

LookAt Function

The function

LookAt(eye, look, up)

in mat.h calculates the matrix V which transforms the vertices from the World Coordinate System to the Camera (Eye) Coordinate System, where

eye = location of the camera

look = the point the camera is looking at

up = the VUP vector

Move to origin

$$T(t_x, t_y, t_z) = \begin{pmatrix} 1 & 0 & 0 & t_x \\ 0 & 1 & 0 & t_y \\ 0 & 0 & 1 & t_z \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

Orient axes:

$$\begin{aligned} \hat{n} &= \frac{\overline{\text{look} - \text{eye}}}{\|\overline{\text{look} - \text{eye}}\|} \\ \hat{u} &= \frac{\overline{\hat{n} \times \text{up}}}{\|\overline{\hat{n} \times \text{up}}\|} \\ \hat{v} &= \hat{u} \times \hat{n} \end{aligned} \Rightarrow R^{-1} = \begin{pmatrix} u_x & u_y & u_z & 0 \\ v_x & v_y & v_z & 0 \\ -n_x & -n_y & -n_z & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

The V matrix can be calculated as $R^{-1} T^{-1}$:

```
mat4 LookAt( const vec4& eye, const vec4& at, const vec4&
up )
{
    vec4 n = normalize(eye - at);
    vec4 u = vec4(normalize(cross(up,n)),0);
    vec4 v = vec4(normalize(cross(n,u)),0);
    vec4 t = vec4(0.0, 0.0, 0.0, 1.0);
    mat4 c = mat4(u, v, n, t);
    return c * Translate( -eye );
}
```