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Computer Generation of Fractals Some Methods and Techniques

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

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

I. INTRODUCTION:

Fractal structures of nature are similar to themselves on different length-scales of observation. This geometrical property has been studied for a great variety of irregular shapes, many of which result from 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 Bark is not smooth, nor does lightning travel in a straight line, says Dr. Beroit Mandelbrot.

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

II. FRACTALS AND **its DIMENSION:**

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

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

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

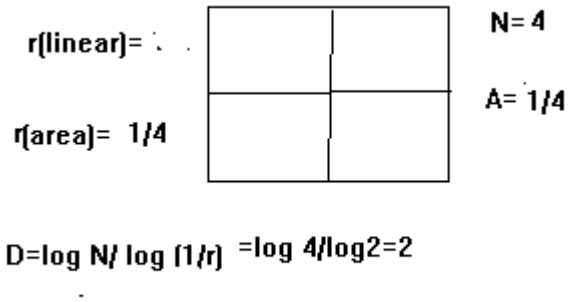

Figure 1. Fractal scaling

III. METHODS AND TECHNIQUES:

Computer generation of fractal may be simplified by introducing methods and techniques. In the following, three method 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 as input value to the function. This method is proposed to reduce the complexity of Computer generation of fractals.

This is defined as n = f (n)
For instance, N
1
2
4

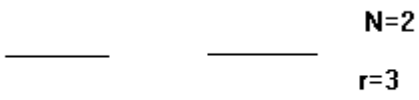

Figure 2. Iteration

= 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 Koch curve. The recursion method is applied to call self-similarity.

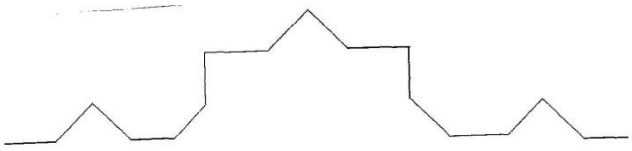

Figure 3. Recursion

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 large number of computations and having the number of sub-tasks. The computer generation of fractals, in which the fractal can be divided into number of sub-tasks and each sub-task will be process with independent processor and generate the self-similarities.

For instance, consider the Sierapinski 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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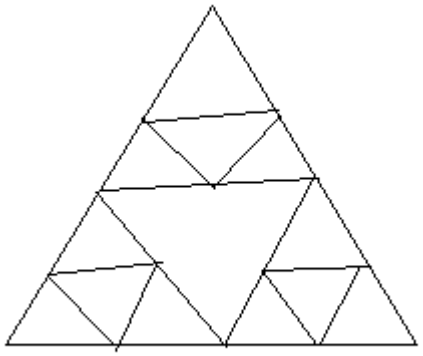
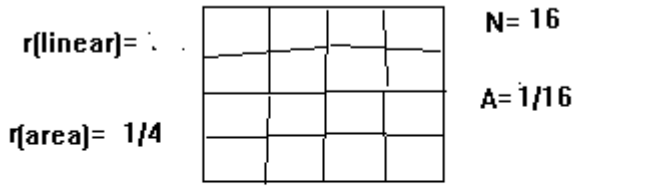


Figure 4. Parallel . Sierapinski gasket



D=log N/ log (1/r) = log 16/ log 1/16 log 16/log 4=2

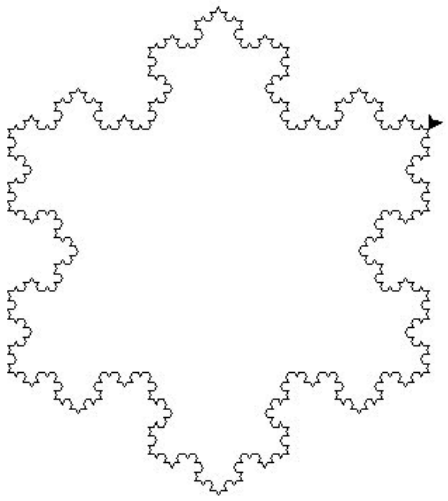
Figure 5. Parallel fractals

IV. COMPUTER GENERATING FRACTALS

Computer generation fractals are any type of graphics with sale-similarities. 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

```
# 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()
```



V. **CONCLUSION:**

Fractals are structures having the property of Scale-invariance or self-similarity. Self-similarity of a system implies that features of a structure or process look alike similar at different scales of length. It has number of applications in designing cloths and crafts. This structure describes as fractals. The fractal dimension will identify the fractal structures or not. For instance circles are not fractals. The fractal structures are studied. The methods and techniques are also proposed for Computer generation of the fractals to simplify the process.

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