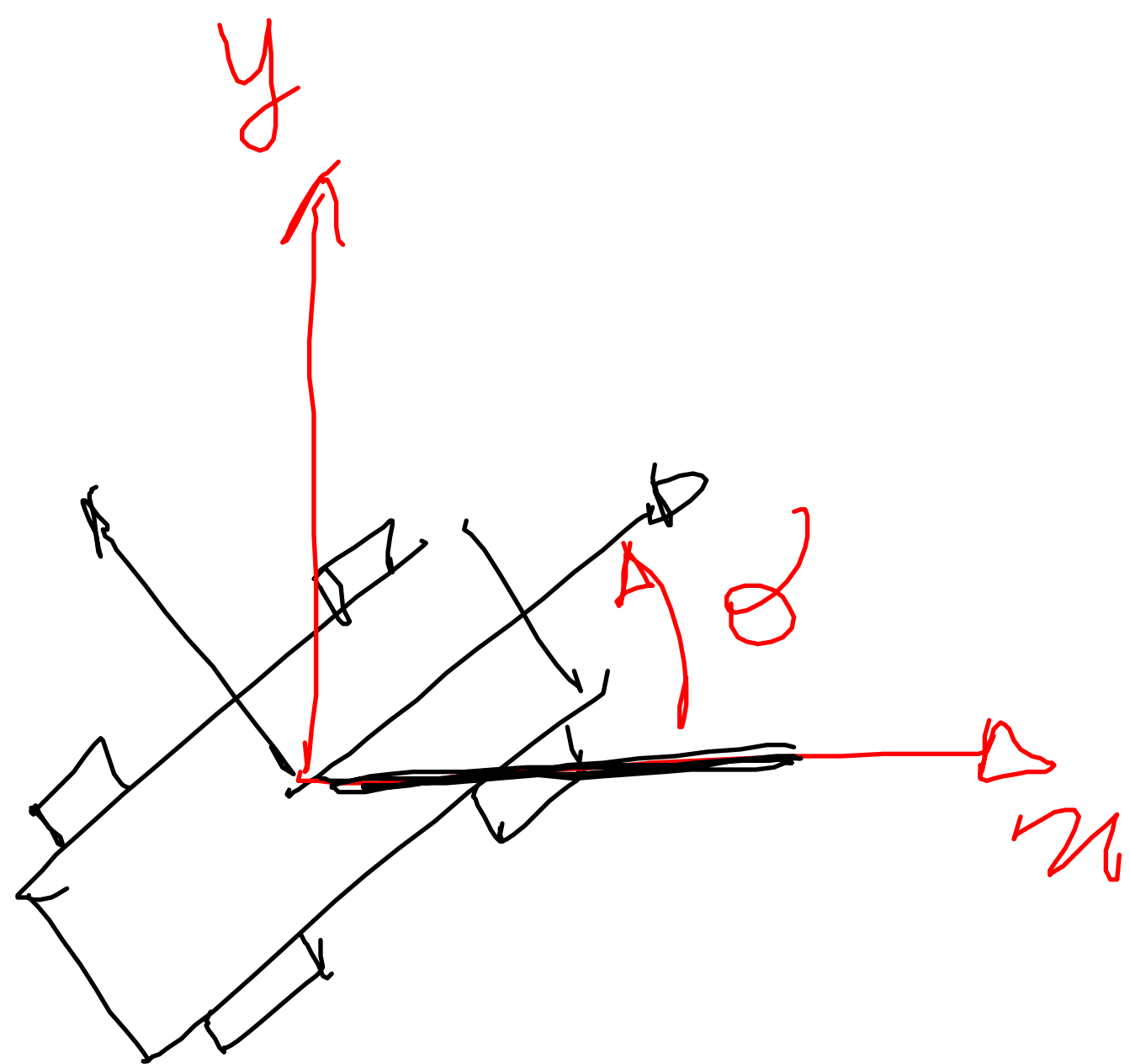
$$q_z(\psi) = c\left(\frac{-60^\circ}{2}\right) + s\left(\frac{-60^\circ}{2}\right) \underline{l}$$

$$q_0 = c(-30^\circ)$$

$$q_1 = s(-30^\circ)$$

$$q_2 = 0$$

$$q_3 = 0$$



$$\alpha = \left. \begin{array}{l} 0 \\ \pi/2 \end{array} \right\}$$

$$q = c \frac{1}{\sqrt{2}} + s \frac{1}{\sqrt{2}}$$

$$q = c \begin{pmatrix} 0 \\ 1/\sqrt{2} \end{pmatrix} + s \begin{pmatrix} 1/\sqrt{2} \\ 0 \end{pmatrix} \bar{k} = 1$$

$$q = c \begin{pmatrix} 2/\sqrt{2} \\ 1/\sqrt{2} \end{pmatrix} + s \begin{pmatrix} 2/\sqrt{2} \\ 1/\sqrt{2} \end{pmatrix} \bar{k} = 1$$