BRIDGES
Mathematical Connections
in Art, Music, and Science

The Ghostly Imagery of Strange Attractors

Robert J. Krawczyk
College of Architecture
Illinois Institute of Technology
3360 South State Street
Chicago, IL, 60616, USA
E-mail: krawczyk@iit.edu

Abstract

Expanding on the previous investigation of strange attractors, a new series of image are produced by generating and reviewing a wider range of potential parameters. The concept of the ghostly imagery is pursued further with additional methods being developed to review a greater variety of parameters to determine which images lay within this chaotic dimension.

1. Introduction

Clifford Pickover [1] extended some of his previous writings on three-dimensional chaotic or strange attractors by including a series of two-dimensional attractors based on a simple equation consisting of sine functions. The most intriguing aspect about these images was the variations possible by the execution of a simple iterative mapping with minor changes in parameters. The visual complexity of the interior detail within the image and the visual perception of a third-dimension as curves began to suggest surfaces became the starting point for this development. Joel [2], Sprott [3], and Bourke [4] also demonstrated this type insight into strange attractors.

2. The Element of Time

In Krawczyk [7] the element of time as density was investigated. Pickover had suggested the rendering the strange attractors be based on the number of times a point was visited. An alternate method was developed that tracked the last time a point was visited, this became the basis for assigned a color to that point. This method began to uncover some of the subtle curves that were apparently found within the attractors.

The initial method used to generate the strange attractors was to exercise the equations from Pickover and Bourke and vary values, functions, and possible parameters. Figure 1 displays the general parameters for the final equations developed. The first set of images was generated with each having twelve-to-fifty-four million computed points. During this process nineteen other equations were developed and investigated. To better understand the scope of these equations, a second review of them was performed. Custom software was written to take these equations and within a set range of values generate random variations. A total of 24,000 images were generated from twenty-four equations. Each image was reviewed and then approximately 200 were selected for further rendering. From these a group of sixteen has been developed for exhibit.

Figure 2 displays two of these images in grayscale; the final ones are red on a black background. They seem to be related to a shell. Natural growth over long periods of time results in patterns that are

normally not seen. Simple growth controlled by time begins to make these complex patterns visible. The shell is just such a container to hide such wonder, a wonder that is normally not considered because we only view a shell's surface markings. Under this surface lies a possible complexity that can only be imagined, never followed logically, never fully understood. The complete 2003 series is in Gallery Two of: www.netcom.com/~bitart/chaos

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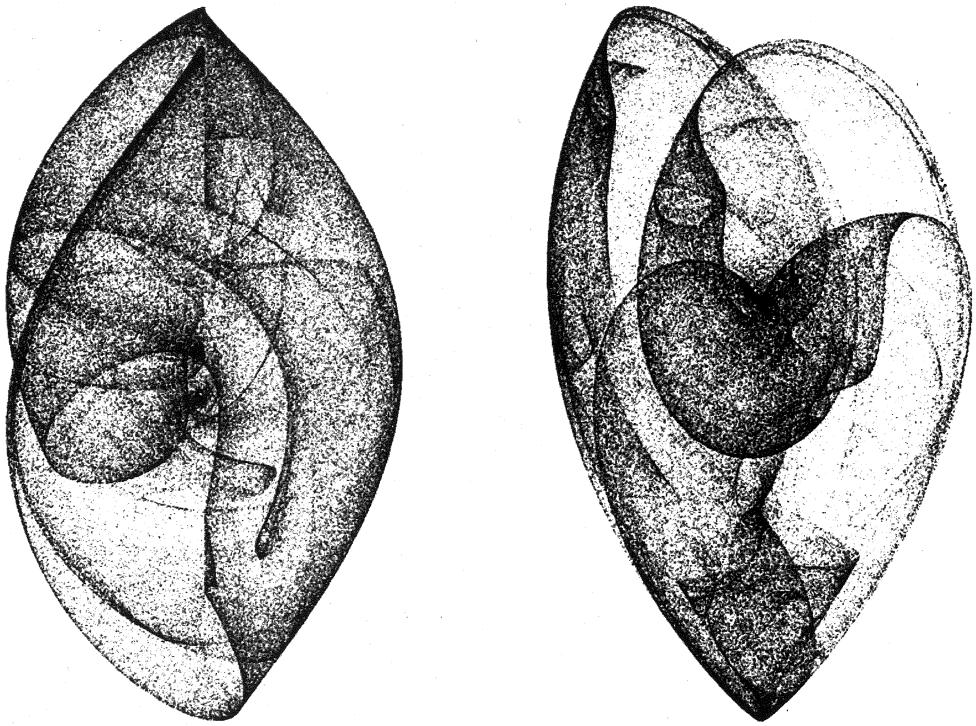
Xpt_t = v1(m1(f1(v2p1)^v3)) + v4(m2(f2(v5p2)^v6)) + v7(m3(f3(v8p3)^v9))
Ypt_t = v10(m4(f4(v11p4)^v12)) + v13(m5(f5(v14p5)^v15)) + v16(m6(f6(v17p6)^v18))

v1-v18 = values m1-m6 = As is, ABS, NEG, SIN, or COS f1-f6 = As is, SIN, or COS
p1-p6 = Xpt_{t-1}, or Ypt_{t-1} + = +, -, *, or /

Figure 1: *Strange Attractor equation parameters.*



Within Shell I, 2003 *Within Shell II, 2003*

Figure 2: *Shell imagery.*

References

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