Inverse Circular Saw

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ABSTRACT
Superior Mandelbrot set is the term, which Rani and Kumar used to make Circular Saw using complex polynomial equation z^n+c .The objective of this paper is to analyze the fractals using same equation with condition; when n is negative.

Keywords
Superior Mandelbrot set, fractals, Circular Saw, Escape Criteria, Mann Iteration

1. INTRODUCTION
It has been shown that the earth terrain has fractal characteristics and the use of fractal theory for analysis of SAR images have been discussed extensively by researchers [9], [10]. The self-squared function, $z = z^2 + c$, for generating fractals has been discussed extensively in the literature [2], [3], [4]. The generalized transformation function z^n+c for positive integer values of *n* has been considered by K. W. Shirriff [11] . The *z* plane fractal images for the function z^n+c for positive and negative, both integer and non-integer values of n have been presented by Gujar along with some conjectures about their visual characteristics [12], [13]. Generally, Mandelbrot set lives in complex plane. D.Rochon [5] studied a more generalized form of Mandelbrot set, which lives in bi-complex plane. Rani and Kumar [6] introduced superior iterates (essentially due to Mann [8]) in the study of fractal theory and created superior Mandelbrot sets. They also introduced the superior iterations on a more general setting in the study of Mandelbrot sets of quadratics, cubic and other complex-valued polynomials and, discuss some related properties [1]. Rani and Kumar also conjectured [7] that the Superior Mandelbrot set for $z^n + c$ is circular when n is large.

In this paper we are going to generate the fractals and apply Mann iterations using the same equation when n is negative. We have studied some properties of Circular Saw using same equation and it will also become Inverse Circular saw in many cases.

2. PRELIMINARIES
Let *X* be a metric space of complex numbers, *D* be nonempty convex subset of *Z* and *T* be a selfmap of *D*, let $z_0 \in D$

The Mann Iteration is defined by:

$$z_{n+1} = (1-\omega)z_n + \omega.\ \theta_c(z) \qquad \text{Eq (1)}$$

Where $0 < \omega < 1, n \geq 0$ and $\theta_c(z)$ can be a quadratic, cubic, or biquadratic polynomial.

When we apply Mann Iteration on Mandelbrot with complex polynomial equation z^n+c, is called Superior Mandelbrot set. The iteration of all values for which the point escapes from the unit circle. The set of all those points is known as escape set.

2.1 Escape Criteria for Quadratic Function:
For $n = 2$, the escape criteria is depends on a constant value or $(z>=1/\omega)$

2.2 Escape Criteria for Cubic Polynomial:
The escape criteria for the cubic polynomials by using Mann iteration for n=3, the escape criteria is $(z>=((1+b)/2\ \omega)^{1/2})$

2.3 Escape Criteria for General Polynomial:
The escape criteria for the general polynomial equation by using Mann iteration procedure in general for n is

$$z \geq \left(\frac{1}{\omega}\right)^{\frac{1}{n-1}}$$

3. GENERATION OF SUPERIOR MANDELBROT SETS
Here we are generating superior mandelbrot sets using polynomial complex equation $\theta_c(z) = z^n+c$ where n is negative and $n \geq 2$.

Initially with $n = 2$ and $\omega = 1$, the equation shows basic Mandelbrot set (see Figure 1).

3.1 Superior Mandelbrot set for $\theta_{-10,c}(z) = z^{-10} + c$

We have drawn superior Mandelbrot sets for ω = 0.5 and 0.7 with the same value of n in Figure 2 and 3 respectively.

3.2 Superior Mandelbrot set for $\theta_{-25,c}(z) = z^{-25} + c$

See the Superior Mandelbrot sets for ω = 0.5 and 0.9 in Figure 4 and 5 respectively.

3.3 Superior Mandelbrot set for $\theta_{-100,c}(z) = z^{-100} + c$

We have generated Superior Mandelbrot sets for $z^{-100} + c$, taking ω = 0.6 and 1.0 in Figure 6 and 7 respectively.

3.4 Superior Mandelbrot set for $1< \omega <=2$

Generally the value of ω exists range in [0, 1] for positive values of n In this paper we have generated the superior mandelbrot sets with extended range of ω [0, 2]. See superior mandelbrot set for ω=2 and n=100 in fig 8. This figure depict image in the vicinity of circular saw.

4. CONCLUSION

In this paper, we have generated many Superior Mandelbrot figures and also analyzed their features. For z^n+c, the range of ω is [0,1].But for the for the z^{-n}+c the range of ω has changed and now the range is [0,2].

For the ω =2 and n= -100, the figure looks like a complete circle.

We also analyzed as the value of n negatively increases the number of prime bulbs increase in inverse direction. We have given the new term “Inverse Circular Saw” for the resultant figures.

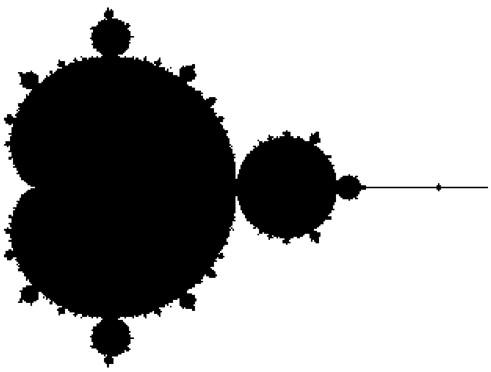

Figure 1: Basic Mandelbrot set

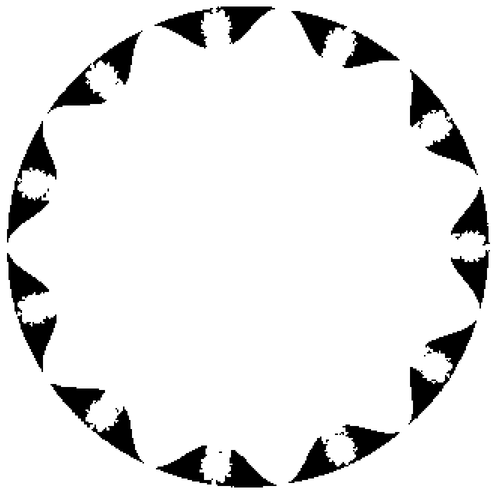

Figure 2: Superior Mandelbrot Set with n=-10, ω = 0.5

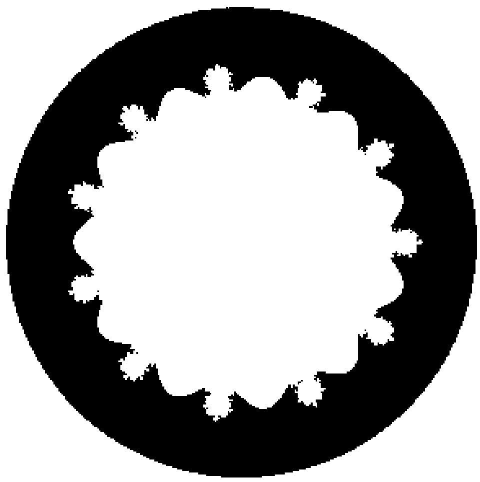

Figure 3: Superior Mandelbrot Set with n=-10, *ω* = 0.7

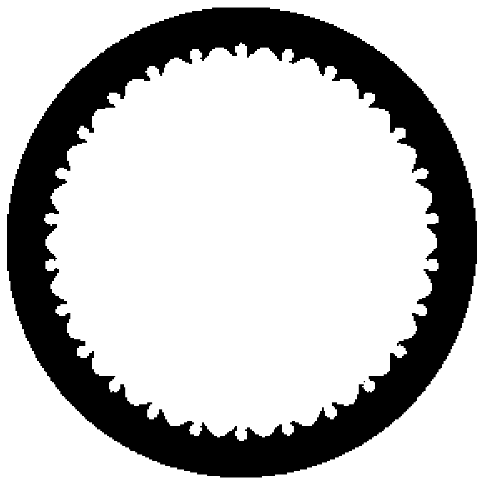

Figure 4: Superior Mandelbrot Set with n=-25, *ω* = 0.6

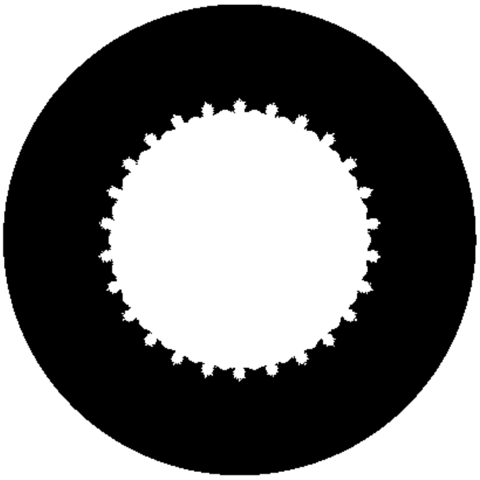

Figure 5: Superior Mandelbrot Set with n=-25, ω = 0.9

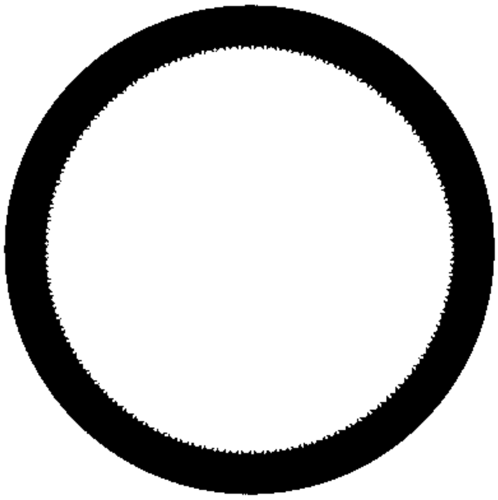

Figure 6: Superior Mandelbrot Set with n=-100, ω = 0.6

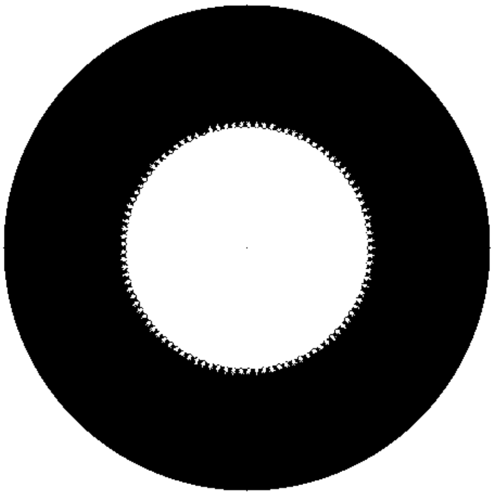

Figure 7: Superior Mandelbrot Set with n=-100, ω = 1

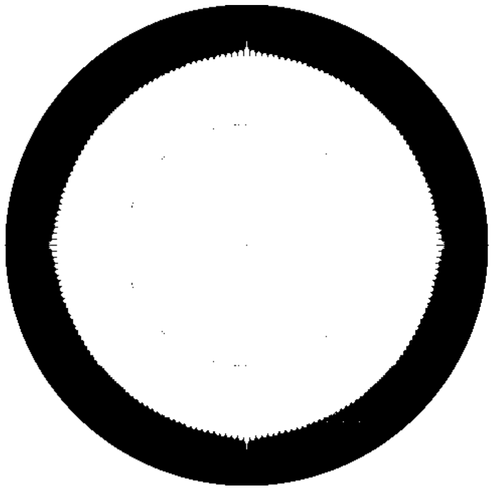

Figure 8: Superior Mandelbrot Set with n=-100, ω = 2

5. REFERENCES

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