Winter 2022: CSI4130
Assignment 2

Due: Monday, Mars 28th, 2022, before 11:55pm University of Ottawa - Université d'Ottawa

Curves, Animation and Viewing

In this assignment, you will build an interactive animation of a scene shown from two viewpoints in two viewports. The basis of this assignment are *Laboratory 3 - Viewing*, *Laboratory 4 - Curves* and *Laboratory 5 - Object Loading and Viewing*. As in this Laboratory 3, you will need to set up an animation and load the teapot. As in Laboratory 4, you will have to work with a parametric curve. Laboratory 5 reviews scenegraphs and viewing and may be helpful but it is not required for this assignment.

You are not allowed to use any other library except Three.js and dat.gui.js.

1. Two Viewports [10]

You will display a teapot for this assignment (but see the bonus). In this assignment you will need to show two views: a front view and a top view of the animation. You will find an example for using two camera views for two different viewports in the THREE documentations in the camera example https://github.com/mrdoob/three.js/blob/master/examples/webglcamera.html. Note: Please do not add the animation changing the viewing from the example.

2. Spirograph Trajectory [5]

Animate the teapot flying on a trajectory in the form of a spirograph. The spirograph curve should be displayed as a thin curve (see Laboratory 4). The math of the spirograph can be roughly described as a circle rotating inside a larger circle. You can find the mathematical basis of the spirograph explained on https://en.wikipedia.org/wiki/Spirograph. In particular, the trajectory equations in 2D are:

$$x(t) = R\left[(1-k)cos(t) + lkcos\left(\frac{1-k}{k}t\right)\right]$$
$$y(t) = R\left[(1-k)sin(t) - lksin\left(\frac{1-k}{k}t\right)\right]$$

where *R* is the outer radius, *k* is the ratio of the radius of the inner circle over the outer circle and

the point of the *pen* on the inner circle over the radius of the radius of the inner circle is l. You can use a fixed value for z.

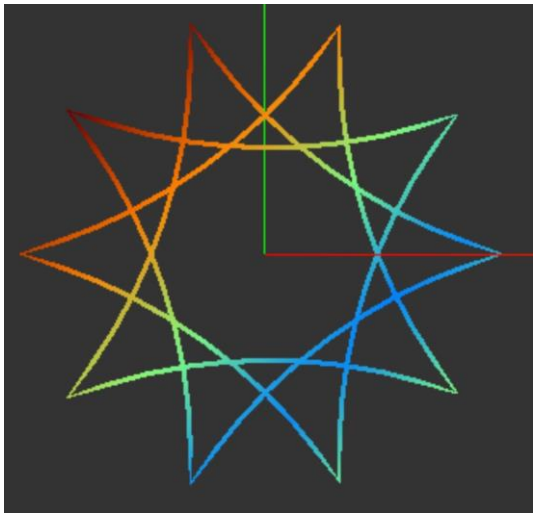

Figure 1: Spirograph.

Parameters are $k = 0.3$ and $l = 0.9$. The free curve parameter ranges over $t = 0 \ldots 6\pi$.

1.1 User Control [2]

Let the user control the ratio of the circles k and the point of the *pen* l on the inner circle with dat.gui sliders.

1.2 3D Trajectory [3]

Find a way to extend the spirograph to 3D, simulating a sphere rotating inside a larger sphere.

Hint: Make use of the scenegraph. You can add two rotations on the 2D Spirograph: onerotating on the y-axis and one rotating on an axis normal to **y**.

1.3 Bonus: Mesh Loading [2]

Replace the teapot with a spaceship, bird, airplane or similar by loading a suitable mesh from file. The Three documentation has many examples of mesh loaders (and meshes).

2 Submission

Your assignment submission must consist of your Javascript and html files. As you are working with the current version of Three.js and dat.gui.js, you will not submit these.

Filename
spirograph.js
spirograph.html

You must submit the files listed above and no library files via Virtual Campus.
This assignment can be done in a group. Only one member of group can submit the work.