Subdivision Surfaces analysis and interrogation exercises

Analysis

- Over what shape region is the basis function non-zero, of the ternary scheme whose non-zero coefficients form the pattern

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- What is the precision set (constant, linear , quadratic ?) of the binary scheme whose mask is

$$\begin{array}{ccccccccc c}
 & & 1 & & 3 & & 1 & & & \\
 & 3 & & 4 & & 4 & & 3 & & \\
1 & & 4 & & 8 & & 4 & & 1 & /14 \\
 & 3 & & 4 & & 4 & & 3 & & \\
 & & 1 & & 3 & & 1 & & &
\end{array}$$

- What is an appropriate univariate scheme to use for the boundaries of a surface defined by Loop's scheme, a binary scheme with mask

$$\begin{array}{ccccccccc c}
 & & 1 & & 2 & & 1 & & & \\
 & 2 & & 6 & & 6 & & 2 & & \\
1 & & 6 & & 10 & & 6 & & 1 & /16 \\
 & 2 & & 6 & & 6 & & 2 & & \\
 & & 1 & & 2 & & 1 & & &
\end{array}$$

- Analyse the continuity of Loop's scheme at an ordinary vertex
- Analyse the continuity of Loop's scheme at an extraordinary vertex of valency 8
- Does Loop's scheme have lateral artifacts ?

Interrogations

- Write an algorithm (in the style of the pseudocode in the notes and to the same level of detail) for the intersection of two surfaces by subdivision. Note that it will come out to rather more lines, as there is more to be covered.

- Write an algorithm for finding the first intersection of a given straight line (defined by a point Q and a tangent vector T) with a surface S by subdivision. 'First' means that the value of $[P - Q].T$ has the smallest positive value of all points P which are both on the line and on the surface. (It is the one which you see when your eye is at Q looking along T.)

- The silhouette curve is defined as the border curve between parts of a surface S which are lit by illumination from a given point Q and those parts which are not.

  What is the equation linking a point P of the surface, the given point Q and the surface normal N to S at P ?

  Write a pseudocode algorithm to compute the silhouette by subdivision.