

CSE-4303 CSE5365 Computer Graphics

Quick Reference

$$R_z(\theta) = \begin{bmatrix} \cos \theta & -\sin \theta & 0 & 0 \\ \sin \theta & \cos \theta & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad R_y(\theta) = \begin{bmatrix} \cos \theta & 0 & \sin \theta & 0 \\ 0 & 1 & 0 & 0 \\ -\sin \theta & 0 & \cos \theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \quad R_x(\theta) = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos \theta & -\sin \theta & 0 \\ 0 & \sin \theta & \cos \theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate a vector around x axis until it lies in the xz plane

$$V = \begin{bmatrix} a \\ b \\ c \\ 1 \end{bmatrix} \quad R_x = \begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \frac{c}{\sqrt{b^2+c^2}} & \frac{-b}{\sqrt{b^2+c^2}} & 0 \\ 0 & \frac{b}{\sqrt{b^2+c^2}} & \frac{c}{\sqrt{b^2+c^2}} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate a vector around y axis until it lies in the yz plane

$$V = \begin{bmatrix} a \\ b \\ c \\ 1 \end{bmatrix} \quad R_y = \begin{bmatrix} \frac{c}{\sqrt{a^2+c^2}} & 0 & \frac{-a}{\sqrt{a^2+c^2}} & 0 \\ 0 & 1 & 0 & 0 \\ \frac{a}{\sqrt{a^2+c^2}} & 0 & \frac{c}{\sqrt{a^2+c^2}} & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Rotate a vector around z axis until it lies in the yz plane

$$V = \begin{bmatrix} a \\ b \\ c \\ 1 \end{bmatrix} \quad R_z = \begin{bmatrix} \frac{b}{\sqrt{a^2+b^2}} & \frac{-a}{\sqrt{a^2+b^2}} & 0 & 0 \\ \frac{a}{\sqrt{a^2+b^2}} & \frac{b}{\sqrt{a^2+b^2}} & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

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Quick Reference

How to convert a general parallel view volume into canonical perspective volume

- Step 1: Translate VRP to origin
- Step 2: Rotate VPN around x until it lies in the xz plane with positive z
- Step 3: Rotate VPN around y until it aligns with the positive z axis.
- Step 4: Rotate VUP around z until it lies in the yz plane with positive y
- Step 5: Shear DOP such that it aligns with vpn.
- Step 6: Translate the lower corner of the view volume to the origin
- Step 7: Scale such that the view volume becomes a unit cube

DOP= CW-PRP (CW: Center of Window on the View Plane)

How to convert a general perspective view volume into canonical perspective volume

- Step 1: Translate VRP to origin
- Step 2: Rotate VPN around x until it lies in the xz plane with positive z
- Step 3: Rotate VPN around y until it aligns with the positive z axis.
- Step 4: Rotate VUP around z until it lies in the yz plane with positive y
- Step 5: Translate PRP (COP) to the origin
- Step 6: Shear such that the center line of the view volume becomes the z axis
- Step 7: Scale such that the sides of the view volume become 45 degrees
- Step 8: Scale such that the view volume becomes the canonical perspective volume