Subdivision Surfaces: exercises

Biquadratic subdivision

Apply two steps of biquadratic subdivision to a cube.

You will need some coefficients for the triangle face. Use the stencil

$$\begin{array}{cc} 1 & \\ 4 & 1 \end{array} /6$$

and its rotations.

Apply two steps of biquadratic subdivision to a coarse toroidal shape with 16 vertices.

Box-splines

Expand out the generating function

$$(1+x)^2(1+y)^2(1+xy)^2$$

to give a mask. What are the stencils ?

Expand out the generating function

$$(1+x+x^2)^2(1+y+y^2)^2(1+xy+x^2y^2)^2$$

to give a mask. What are the stencils ?

Others

Determine the mask which results when

$$\begin{array}{ccccccc}
 & & -1 & & -1 & & \\
 & 0 & & 0 & & 0 & \\
-1 & & 10 & & 10 & & -1 \\
 & 0 & & 32 & & 0 & \\
-1 & & 10 & & 10 & & -1 \\
 & 0 & & 0 & & 0 & \\
 & & -1 & & -1 & &
\end{array} /32$$

is applied twice.

Remember that this is a $\sqrt{2}$ scheme, and so the configuration needs to be rotated through 45 degrees between the two steps.

Determine the mask which results when

$$
\begin{array}{ccccc}
 & & 1 & & \\
 & 2 & & 2 & \\
1 & & 4 & & 1 \\
 & 2 & & 2 & \\
 & & 1 & &
\end{array} \;/8
$$

is applied twice.

Remember that this is a $\sqrt{2}$ scheme, and so the configuration needs to be rotated through 45 degrees between the two steps.

Generation of all subdivision schemes

- Sketch one example of each of the eight categories possible within the combinations of quad, tri and hex grids and primal, dual, both and neither types.

  Draw the new grid in one colour and the old one in another.

- Sketch one example on a quad grid, one on a tri-grid and one on a hex-grid each of which has a complex arity.