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Assignment in Computer Graphics II

- Assignment 7 -Computer Graphics and Multimedia Systems Group David Bulczak, Christoph Schikora

Assignment 1 [2 Points] Evaluation of TP-Bézier-surfaces

Given the bi-quadratic Bézier-surface with control points

$$\mathbf{C}_{00} = \begin{pmatrix} 0\\2\\2 \end{pmatrix}, \qquad \mathbf{C}_{10} = \begin{pmatrix} 4\\2\\6 \end{pmatrix}, \qquad \mathbf{C}_{20} = \begin{pmatrix} 12\\2\\2 \end{pmatrix}, \qquad \mathbf{C}_{01} = \begin{pmatrix} 0\\6\\6 \end{pmatrix}, \qquad \mathbf{C}_{11} = \begin{pmatrix} 4\\6\\10 \end{pmatrix}$$
$$\mathbf{C}_{21} = \begin{pmatrix} 12\\6\\6 \end{pmatrix}, \qquad \mathbf{C}_{02} = \begin{pmatrix} 0\\14\\2 \end{pmatrix}, \qquad \mathbf{C}_{12} = \begin{pmatrix} 4\\14\\6 \end{pmatrix}, \qquad \mathbf{C}_{22} = \begin{pmatrix} 12\\14\\2 \end{pmatrix}$$

- 1. Evaluate twice the surface using the two-stage de Casteljau algorithm for the parameters (0.5,0.5):
 - First in *u* and then in *v* direction
 - Then first in *v* and then in *u* direction.
- 2. Determine the surface normal \hat{n} for the parameters (0.0,1.0).
- 3. Determine the surface normal \hat{n} for the parameters (0.5,0.5).

Assignment 2 [2 Points] Subdivision

In this task you will implement two subdivision schemes. Download the framework polygon-framework.zip and take an initial look on the code.

All relevant files for this programming tasks, related to subdivision, can be found in the Polygon folder. In Polygon/Polygon.hpp you can find the abstract base class for all further subdivision classes. It provides two abstract member functions evalPolygon, evalConstruct which you will have to implement for all derived classes at least. Please study this class, read the comments and try to understand it.

To build the project in your preferred development environment use the included CMake project ("CMake-Lists.txt"). CMake can be downloaded from the following website: http://www.cmake.org/. Use the instructions on the page

http://www.cmake.org/cmake/help/runningcmake.html and the tutorial page to create the project.

- 1. Implement the 4 point subdivision scheme in Polygon/4Point.hpp and Polygon/4Point.cpp.
 - evalConstruct: In this function you have to compute and store the intermediate results of the 4 point subdivision scheme. The results have to be stored in the point hierarchy contructedPoints_. It is a C++ std::map of point containers where the key value represents the algorithm level e.g. contructedPoints_.at(0) returns a PointContainer that contains the input points.
 - evalPolygon: In this function the polygon has to be evaluated. Push the resulting points into the std::vector polygonPoints_.
- 2. Implement the Chaikin subdivision scheme in Polygon/Chaikin.hpp and Polygon/Chaikin.cpp.
 - evalConstruct: In this function you have to compute and store the intermediate results of the Chaikin subdivision scheme. The results have to be stored in the point hierarchy contructedPoints_. It is a C++ std::map of point containers where the key value represents the algorithm level
 e.g. contructedPoints_.at(0) returns a PointContainer that contains the input points.
 - evalPolygon: In this function the polygon has to be evaluated. Push the resulting points into the std::vector polygonPoints_.

Hand in: 09.06.2016, , at beginning of the lecture or until 10:00 in the mailbox of the chair (next to room H-A 7107) or via e-mail.