

CSC 305: Assignment 3 README

The following document outlines the usage, algorithms, data structures and extra features of my assignment 3 submission. Note that this has been tested in **QT 4.8.6 with QT Creator 3.2**.

Usage

To use my application, run with Command + R. Draw points in the 2D Orthographic windows supplied as white windows with axes drawn. Manipulate points and draw new ones as you please. Use the clearly labeled options supplied in the main window to manipulate the environment. Too many options on at once will be confusing, so try to limit viewing options to a few at a time, even though it functions with all options enabled.

Algorithms

The algorithm to draw Catmull-Rom Splines is hard-coded for efficiency. The hard-coded values come matrix multiplication on MU and P, where MU is the polynomial breakdown of equations for catmull and P is the 4 points needed to interpolate over one segment.

For the generalized cylinder, I used a translation and rotate frenet algorithm instead of calculating the frenets at every point so that there is no harsh twisting that occurs on inflection points. The algorithm I am implementing is called the "[Rodrigues' Rotation Formula](#)". It's worth noting that I tried plenty of other algorithms to solve the inflection problem, and all of them failed. All other algorithms used were from the class slides.

Data Structures

QVector: A dynamic array. I used this data type because of the convenience given with built-in class member function calls such as `.last()` which returns a reference to the element at the last index. Also nice because it is dynamic, which means I don't have to worry about size.

QVector3D: An object that stores x, y, and z, being used to represent a point in the Cartesian plane, with z as the perspective value. I used QVector3D because it allowed for built-in class member function calls.

Extra Features

Features that I included that were not listed as requirements include:

- Radio buttons for toggling between generalized cylinder views: "No Cylinder", "Triangle Mesh", "Wire Frame - Cylinder", and "Wire Frame - Heart".
- Slider to make the cross-sections different radii
- Option to make the Cross Section an arbitrary polygon: a heart shape.
- Added Phong Shading to the Triangle Mesh view.
- Tension Slider
- Five toggle boxes for: Ground Plane, Axis, Control Points, Control Lines, Catmull Rom
- 2D Orthographic Viewports are scaled around the axis to give the user a better experience, in other words, the user does not have their points being added to the edge of the other 2D Orthographic Viewports