Lab #6, Basic Drawings in OpenGL

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Introduction

In the first lab, when we installed and configured OpenGL, we drew some random points or pixels. In this lab we would be looking at drawing some interesting configuration of points. Some of these techniques would prove very useful later.

Getting Started

For our first "drawing", we would draw a very simple fractal. A fractal is a self-repeating structure which has recently recieved significant attention for its application in a vast variety of domains. Righ now we are just concerned with drawing them. The first fractal is the Sierpinski Gasket.

Sierpinski Gasket

The Sierpinksi Gasket is drawn as follows:

1. Take three points as the corners of a traingle, with one randomly selected as the starting current point.
2. Select one corner at random.
3. Draw point at midway between current and the randomly selected corner
4. Label this point as the current point.
5. Repeat.

The source code for the Sierpinski Gasket is as follows.

```
void sieprenski(MyPoint pt[3]){
   int index = rand()%3;
      MyPoint cp = pt[index];
      glClear(GL_COLOR_BUFFER_BIT);
      glBegin(GL_POINTS);
      for (int i=0;i<NUM_POINTS;i++) {
            index = rand()%3;
            cp.x = (cp.x + pt[index].x)/2;
            cp.y = (cp.y + pt[index].y)/2;
            glVertex2i(cp.x, cp.y); }
      glEnd();
      glFlush();}
```

Remember to register the callback function and ask the user to input three points by mouse-clicks. Also see what is the affect of changing NUM_POINTS gradually, or how the pattern ”grows” to be more precise.

Gingerbread Man

Another intersting pattern is the Gingerbread Man. It is drawn using the following equations:

$$q.x = M(1 + 2L) - p.y + |p.x - LM| \tag{1}$$

$$q.y = p.x \tag{2}$$

All that needs to be done is to specify a starting point (seed) and a termination condition (how?).

Logarithmic Spiral

The logarithimc spiral is a very interesting curve (not a fractal). It has the property that the tangent to it at any point is the same. It has attracted much fascination in the mathematics community, particulary by Jacob Bernoulli, who had it carved on his gravestone[1]. The logarithmic spiral in polar coordinates is given as:

$$r = ae^{b\theta} \tag{3}$$

which can be translated into cartesian coordinates to:

$$x = ae^{b\theta}cos(\theta) \tag{4}$$

$$y = ae^{b\theta}sin(\theta) \tag{5}$$

Plot the logarithmic curve and see what it looks like. Try zooming in and out by changing the world window and see what happens.

[1] Not to perfection though and it ended up like an Archimedean Spiral

Archimedean Spiral

The only differnce between the Archimedean Spiral and the Logarithmic spiral is that the logarithmic spiral progresses in a geometric fashion, whereas the Archimedean Spiral grows arithematically. The Archimedean spiral is given as:

$$r = a + b\theta \tag{6}$$

Draw this spiral overlapping the Logarithmic spiral in differenc color and see how the two differ[2].

Regular Polygons and variations

These are just variation of what was discussed in the theory class. You can draw a regular n-gon, a rossette, a stellation. Then there are variations of the n-gon. Nested n-gons of same degree, nested n-gons of different degrees, nested n-gons of different degree sharing an edge.

Turtule Graphics

In order to draw turtule graphics all you need, as mentioned in the text, is to be able to store a current position and a direction. Then you select a drawing primitive and repeat it with slight modification. The drawing primitive can be anything from concentric n-gons reducing in size, to line segments meandering about a direction. Draw the figures mentioned in the textbook (Try all at home since i do not have the book with me to identify specific shapes)

Evaluation

1. Sierpinski Gasket
2. Gingerbread Man
3. Logarithmic Spiral
4. Archimedean Spiral
5. N-gons, Rossettes, Stellations.
6. Variations.
7. Turtule Graphics.

[2] Can you see why the artist confused the Log-spiral with the Archimedean Spiral?