Matrices, GL Transformations

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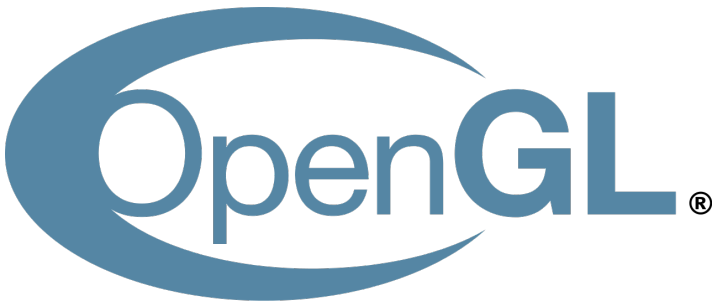

Matrices

Matrix math is the building block of everything OpenGL does. Matrices add a W to our X, and Y coordinate system. W will specify whether or not it is a point in space, or a direction. Much like functions, matrices are in a stack in OpenGL and can be “pushed” or “popped”.

Push and Pop Matrices

There are at least 2 matrices on our OpenGL stack at any given moment. However whenever we use 3D graphics there will be at least 32 matrices. We can push and pop these matrices just like we can functions on a stack.

glPopMatrix(void);

Pops the current matrix, replacing the matrix below it.

glPushMatrix(voidX);

Pushes the current matrix, adding a matrix above it.

glRotate

glRotate rotates by angle around our shape. The function generates a rotation matrix, that is multiplied by our current matrix. The product of this multiplication replaces our current matrix.

void glRotatef(GLfloat angle, GLfloat x, GLfloat y, GLfloat z);

- angle – specifies in degrees how far to rotate the matrix.
- x, y, z – The angles to be rotated. simply pass 0 in if you wish to not rotate by that dimension simply pass 0.0 as the parameter.

$$\begin{pmatrix} x^2(1-c)+c & xy(1-c)-zs & xz(1-c)+ys & 0 \\ yx(1-c)+zs & y^2(1-c)+c & yz(1-c)-xs & 0 \\ xz(1-c)-ys & yz(1-c)+xs & z^2(1-c)+c & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

glScale

glScale will scale differently to each axis, unless the scale factor for x, y, and z are all equal. Each parameter represents the scale to factor each axis

void glScalef(GLfloat x, GLfloat y, GLfloat z);

- x, y, z – factor of how each axis should be scaled.

$$\begin{pmatrix} x & 0 & 0 & 0 \\ 0 & y & 0 & 0 \\ 0 & 0 & z & 0 \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

glTranslate

glTranslate produces a translation matrix that is multiplied by our current matrix. Our current matrix is replaced by the product.

void glTranslated(GLdouble x, GLdouble y, GLdouble z);

- x, y, z – factor of how each axis should be translated.

$$\begin{pmatrix} 1 & 0 & 0 & x \\ 0 & 1 & 0 & y \\ 0 & 0 & 1 & z \\ 0 & 0 & 0 & 1 \end{pmatrix}$$

glList

Lists in OpenGL allow us to compile code at runtime, and assign a tag to the code that was compiled. Useful when maximizing information hiding when using classes.

References

 https://www.opengl.org/ (2015)