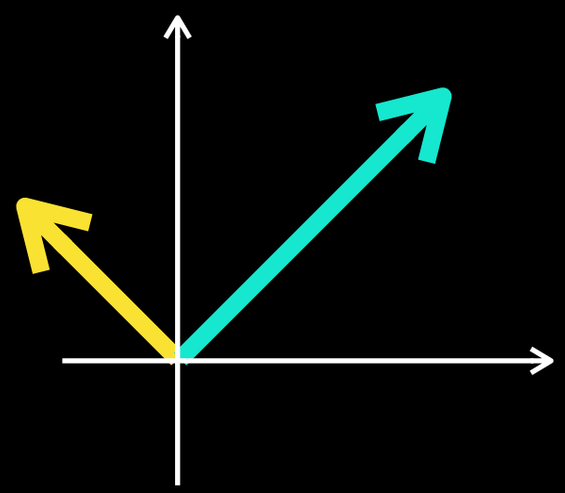
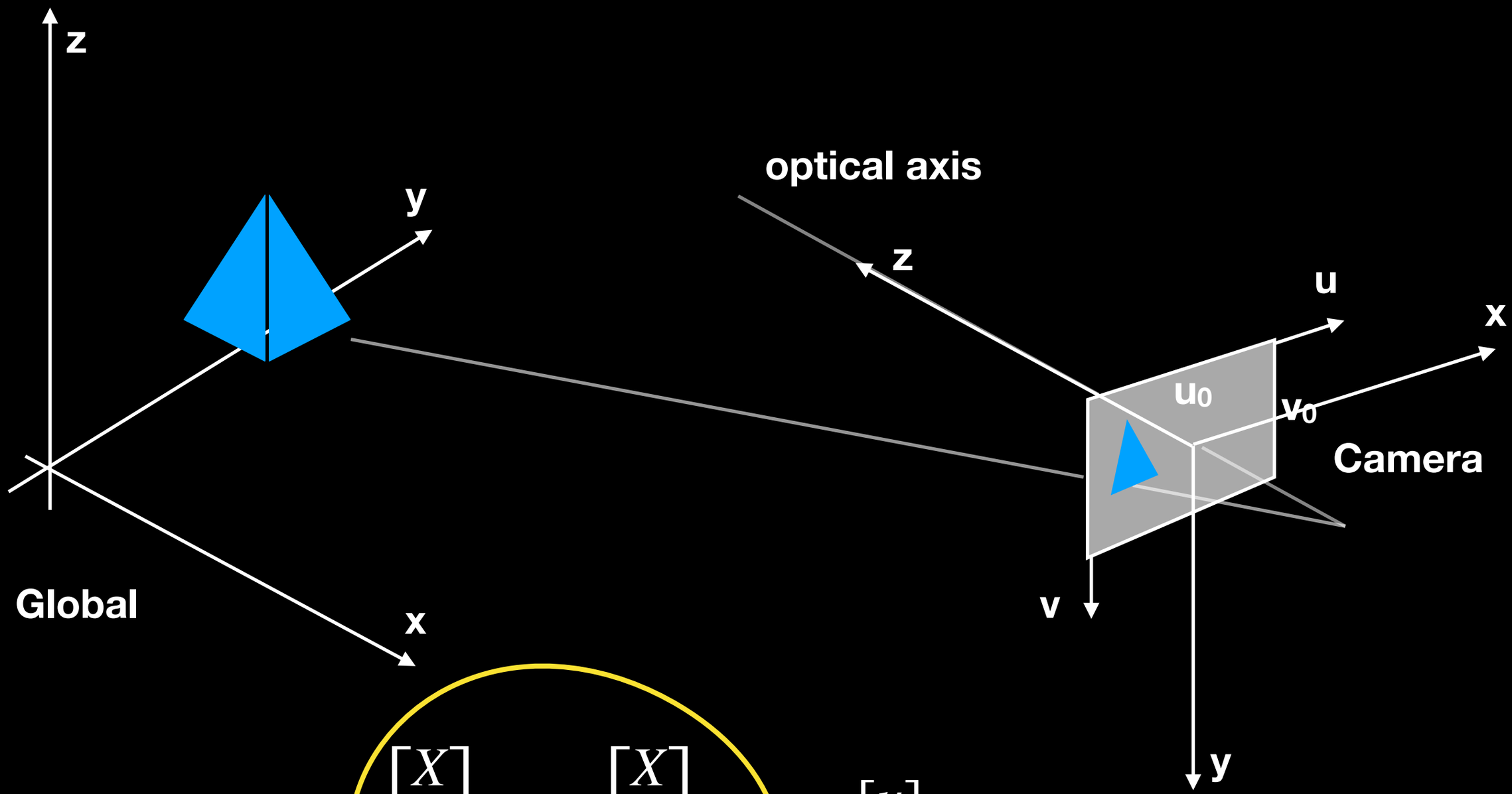
3D / 3D transformation

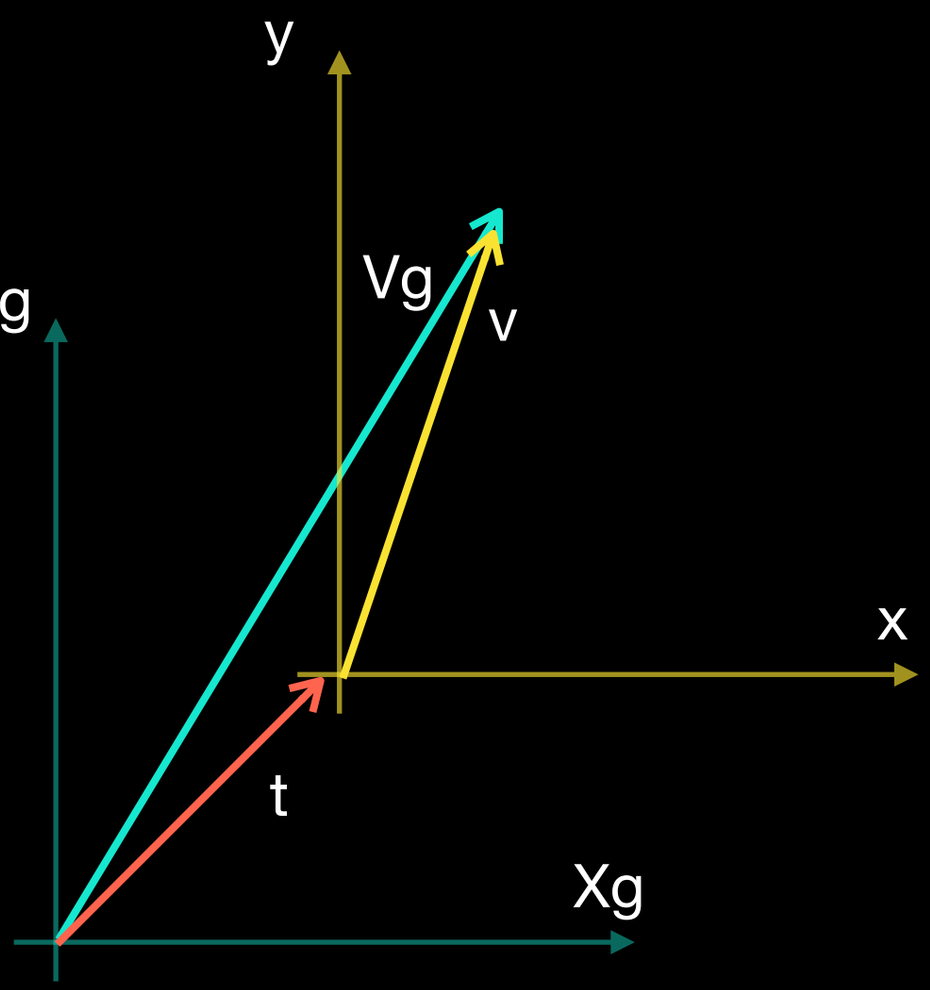
Linear Algebra Essentials

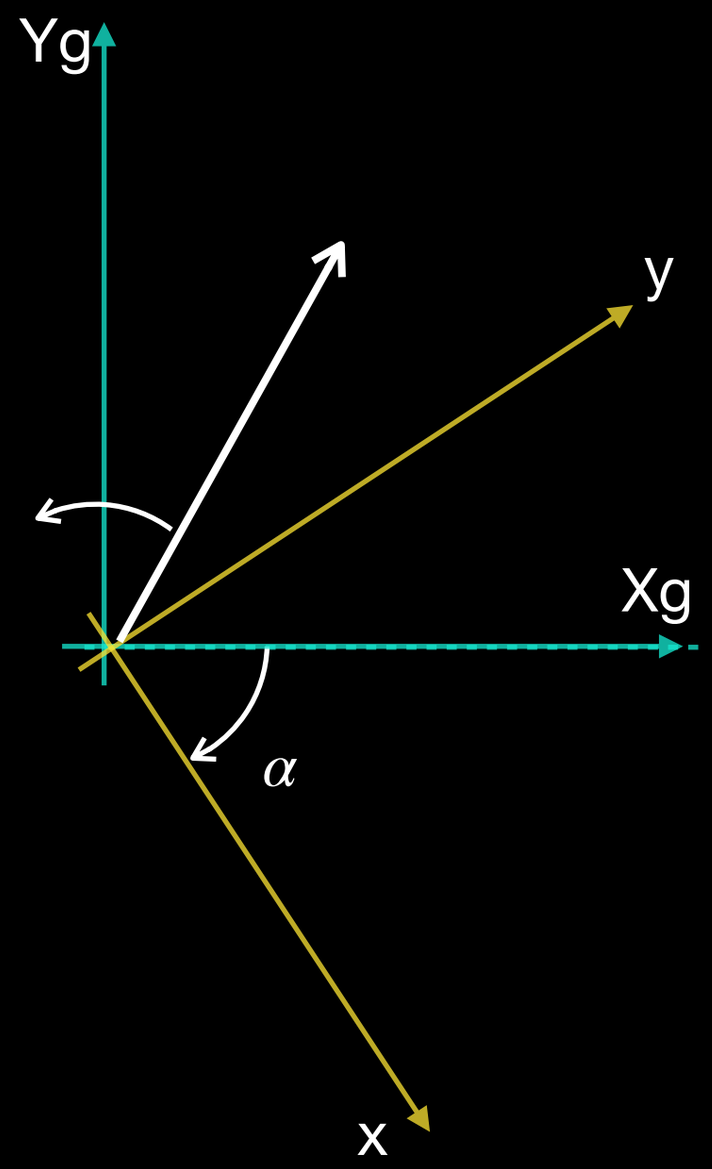


3D - 3D transformation



$$\begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_G \rightarrow \begin{bmatrix} X \\ Y \\ Z \end{bmatrix}_{cam} \rightarrow \begin{bmatrix} u \\ v \end{bmatrix}$$



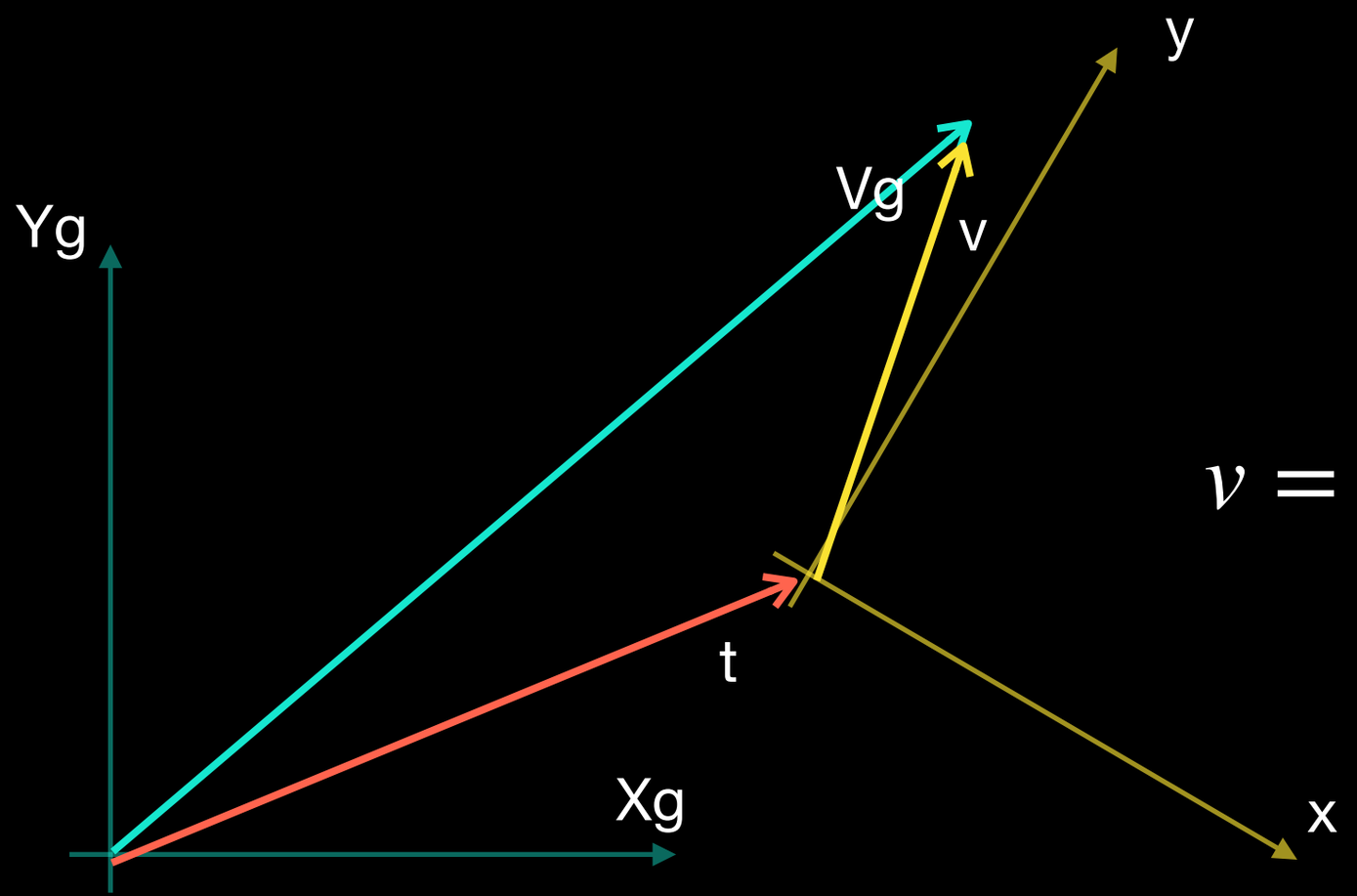


Only translation:

$$v = v_g - t$$

Only rotation:

$$v = R^T v_g$$

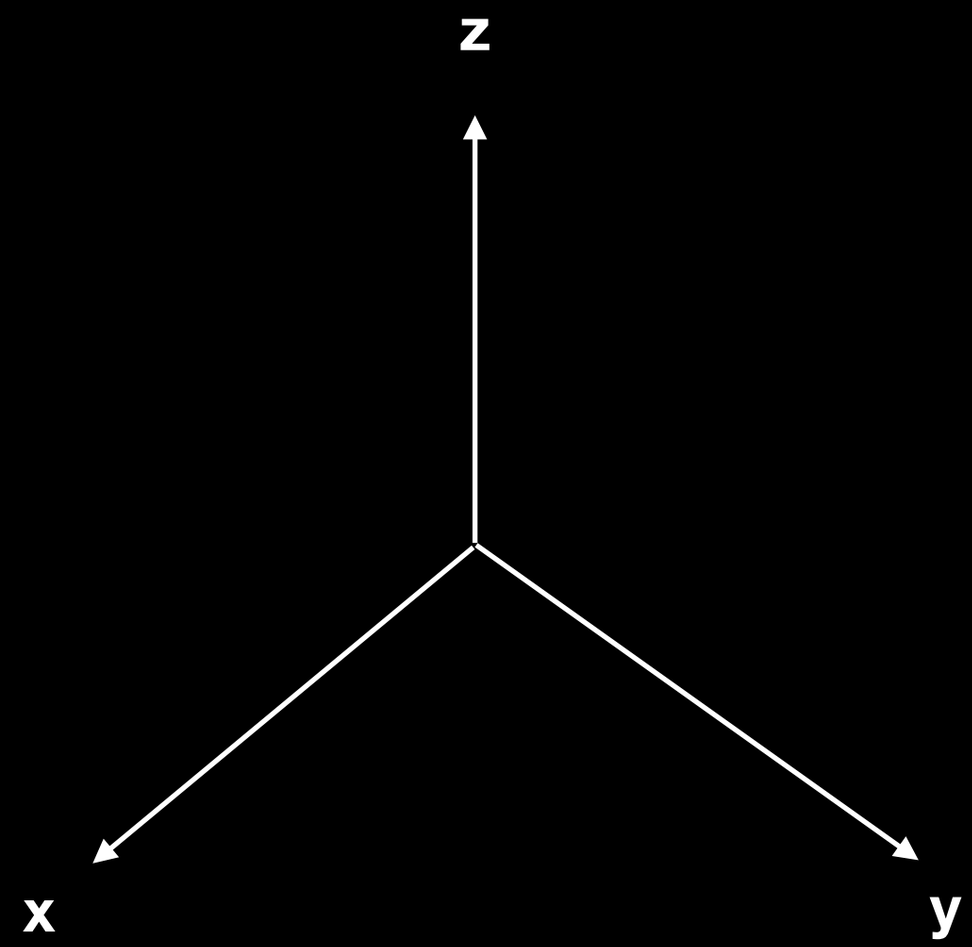


$$v = R^T(v_g - t) = R^T v_g - R^T t$$

$$\begin{bmatrix} x \\ y \\ z \end{bmatrix}_{cam} = \underset{(3 \times 4)}{\left[R^T \mid -R^T t\right]} \cdot \begin{bmatrix} X \\ Y \\ Z \\ 1 \end{bmatrix}_{glob}$$

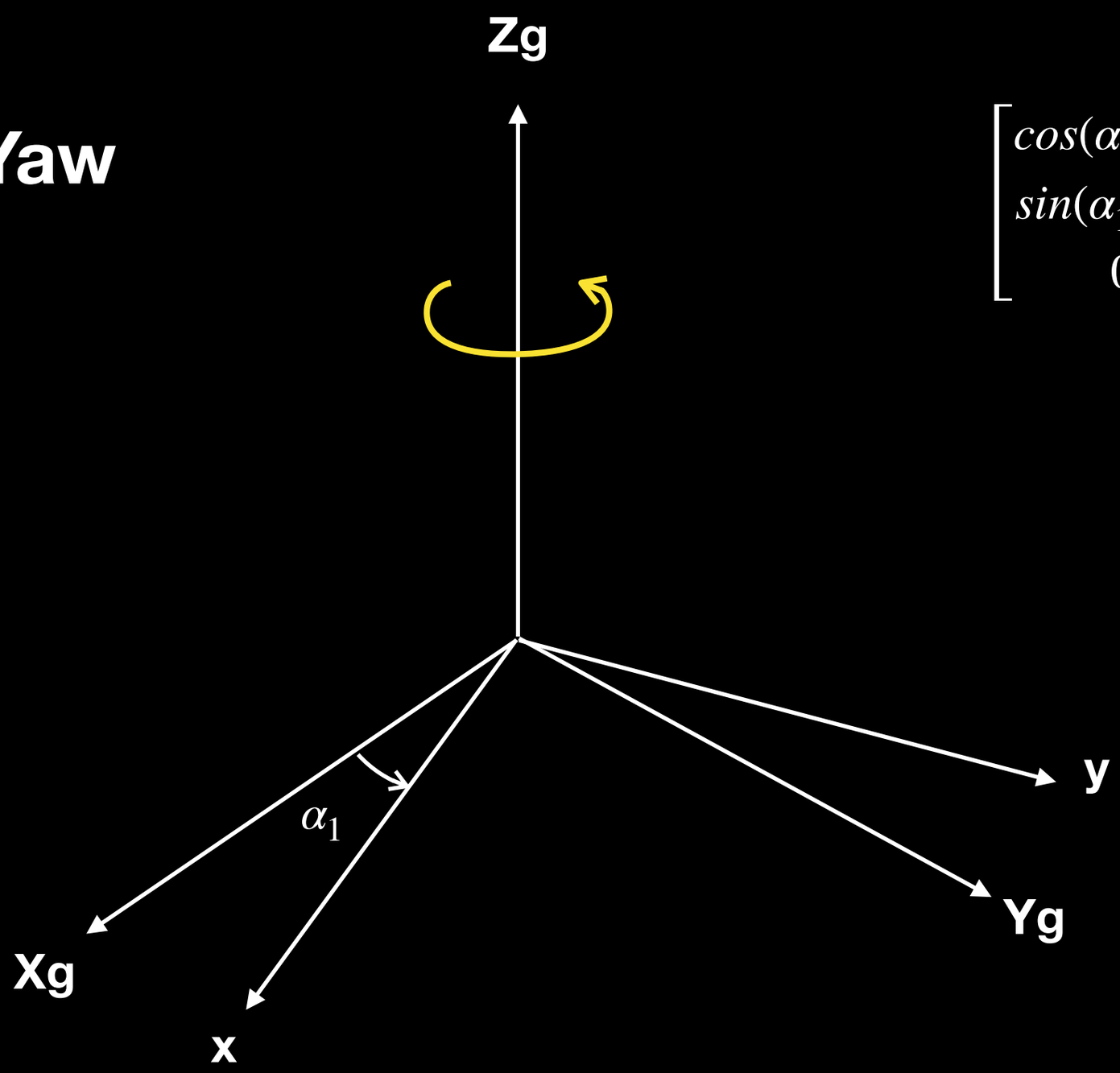
Euler angles

https://en.wikipedia.org/wiki/Euler_angles



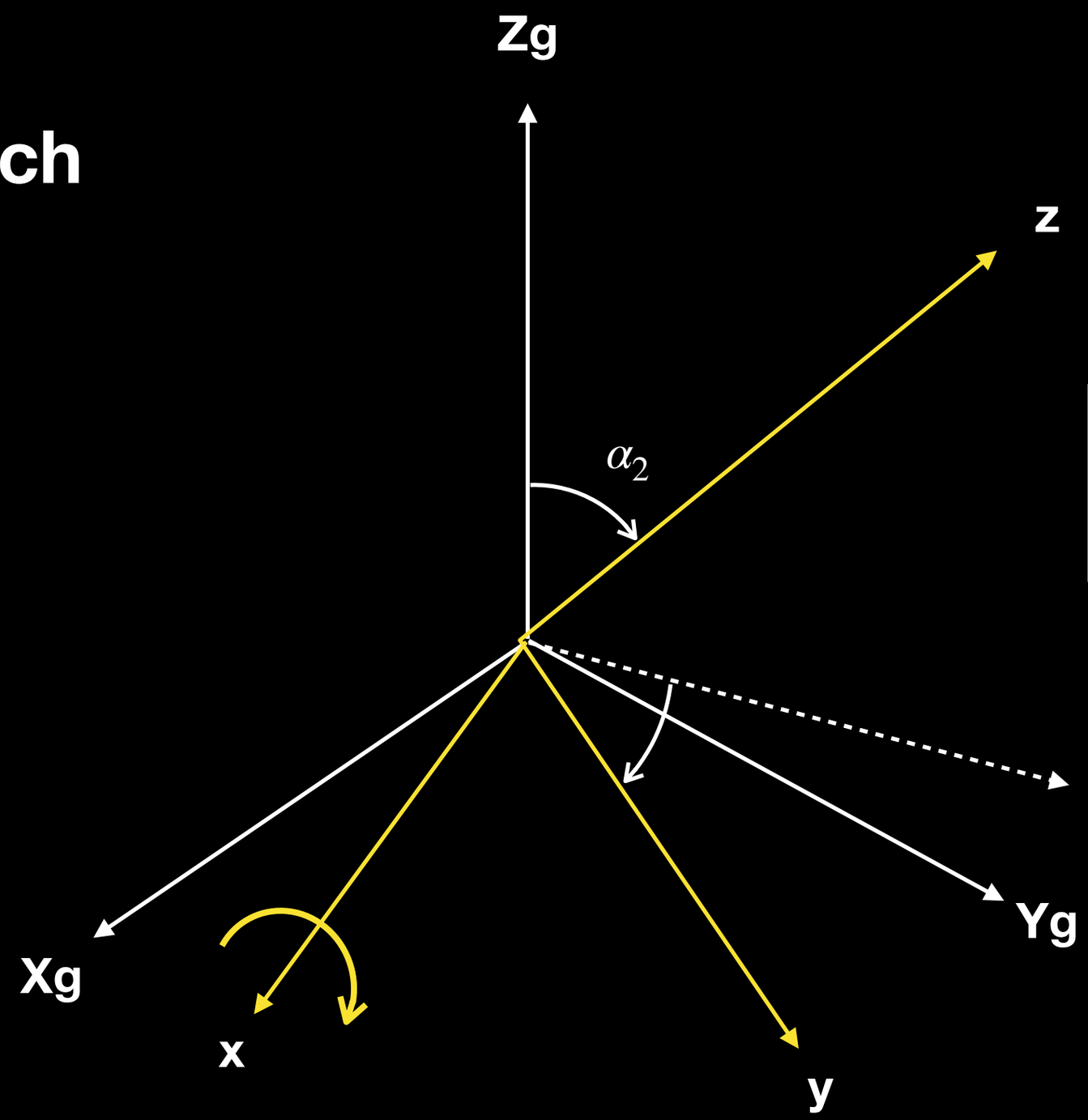
ZXZ schema

Yaw



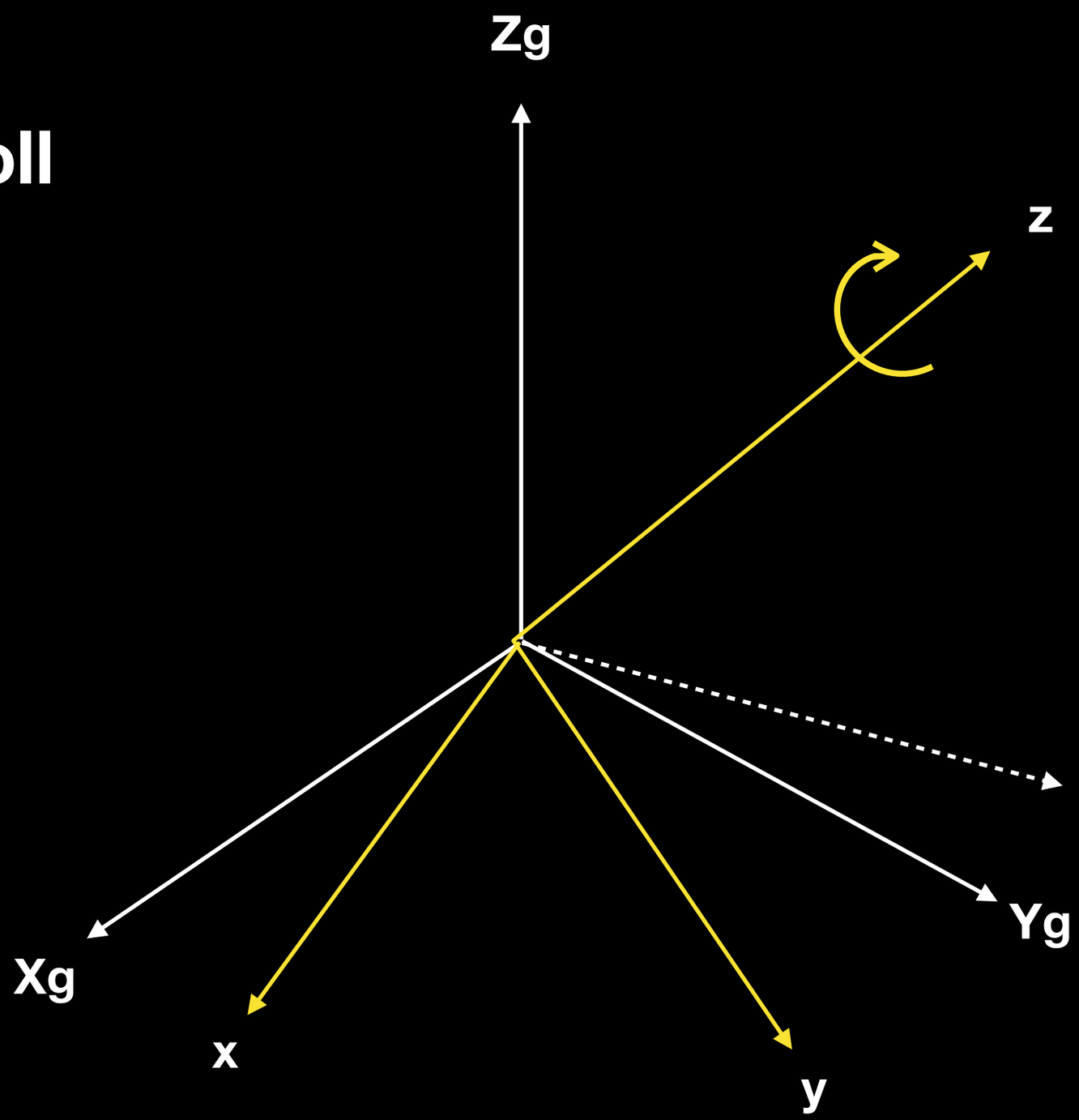
$$\begin{bmatrix} cos(\alpha_1) & -sin(\alpha_1) & 0 \\ sin(\alpha_1) & cos(\alpha_1) & 0 \\ 0 & 0 & 1 \end{bmatrix}$$

Pitch



$$\begin{bmatrix} 1 & 0 & 0 \\ 0 & cos(\alpha_2) & -sin(\alpha_2) \\ 0 & sin(\alpha_2) & cos(\alpha_2) \end{bmatrix}$$

Roll



$Z_1X_2Z_3$

$$Z_1 X_2 Z_3 = \begin{bmatrix} c_1 c_3 - c_2 s_1 s_3 & -c_1 s_3 - c_2 c_3 s_1 & s_1 s_2 \\ c_3 s_1 + c_1 c_2 s_3 & c_1 c_2 c_3 - s_1 s_3 & -c_1 s_2 \\ s_2 s_3 & c_3 s_2 & c_2 \end{bmatrix}$$