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FRACTAL SURFACES

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Apart from self-similarity, fractal objects demonstrate specific properties distinguishing them from other geometrical objects. Examples include the Cantor set whose length tends to zero, the Sierpinski Triangle whose area tends to zero, the Van Koch Curve which is a crooked line which tends to the differentiable smooth curve.

Depending on their generation method, fractal objects can be divided into four types:

- classic fractals generated with the use of descriptive procedure

- fractals generated with the use of IFS method (*Iterated Function System*)

- fractals generated with the use of Lindenmayer system (L-system)

- fractal surfaces

Fractal surfaces are used to generate objects imitating natural landscapes. The literature on the subject gives examples of computer programs such as Terragen or Fractal Mountain Generator which generate fractal landscapes with the use of the random midpoint displacement algorithm. Depending on assumed surface tesselation, a triangle or a square can be the initial object. In both cases the method employs displacement of network nodes in the direction of Z axis. The procedure is applied recurrently for a denser and denser network of polygons. The values of the translation vector are set randomly. The randomness of the parameter selection is implied by the fact that in the case of a square network the quadrangular elements are transformed into triangular elements and at the same time in both cases self-similarity, which is characteristic of fractal objects, disappears. In the research an attempt was made to identify the rules of development of fractal surfaces which can be used in construction as roofing in sports and recreations facilities.

The following were assumed as basic principles:

- elimination of randomness when selecting the parameter of translation of network nodes as well as

- strict application of the recurrent transformation of elements of the fractal surface network

- in the case of surfaces with square tesselation - the selection of parameters guaranteeing the maintenance of a quadrangular network layout

The examples which were generated manually with the use of the 3D Studio Max Design computer program are polyhedral surfaces. Similarly to all fractal objects the generation process is dynamic. The parameters of the mesh decrease along with the increase of the number of steps in the construction, which is why the polyhedral structure tends to the differentiable smooth surface with a non-zero curvature.

Some examples of surfaces can be taken into account in further research on the use in construction as roofing in organic architecture.
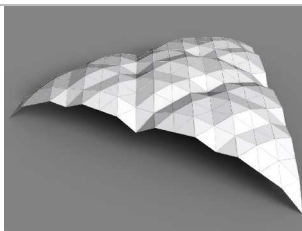

Fig. 1 An example of fractal surface

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