JOURNAL OF INNOVATIONS IN SCIENTIFIC AND EDUCATIONAL RESEARCH
VOLUME-2, ISSUE-13 (26-December)

GEOMETRIC MODELING AND VISUALIZATION OF SELF-SIMILAR STRUCTURES BASED ON FRACTAL THEORY

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Annotation: *The article is devoted to constructing the equation of fractal structures using the L-systems method, applying the recursion procedure. Using the elementary geometries of objects and constructive tools of the L-systems method, various fractal equations are created. Based on these equations, various pre-fractals are generated by determining the number of iterations and the inclination angle.*

Keywords: *Fractal, Fractal graphics, Geometric modeling, B. Mandelbrot, Fractal geometry of nature, Quasi-fractal, Multifractal, Ultra Fractal program, ChaosPro, fraction. Cantor's Dust, Peano.*

1. INTRODUCTION

Fractal graphics, like vector graphics, are based on mathematical calculations, The performance of fractal graphics is the formulas describing the lines and linear surfaces, that is, no objects are stored in the computer memory, and the image is created only according to the formulas (equations). Many objects in nature have fractal properties, such as coasts, clouds, tree crowns, and the circulatory system. Fractals are popular for combining beauty with the simplicity of computer-aided construction, especially in aircraft.

Fractal geometric objects can be divided into infinite parts, each of which will be similar to the original. They are usually self-similar and scale-independent. These fractals can be created using a repeating pattern. As an example of a fractal, we can take the Koch snowflake.

Let a complex domain $\Omega \subset R^2$ with a boundary Γ be given as a combination of simple domains $\{\Omega_k\}_{k=1}^m$ with the help of set-theoretic operations of interection, union and complement. If the implicit eqution of the boundaries of these are known ,

$$f_1 \wedge f_2 \equiv f_1 + f_2 - \sqrt{f_1^2 + f_2^2}, \quad f_1 \vee f_2 \equiv -(\overline{f}_1 \wedge \overline{f}_2), \quad \overline{f} \equiv -f.$$

$\{\omega_k(x,y)=0\}_{k=1}^m$ such as $\omega_k > 0$ with (x, y) ∈ Ωi and ωk < 0 with The most common system of L-systems is the system 0, whose algebra logical operations are

Consider constructing the equations of the Koch curve based on L-systems

There are many editors for creating fractal images. We considered the following most common and inexpensive fractal graphics generator programs: UltraFractal, FractalExplorer, ChaosPro, Apophysis, Chaoscope. The following criteria were selected for comparing programs for creating fractal graphics in the work process: image export, construction of several fractals in different windows at the same time, creation of three-dimensional images of fractals based on simple two-dimensional images, availability of a library of standard formulas and o z format, distribution method, principle of creating fractal images, etc. working with layers, adjusting color parameters, the ability to create animations, the level of complexity of the work interface

Fractal Editor is a free geometric fractal editor. This is one of the most primitive fractal graphics programs. Its interface is very simple and easy to use. The interface consists of a menu bar at the top, a window for viewing the finished pattern, as well as a bottom line with a number level indicator. The top row consists of the following buttons and elements: "Auto refresh", "Refresh", "Depth", "Side", "Outgoing number", "Save". "Auto-refresh" and "Refresh" are two related options, if the box next to "Auto-refresh" is checked, the image on the screen will change automatically after performing this or that action.

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