EasyChair Preprint

№ 3890

Computer Generation of Fractals Some Methods and Techniques

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January 17, 2023

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Some Methods and Techniques

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Abstract Fractals are objects, have the property of a system scale invariance or self-similarity. These objects are accursed in nature in the form of cost, hills, clouds, and waling act. These structures are need computer assistance for a generation. In this paper, the fractal dimensions were studied. Some methods and techniques are studied to simplify the Computer generation of fractals. Python programming is given to generate fractal graphics.

Keywords fractals, fractal generation, fractal dimension, iteration, recursion, parallelism, python.

I. INTRODUCTION

Fractal structures of nature [1] are similar to themselves on different length-scales of observation. This geometrical property is studied for a great variety of irregular shapes, many of which result from the growth process.

Fractals geometry is introduced by Mandelbrot [l} as ” the Geometry of Nature”. Clouds are not spheres, mountains are not cones, coastlines are not circles and nor does lightning travel in a straight line, says Dr. Beroit Mandelbrot.

Human expertise is not sufficient to generate Fractals of nature. Fractals need computer assistance. Even Computer programming also requires methods and techniques to generate fractals. In the following, some methods and techniques are proposed for Computer generation of fractals.

Manuscript received 21-12-2020

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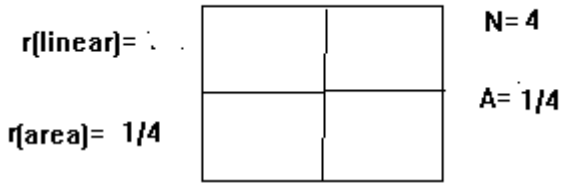
II. FRACTALS AND **DIMENSION:**

Fractal is defined as similar to themselves of geometrical shapes. For instance, coastlines, mountains, rivers, etc. The fractal structures are studied through the fractal dimension and defined by

$$D = \log N(h)/\log(1/h)$$

Where h is the length of line-segment and N(h) is the number of line-segments.



$D=\log N/\log(1/r) = \log 4/\log 2 = 2$

Figure 1. Fractal scaling

III. METHODS AND TECHNIQUES:

Computer generation of fractal shell be simplified by introducing methods and techniques. In the following, three methods and techniques are introduced to simplify the complexity of Computer generation of fractals.

a. **Iteration**

Iteration is the method in which output function value may be taken an input value to the function. This method is proposed to reduce the complexity of Computer generation of fractals.

This is given by
n = f (n)
For instance, N
1
2
4

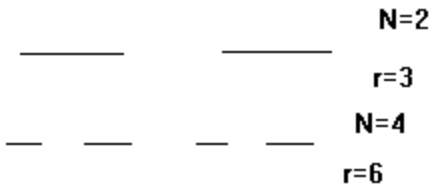


Figure 2. Iteration

D== log(2/3) = 0.63 09

Here, the number of self similarities can be defined as N = f(N).

b. Recursion:

Recursion is a process that calls itself, directly or indirectly. This method can be applied to simplify the complexity of Computer generation of fractals using programming.

For instance, consider the generation of the Koch curve. The recursion method is applied to call self-similarity.

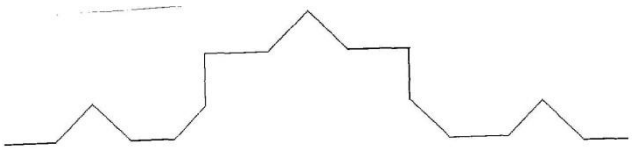


Figure 3. Recursion

D=log 4/log 3 = log 16/log 9=.26

c. **Parallel fractals**

The parallel processing technique is divide number of sub-task of the task and each task will processed independently with individual processors in the Multiprocessing computer system. This parallel processing technique is proposed for Computer generation of fractals when the large number of computations and having the number of sub-tasks. The computer generation of fractals, in which the fractal can be divides into the number of sub-tasks, and each sub-task will be processed with independent processor and generate the self-similarities.

For instance, consider the Sierpinski gasket in which the triangle is divided into three triangles and each triangle will self-similarly generate with independent processor in Multiprocessing computer system.

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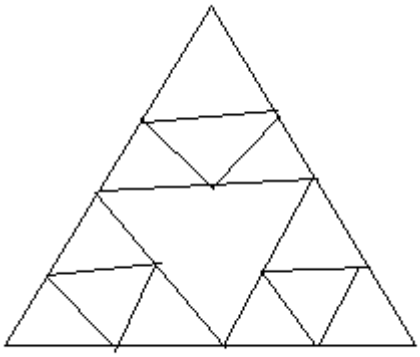

Figure 4. Parallel . Sierpinski gasket

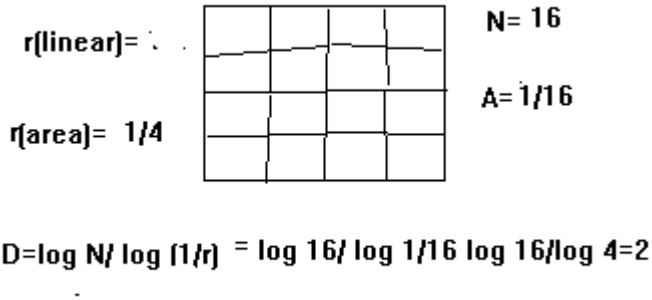

Figure 5. Parallel fractals

IV. COMPUTER GENERATING FRACTALS

Computer generation fractals are any type of graphics with sale-similarities [3]. The recursion technical is used to generate fractals with self-similarities. The applications of fractal graphics ranging from graphics design to designing fractals on garments Python Programming is to generate Fractal Graphics [2]

```
# Fractal generation with phython
from turtle import *
def mink(lengthSide, levels):
        if levels == 0:
                forward(lengthSide)
                return
        lengthSide /= 3.0
        mink(lengthSide, levels-1)
        left(60)
        mink(lengthSide, levels-1)
        right(120)
        mink(lengthSide, levels-1)
        left(60)
        mink(lengthSide, levels-1)

if __name__ == "__main__":
        speed(0)
        length = 300.0
        penup()
        backward(length/2.0)
        pendown()
        for i in range(4):
                mink(length,4)
                right(120)
        mainloop()
```

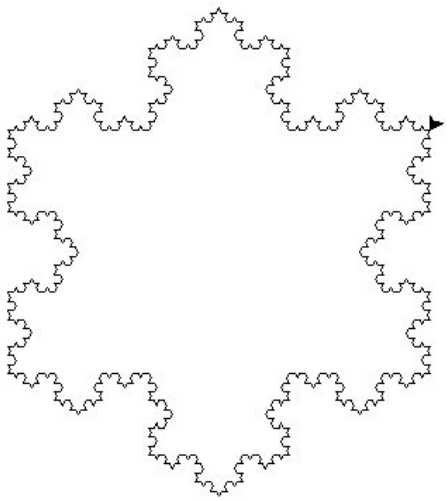

Figure 6. Koch curve

V. **CONCLUSION:**

Fractals are structures which having the property of Scale-invariance or self-similarity. Self-similarity of a system implies that features of a structures are lookalike similar structures at different scales of length. Fractal Graphics have the number of applications in designing clothes and crafts. These a pplications are describes as fractals. Fractal dimension will identify the fractal structures or not. For instance, circles are not fractals. Different fractal structures are studied. The methods and techniques are also proposed for Computer generation of the fractals to simplify the process.

Références

[1] B.B. Mandeibrot, The fractal geometry of nature, W.H. Freeman, San Francisco, 1982.

[2] Timoti Budd, Exploring Python, tata McGraw-Hill, New Delhi, 2010

[3] Poli Venkata Subba Reddy, "Computer Generations of Fractals", National Conference on Fractals and Its Applications, University of Hyderabad, Hyderabad, February21-23, 1991