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CSE 5542

HW 2

1. p’ = A*B*C*D*E*p

Matrix A is the viewport transformation matrix that transforms the point from the projection coordinates of the canonical view volume to the device coordinates. Matrix B is the orthographic projection matrix, and C is the perspective projection matrix. These transform the object from camera space to the canonical view volume depending on whether the view is orthographic or perspective. D is the camera matrix to transform from world space to camera space. Finally, E is the modeling matrix which is a transform from the object’s local space to world space. Matrix values (model matrix is result of transforms to world coordinates):

$$p' = \begin{bmatrix} \frac{n_x}{2} & 0 & 0 & \frac{n_x - 1}{2} \\ 0 & \frac{n_y}{2} & 0 & \frac{n_y - 1}{2} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} \frac{2}{r-l} & 0 & 0 & -\frac{r+l}{r-l} \\ 0 & \frac{2}{t-b} & 0 & -\frac{t+b}{t-b} \\ 0 & 0 & \frac{2}{n-f} & -\frac{n+f}{n-f} \\ 0 & 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} n & 0 & 0 & 0 \\ 0 & n & 0 & 0 \\ 0 & 0 & n+f & -fn \\ 0 & 0 & 0 & 1 \end{bmatrix} [u, v, w, 1]^{-1} M_{model}$$

2. Camera position e = (x, y, z, 1)       $\theta_h$, $\theta_w$

Look vector: look       up vector: up             clip planes: near, far

$$A=\begin{bmatrix} \frac{\llbracket near)_x}{2} & 0 & 0 & \frac{(\llbracket near)_x-1]}{2} \\ 0 & \frac{near_y}{2} & 0 & \frac{\llbracket near)_y-1}{2} \\ 0 & 0 & 1 & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$B=\begin{bmatrix} \frac{2}{r-l} & 0 & 0 & -\frac{r+l}{r-l} \\ 0 & \frac{2}{t-b} & 0 & -\frac{t+b}{t-b} \\ 0 & 0 & \frac{2}{near-far} & -\frac{near+far}{near-far} \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$C=\begin{bmatrix} near & 0 & 0 & 0 \\ 0 & near & 0 & 0 \\ 0 & 0 & near+far & -far*near \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

$$D=\begin{bmatrix} u & v & w & e \\ 0 & 0 & 0 & 1 \end{bmatrix}^{-1}$$

u = -look/||look||      w = up X u / ||up X u||         v = u X w

$$E=M_{model}$$