

$??$
 $systemprocess.jpg3D$
 $?$
 $cloudMap.jpg$
 XY
 $Box.jpg$
 $\tan\theta$
 θ
 θ
 $\tan\theta_{Pose.jpg}[] [width = 0.33] figures/RotationResult.jpg$
 $virtualCamera.jpg$
 $image.jpg(near)(far)$

$$\begin{pmatrix} \frac{2near}{right-left} & 0 & \frac{right+left}{right-left} & 0 \\ 0 & \frac{2near}{top-bottom} & \frac{top+bottom}{top-bottom} & 0 \\ 0 & 0 & -\frac{far+near}{far-near} & -\frac{2far\times near}{far-near} \\ 0 & 0 & -1 & 0 \end{pmatrix}$$

 $[-1,1]$
 $\frac{1}{z}$
 $\frac{1}{z}$
 $\frac{z\times x}{y} =$
 $ax +$
 b
 $a(\frac{z}{b}-1)$
 $p_3 =$
 $tp_2 +$
 $(1 -$
 $t)p_1$
 $a(\frac{b}{z_3}-1)=t\frac{n}{a}(\frac{b}{z_1}-1)+(1-t)\frac{n}{a}(\frac{b}{z_2}-1)$
 $z_3=t\frac{1}{z_1}+(1-t)\frac{1}{z_2}$
 $\frac{b_3-b_1}{b_2-b_1} =$
 $\frac{z_3-z_1}{z_2-z_1}$
 $\frac{z_3}{3} =$
 $\frac{\frac{1}{z_1}t+\frac{1}{z_2}(1-t)}{3}$
 $z_3[\frac{b_1}{z_1}t +$
 $\frac{b_2}{z_2}(1 -$
 $t)]$
 $(x,y,z,w)(x',y',z',w')(P_x,P_y,P_z,P_w)$
 $zy' = \frac{-ny}{z}$
 $[-1,1]$
 $x\frac{1-(-1)}{r-l} = \frac{r-x'}{r-l}\frac{1-P_y}{1-(-1)} = \frac{t-y'}{t-b}$
 $x =$
 $\frac{2x'}{r-l} -$
 $\frac{r+l}{r-l}P_y =$
 $\frac{2y'}{t-b} -$
 $\frac{t+b}{t-b}$
 $t-b$
 x',y'
 $x =$
 $\frac{2n}{r-l}(-\frac{x}{z}) -$
 $\frac{r+l}{r-l}P_y =$
 $\frac{2n}{t-b}(-\frac{y}{z}) -$
 $\frac{t+b}{t-b}$
 $t-b$
 $P_Zfrac{1}{z}P_z =$
 $\frac{a}{z} +$
 $b(-n,-1),(-f,1)$
 $f-nb = \frac{f+n}{f-n}P_z = \frac{2nf}{f-n}(\frac{1}{z}) + \frac{f+n}{f-n}$
 P_x,P_yP_Z

$$\begin{cases} -zP_x = \frac{2n}{r-l}x + \frac{r-l}{r+l}z \\ -zP_x = \frac{2n}{t-b}x + \frac{t+b}{t-b}z \\ -zP_z = -\frac{2nf}{f-n} - \frac{f+n}{f-n}z \\ w = -z \end{cases}$$

 $Filter.jpg$
 $(x,y,z,w)(x',y',z')??$
 $\begin{cases} x' = x/w \\ y' = y/w \\ z' = z/w \end{cases}$
 $??Z_n =$
 $nearZ_f =$
 $farw =$
 $\frac{2\times Z_n}{right-left}Q =$
 $\frac{Z_f}{Z_f-Z_n}$
 $\times Z_n\overline{(Q-Z)}$