$$R_{yxz}(\alpha, \beta, \gamma) = R_z(\gamma) \cdot R_x(\beta) \cdot R_y(\alpha)$$ YXZ **ok**

$$\begin{bmatrix} r_{11} & r_{12} & r_{13} \\ r_{21} & r_{22} & r_{23} \\ r_{31} & r_{32} & r_{33} \end{bmatrix}$$

$$\begin{cases} s(\beta) = r_{32} \\ c(\beta) = \pm\sqrt{1 - r_{32}^2} \end{cases}$$

$$\beta = \mathrm{atan2}\left(r_{32}, \pm\sqrt{1-r_{32}^2}\right) \Rightarrow \begin{cases} \beta \\ \beta + \pi \end{cases}$$

Non sono in singolarità se $\beta \neq \frac{\pi}{2}, \frac{3}{2}\pi$.

$$\begin{cases} s(\gamma) = -\frac{r_{12}}{c(\beta)} \\ c(\gamma) = \frac{r_{22}}{c(\beta)} \end{cases} \Rightarrow \gamma = \mathrm{atan2}\left(\mp\frac{r_{12}}{\cancel{c(\beta)}}, \pm\frac{r_{22}}{\cancel{c(\beta)}}\right) \Rightarrow \begin{cases} \gamma \\ \gamma + \pi \end{cases}$$

$$\begin{cases} s(\alpha) = -\frac{r_{31}}{c(\beta)} \\ c(\alpha) = \frac{r_{33}}{c(\beta)} \end{cases} \Rightarrow \alpha = \mathrm{atan2}\left(\mp\frac{r_{31}}{\cancel{c(\beta)}}, \pm\frac{r_{33}}{\cancel{c(\beta)}}\right) \Rightarrow \begin{cases} \alpha \\ \alpha + \pi \end{cases}$$

$$R_{xyz}(\alpha, \beta, \gamma) = R_z(\gamma) \cdot R_y(\beta) \cdot R_x(\alpha)$$ XYZ **ok**

$$\begin{cases} s(\beta) = -r_{31} \\ c(\beta) = \pm\sqrt{1 - r_{31}^2} \end{cases} \Rightarrow \beta = \mathrm{atan2}\left(-r_{31}, \pm\sqrt{1-r_{31}^2}\right) \Rightarrow \begin{cases} \beta \\ \beta - \pi \end{cases}$$

Non sono in singolarità se $\beta \neq \frac{\pi}{2}, \frac{3}{2}\pi$.

$$\begin{cases} s(\gamma) = \frac{r_{21}}{c(\beta)} \\ c(\gamma) = \frac{r_{11}}{c(\beta)} \end{cases} \Rightarrow \gamma = \mathrm{atan2}\left(\pm\frac{r_{21}}{c(\beta)}, \pm\frac{r_{11}}{c(\beta)}\right) \Rightarrow \begin{cases} \gamma \\ \gamma - \pi \end{cases}$$

$$\begin{cases} s(\alpha) = \frac{r_{32}}{c(\beta)} \\ c(\alpha) = \frac{r_{33}}{c(\beta)} \end{cases} \Rightarrow \alpha = \mathrm{atan2}\left(\pm\frac{r_{32}}{c(\beta)}, \pm\frac{r_{33}}{c(\beta)}\right) \Rightarrow \begin{cases} \alpha \\ \alpha - \pi \end{cases}$$

$R_{zyz}(\alpha, \beta, \gamma) = R_z(\gamma) \cdot R_y(\beta) \cdot R_z(\alpha)$ ZYZ

$$\begin{cases} s(\beta) = \pm\sqrt{1 - r_{33}^2} \\ c(\beta) = r_{33} \end{cases} \Rightarrow \beta = \operatorname{atan2}\left(\pm\sqrt{1 - r_{33}^2}, r_{33}\right) \Rightarrow \begin{cases} \beta \\ -\beta \end{cases}$$

OK

Vom avea în singularitate de $\beta \neq 0, \pi$.

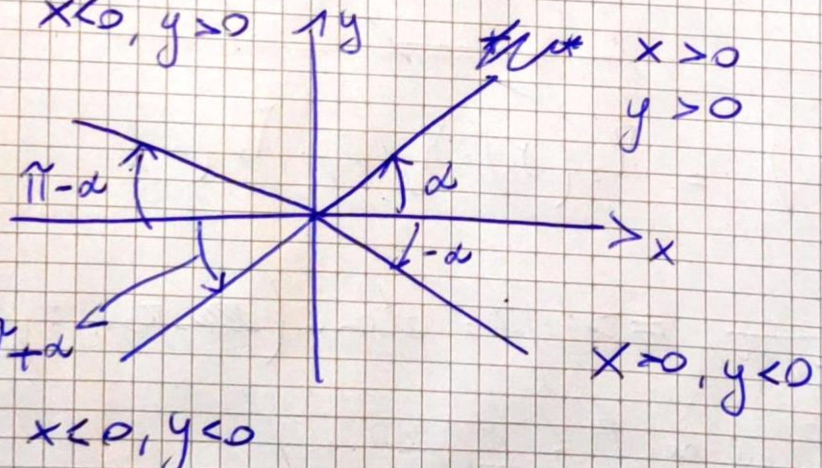
$$\begin{cases} c(\gamma) = \frac{r_{13}}{s(\beta)} \\ s(\gamma) = \frac{r_{23}}{s(\beta)} \end{cases} \Rightarrow \gamma = \operatorname{atan2}\left(\pm\frac{r_{23}}{\cancel{s(\beta)}}, \pm\frac{r_{13}}{\cancel{s(\beta)}}\right) \Rightarrow \begin{cases} \gamma \\ \gamma - \pi \end{cases}$$

$$\begin{cases} c(\alpha) = -\frac{r_{31}}{s(\beta)} \\ s(\alpha) = \frac{r_{32}}{s(\beta)} \end{cases} \Rightarrow \alpha = \operatorname{atan2}\left(\pm\frac{r_{32}}{\cancel{s(\beta)}}, \mp\frac{r_{31}}{\cancel{s(\beta)}}\right)$$

$$\Rightarrow \begin{cases} \alpha + \pi \\ \alpha \end{cases} = \begin{cases} \alpha' \\ \alpha' - \pi \end{cases}$$

$(\pm x)^2 + 0$

min $a^2 + b^2$



$\alpha' = \alpha + \pi \Rightarrow \alpha = \alpha' - \pi$