



Geometric Modeling

Assignment sheet 6 (Rational Splines, due June 13th 2008)

(1) Rational Bézier Editor [1+4 points]

- a. Create a new experiment. Use the GLGeometryViewer which allows adding control points interactively. Draw a control polygon by connecting subsequent user-defined input points. Additionally, display points (weight handles) on the edges that represent the weight ratio of neighbouring points (different colour) and a rational quadratic Bézier spline using the control polygon (use enough line segments to make it look smooth). If a weight handle lies on the midpoint of an edge it represents $w=1$. If it is positioned at either end of the edge it represents $w=0$ and $w=\infty$ respectively.
- b. Allow dragging of weight handles as well as regular points and update the spline interactively.
When a weight handle is dragged, project it onto and clip it to the corresponding edge.
Hint: To achieve interactive editing perform the necessary computations in the `update()` function of your experiment.

(2) Direct Spline Manipulation [1+7 points]

In this exercise direct manipulation of splines as known from vector editing tools will be implemented. That is dragging a point on a curve should result in a new curve that intersects the dragged point.

- a. Add a button that displays a suitable number of draggable points on the curve from (1). You may use regular or rational quadratic Bézier curves for this exercise.
- b. Allow dragging these points. Adjust the control polygon such that the curve changes as little as possible (local minima are acceptable) while enforcing that the curve intersects the dragged point. Keep the end points of the modified segment static. I.e. only change the position of the middle point.

(3) Circle fitting [1+6 points]

- a. Add a button that changes the weights of the first 3 control points and, if necessary, the position of the second control point, such that the curve is circular.
- b. Add a button that adds control points between the existing points and adjusts the weights such that a G^1 continuous curve is created that consists of circular segments. Note that after placing the first point the resulting curve is deterministic. This first point can be placed in any way you like. What conditions does this point have to adhere to for this exercise to be solvable?