3D Transformation Matrices

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Translation

- To translate by d_x, d_y, d_z:

$$\begin{bmatrix} 1 & 0 & 0 & d_x \\ 0 & 1 & 0 & d_y \\ 0 & 0 & 1 & d_z \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Scale

- To scale by s_x, s_y, s_z:

$$\begin{bmatrix} s_x & 0 & 0 & 0 \\ 0 & s_y & 0 & 0 \\ 0 & 0 & s_z & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate

- By angle φ about x axis ($\alpha=\cos(\varphi)$, $\beta=\sin(\varphi)$)

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \alpha & -\beta & 0 \\ 0 & \beta & \alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate

- By angle φ about y axis ($\alpha=\cos(\varphi)$, $\beta=\sin(\varphi)$)

$$\begin{bmatrix} \alpha & 0 & \beta & 0 \\ 0 & 1 & 0 & 0 \\ -\beta & 0 & \alpha & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate

- By angle φ about z axis ($\alpha=\cos(\varphi)$, $\beta=\sin(\varphi)$)

$$\begin{bmatrix} \alpha & -\beta & 0 & 0 \\ \beta & \alpha & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$