GIS'F FRACTAL ANALYSIS WITH PIVOTING GRAPHIC

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RESUMEN: En este trabajo se presentan las estaciones de modelado precios geométricos fractales de Capital Markets en París, Franfuk, Londres, Tokio, Nueva York y México, nuestro objetivo es lograr una mayor rentabilidad de las inversiones realizadas en el tiempo Ex Ante y que sirvan de referencia en tiempo iterativos Ex post, para ello utiliza la metodología de los sistemas de información geográfica y la aplicación de análisis fractal GIS'F de recurrencia vía armónica, series de Fourier, a diferencia de términos, esfera tridimensional y los campos de difracción de Fresnel de la acción del mercado para su compra y funciones de venta .

Palabras clave: Fractal, difracción, el costo, el margen; inversión de títulos.

ABSTRACT: In this paper we present geometric modeling fractal stations prices of Capital Markets in Paris, Franfuk, London, Tokyo, New York and Mexico, our goal is to achieve a better return on investments made in time Ex Ante and to serve as references in time iterative Ex Post, for this we use the methodology of geographic information systems and implement GIS'F fractal analysis of recurrence via Harmonic, Fourier series, Unlike terms, Three-dimensional sphere and Fresnel diffraction fields of action of the market for their buying and selling functions.

Keywords: Fractal; diffraction; cost; margin; inversion de titles.

1. Introduction.

Fractal analysis is related to chaos theory because it recognizes that not all models studied are linear, as in the case of the models used to analyze financial markets. This is one of the advantages to work with Fractals applied to the financial economy; we can work with broken trends without harmony in market risks, so sticks closer to reality. The assumptions of the fractal-dimensional method, are modeled through 50 sine and cosine functions with logarithms maximum price ranges and minimum price range 100,000 times in three-dimensional scales and fourth (includes Joint leakage points), demonstrating a advantage over the use of quantitative method in which the two elements are bagged study the average Julia set's financial growth in order.Overall we can say that in times of economic boom movement intensifies, the number of participants increases, the money is readily available, the investment is made quickly, allowing growth profitability, companies are capitalized and their instruments tend to rise in price. It also suggests that when markets are efficient, adjustment to the information has to be instantaneous, hence in an efficient market can verify the relevance of information noting whether prices adjust after publication. A discrete dynamical system is a pair (x, f) where X is a field and $f : X \to X$. Given a point $x \in X$, set $\{x, f^1(x), f^2(x), f^3(x), f^4(x), \ldots\}$ will be called the orbit of X , where $f^n(x) = f \circ \cdots \circ f(x)$, therefore consider the classification of fixed points according to their properties in a complex dynamic system (C, f) , are as follows:

$$z_0 \in C,\ z_0 \text{ itself is a point attractor} \left| f'(z_0) \right| < 1 \tag{1}$$

$$z_0 \in C,\ z_0 \text{ itself is a repulsor point} \left| f'(z_0) \right| > 1 \tag{2}$$

$$z_0 \in C,\ z_0 \text{ itself is an indifferent point} \left| f'(z_0) \right| = 1 \tag{3}$$

$$z_0 \in C,\ z_0 \text{ is a super point attractor itself} \left| f'(z_0) \right| = 0 \tag{4}$$

The dimension[1] is then a quantitative measurement of the fractal properties of self similarity.

[1] Is sometimes used with respect to analytical processes have been divided into two parts. One dimension of cash flows could result in the separation of payment of mortgage interest and principal cash flows and direct these to different investors.

1.1. Fractal Replication of Market Prices.

The topology of the complex plane[2] can be designed through the equivalence set of Riemann between the sphere and the complex plane, ie the projection of the points of the radio unit sphere with center N , tangent to the complex plane on it, following a bijection. From the geometric point of view, complex numbers can be identified with the Cartesian plane points by matching the complex $\mathrm{z} = \mathrm{a} + \mathrm{bi}$ point (a, b) , as shown below:

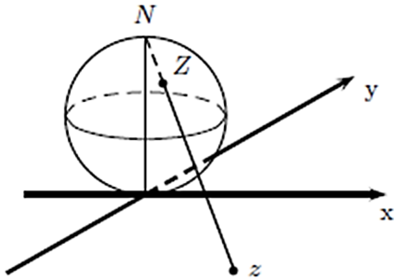


Figure 1: Riemann Sphere.

Complex numbers can be identified with the points of the Cartesian plane by matching the complex point.

There are different fractal dimensions, the simplest is the dimension of similarity Auto: d = Log (N) / Log (M) → Md= N; where M is the number of parts in which the object will be divided, d is the dimension of the object and N the number of resulting parts. Is used only in case the object is geometrically similar car, so that the resulting pieces are self-similar to the original object. In the case of a segment divided into three equal parts ; d=1, M=3 → N=3, an area divided into three parts each side ; d=2, M=3 → N=9 and a bucket [3], dividing each side into three parts; d=3, M=3 → N=27.

[2] In a space of a single dimension (as a line), a hyperplane is one point divides a line into two lines. In a two-dimensional space (such as the xy plane), a hyperplane is a line, divides the plane into two halves. In three dimensional space, a hyperplane is a plane current, divided the space into two halves. This concept may be applied to four-dimensional space and where these objects are simply called splitters hyperplanes, since the purpose of this nomenclature is to link with the plane geometry.

[3] A cube, and is a hexahedron, may also be classified as a parallelepiped rectangle straight because all sides are parallel sides and four pairs, and even as a prism with a square base and height equal to the side of the base.

The capacity dimension allows evaluation of the dimension of geometrically irregular objects. Instead of having similar auto parts resulting (N) will count the number of circles N(r); where the dimension of capacity is the value of Log N(r) / Log (1/r) when r tends to 0[4]. Topological dimensión [5] describes the way in which the points of an object are connected to each other. Indicates whether the object is an edge, or a solid surface and its value is always an integer. There are several ways to determine it: i) Size of Coverage: calculate the smallest number of sets needed to cover the object, which may overlap. If each object point is covered by no more than G sets then the dimension of coverage is d = G-1 ii) Dimension Iterative: Based on the edges of the D-dimensional space has dimension d-1 as well, all three-dimensional volume can be surrounded by two-dimensional planes. Is calculated by looking for the edges of the edges up to the dimension 0 *(point)*. The number of times on the operation (H) equals the dimension d = H.

Finally Underlying Dimension [6] *(embedding)*: describes the space containing the fractal object. Indicates whether a line, area or volume. Its value can be an integer or a fraction and it is difficult to identify the appropriate underlying dimension. A Mandelbrot set is built according to the iterative process on a complex dynamic system with $z_0 = 0$ and the complex constant c such that $\{f^n(z)\}_{n=1}^{\infty}$ is bounded, this follows another complex constant $|c| < 2$, otherwise $c \notin M$ and orbit $z_0 = 0$ diverges. Note that the point $z_0 = 0$ with $c \in M$ and $f_c(z) = z^2 + c$, converted to z_0 at one point to super attractor, as $|f_c{}'(0)| = |2(0)| = 0$, iterations to construct M are expressed as:

$$f^1(0) = c,\ f^2(0) = c^2 + c \ \text{ with } n = 1,2,\ldots\ ;\ z_0 = 0\ \&\ C = |c| < 2 \qquad (5)$$

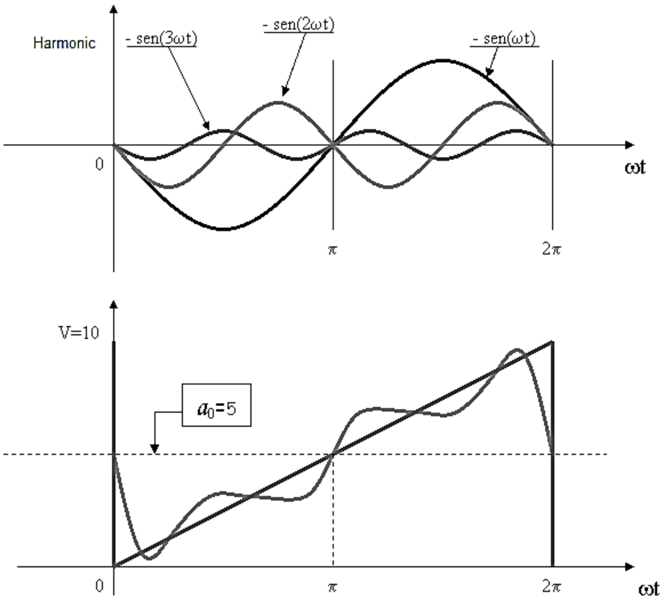
Most of the pictures of the Mandelbrot set usually appear colored depending on the speed [7] with each point converges to infinity, these points can be plotted according to the algorithm called "Escape time algorithm," presented below: For each point c, calculate its orbit, iterating $f_c(0)$ a number $n \propto 100$ times, if it remains bounded by the circle centered at the origin of radius 2, then we can reasonably assume that is

[4] Marrero , J.C. Symplectic geometry and science (2002). A walk through the geometry. Department of Mathematics, University of Ohio .Pp.183.

5 He is interested in concepts such as proximity, number of holes, the kind of consistency (or texture) having an object, compare and classify objects and also other attributes.

[6] It's invisible can not go in a certain factor, plus it has a monotonous process and is not completely finished it may happen that a function is not continuous throughout its domain of definition. If a function is continuous at one point, he said that the function has a discontinuity at that point and that the function is discontinuous.

[7] Speed is a physical quantity expressing vector nature of an object displacement per unit time. She is represented by o. His unit in the International System is the m / s. By its vector character, to set the speed to be considered the direction of travel and the module, which is called speed or quickness.



within M ; if for some iteration $k < n$ "Escapes" from this circle, it is decided that does not belong to M and stops for the iteration $n+1$, namely, $f_c^{n+1}(0)$. If each number $0 < k < n$ is assigned a color, and representing each c by Color k , for which the orbit c diverges, we get the beautiful designs that characterize the Mandelbrot sets. For there to be an aperiodic signal in prices can be represented by a harmonic series or Fourier, must respect the Dirichlet conditions:

- Having a finite number of discontinuities in the period T, in case of discontinuous.
- The average value in the period T, is finite.
- Have a finite number of positive and negative peaks.

For the case p=0, we have nothing but the geometric series evaluated ½. To p >0, what we have is the leading term of the derivative and of this, evaluated at that point.

Figure 2: Playing with Breasts price signals.

To find the sum, we derive p times to 1 / (1-z), isolate the leading term so that only depends on series of the same type with lower order powers p and then evaluate at z =

½, the analysis Fourier synthesis is called recombination of trigonometric series terms to reproduce the original signal (in our case the volatility of the price of the shares issued).

Since this signal has discontinuities, the series does not converge quickly. It is verified that with increasing the number of terms in the series, the final wave irregularities decreases and approaches the original signal.

And note that in the interval where the signal is continuous, the wave of the series converges, with some imperfections, the original signal, and places of discontinuities, the wave converges to the mean value or market stability, the series Fourier is as follows:

f (x) = 2/pi (sen x + ½ sen 2x + 1/3 sen 3x + ¼ sen 4x + 1/5 sen 5x +… 1/n sen nx)

(6)

As in the above description, when determining the components of a vector8, we can determine the coefficients Cn by the inner product. Multiplying the above equation by $\emptyset_{m\omega(x)}e$, integrating in the interval [a,b] Rates of Ex Post and Ex Ante, we obtain:

$$\int_{-p}^{p} f(x)\emptyset_n(x)dx = c_o \int_{p}^{p} \emptyset_0 (x)dx + c_1 \int_{p}^{p} \emptyset_1 (x)\, \emptyset_m(x)dx + \cdots + c_n \int_{p}^{p} \emptyset_n (x)\, \emptyset_m(x)dx + \cdots \tag{7}$$

Because of the orthogonality, each term of the right side of the last equation is zero except when m=n. In this case we:

$$\int_{-p}^{p} f(x)\emptyset_n(x)dx = c_n \int_{p}^{p} \emptyset_n^2 (x)dx \tag{8}$$

Then the coefficients of prices that we seek are the ranges and divide by the number of companies that have:

$$c_n = \frac{\int_2^{\emptyset} f(x)\emptyset_n(x)dx}{\int_2^{\emptyset} \emptyset n\,(x)dx} \tag{9}$$

[8] A vector field is a construction of vector calculus which associates a vector to each point in Euclidean space.

The coefficients $a_0, a_1, a_2, \ldots..$ can be determined as described for the generalized Fourier series and integrating both sides, from –p *(cost) to* p *(margin), we obtain:*

$$\int_{-p}^{p} f(x)\, dx \frac{a_0}{2} \int_{-p}^{p} dx + \sum_{n-1}^{\omega} (a_n \int_{-p}^{p} \cos \frac{m\pi}{p} x dx + b_n \int_{-p}^{p} \operatorname{sen} \frac{n\pi}{p} x dx) \tag{10}$$

n>1, is orthogonal to 1 in the range, the right side is reduced to a single term, and therefore:

$$\int_{-p}^{p} f(x) dx = \frac{a_0}{2} \int_{-p}^{p} dx = \frac{a_0}{2}\ x \int_{-p}^{p} = pa_0 \tag{11}$$

Solving a_0 is obtained:

$$a_n = \frac{1}{p} \int_{-p}^{p} f(x)\, dx \tag{12}$$

Now multiply by cos (mπx /p) and integrate all ranges of stock prices:

$$\int_{-p}^{p} f(x) \cos \frac{m\pi}{p} x dx = \frac{a_0}{2} \int_{-p}^{p} \cos \frac{m\pi}{p} x d \ \sum_{n-1}^{\omega} (a_n \int_{-p}^{p} \cos \frac{m\pi}{p} x \cos \frac{m\pi}{p}\ x dx + b_n \int_{-p}^{p} \cos \frac{m\pi}{p} x \operatorname{sen} \frac{m\pi}{p}\ x dx) \tag{13}$$

In a similar way when *f* is odd in the range (-p,p),

n = 0 , n=0,1,2,...,

$$b_n = \frac{2}{p} \int_{0}^{p} f(x) \operatorname{sen} \frac{n}{p}\ x dx \tag{14}$$

Considering all the sines and cosines of the behavior of stocks we will mention, its general form for the function:

$$f(t) = \frac{a\,0}{2} + \sum_{n-1}^{\omega} [\![a_n = \frac{e^{j.n\,\omega.t +}\, e^{-jn\omega.t}}{2} + b_n \frac{e^{j.n\,\omega.t -}\, e^{-jn\omega.t}}{2'j}]\!] \tag{15}$$

We are using on how to form a Fourier series expansion in very simplified:

$$f(t) = \frac{a\,0}{2} + \sum_{n-1}^{\omega} [\![a_n = \frac{e^{j.n\,\omega.t}}{2} + a_n \qquad \frac{e^{j.n\,\omega.t}}{2} + b_n \frac{e^{j.n\,\omega.t}}{2'j} -$$

$$b_n \frac{e^{j.n\,\omega.t}}{2'j} \rrbracket \qquad (16)$$

If the Fourier series converges to: $f(x)$ for each point x where f is differentiable [9], and b have to cost ratio *(negative)* and the function of range *(positive)*:

$$f\,(t) = (a\,0)/2 + \sum\_(n-1)\hat{}\omega ▒ \llbracket e\hat{}(j.n.\omega.t) \dashv (a\_n/2 + b\_n/(2'j)) + e\hat{}(-jn\omega.t) \vdash (a\_n/2 - b\_n/(2'j))\rrbracket \qquad (17)$$

We have seen therefore that the sum of multiple frequencies in the stock price are harmonically related so it gives rise to a periodic waveform having a more or less complex operation is called harmonic synthesis (Ex post or Ex ante). Conversely, a newspaper Price Range complex shape can be decomposed into several sinusoidal vibrations that are harmonically related, operation is called harmonic analysis in the Stock Market.

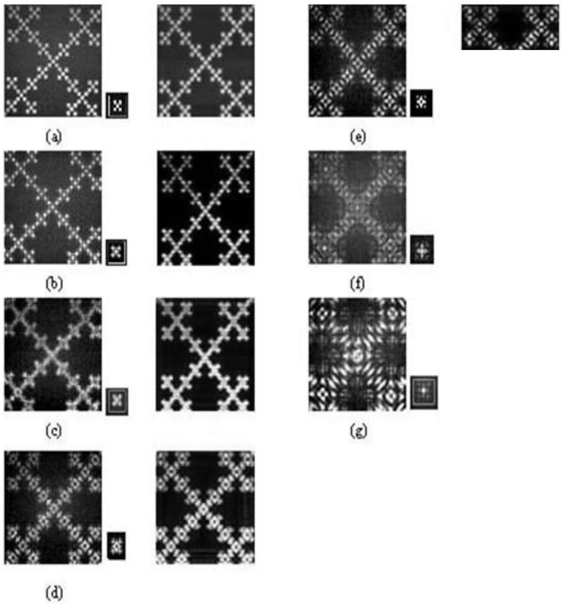


Figure 3: Sequence of the numerical propagation of a Fresnel regime.

The blade of the store and the logistic map produced some interesting patterns as the flashing if clearly by this method (as in the photo on the left), and excluded combinations can be detected, although more work than driven IFS. IFS and Kelly plots complement each other well with Fresnel regimes.

[9] Differentiable structure is given by a maximal atlas (an atlas is a collection of cards differentiable coordinate changes). Each atlas is contained in a single maximal atlas. It is said that two maximal atlas *A* and *A0* on the same variety M differentiable structures defined equivalent if there exists a diffeomorphism between (*M;A*) and (*M;A0*).

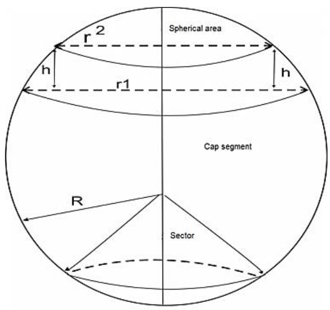
Meanwhile, some long-range correlations may be more easily seen. Furthermore, this method has more flexibility in the number of containers allocated to data. Powered

The evolution of the diffraction patterns produced by a letter Fractal *(n=4)* together with corresponding to the generator *(level fractal n=1)* , have been obtained on the stock exchanges for the same distances *z (Ranges)*, and conclude that at small distances we can reconstruct the image of fractal pivot 1-4 placing the generator providing the different positions of the initial plane.

Since what is observed is the total diffracted intensity, the phase information is not observable, and therefore can not identify the evolution of the generator with that of the entire structure, for these particular distances between the price and Ex Ante Ex Post, this indicates it is not always possible to reveal the fractal properties based only on measurements of the intensity distribution of Share Prices[10].

2. Aperiodicity of flashing on the economy hypersphere global financial.

An ordinary sphere, or two-dimensional sphere consists of all points equidistant from a given point in ordinary three-dimensional Euclidean space, R^3. A three-dimensional sphere consists of all points equidistant from a given point in R^4 *(chaos theory)*[11]. While a two-dimensional sphere is a surface "soft" two dimensions, entirely analogous manner, it is possible to define areas of a higher number of dimensions, called hyperspheres or n-spheres. These objects are n-dimensional varieties and three-dimensional volumen *(or hiperárea)* of a hypersphere of radius r, while the four-dimensional hypervolume (The volume of the region 4 bounded by the hypersphere dimensions). The nontrivial homology groups of the hypersphere are: $H_0(S^3,Z)$ y $H_3(S^3,Z)$ are both infinite cyclic, while $H_i(S^3,Z) = \{0\}$ for all other index i.



[10] The distance between two points in Euclidean space is equal to the length of the segment of straight line, expressed numerically. In more complex areas, as defined in non-Euclidean geometry, the "shortest path" between two points is a curve segment.

[11] It is the popular name for the branch of mathematics and physics to treat certain types of unpredictable behavior of dynamic systems.

Figure 4: Three-dimensional Sphere Capital Markets.

Homotopy groups larger ($k \geq 4$) are all finite (indicators investment margins), but also it does not follow any discernible pattern. Apparently nothing is as simple as the unit sphere in three dimensional space.

Where:

V= Operating volume.

S= Size of Market (Participation or Cognitive).

L= Size Range in Rates.

π= 3.141592

h= Maximum Price

r= Minimum Price

The fact that they can identify and R3n R2n spaces results in the odd-dimensional spheres have a fractal geometry that of even dimension. To clarify in what sense geometry is self-similar or related to another we must first introduce some concepts. The Kahler manifolds are the richest among them [12].

Table 1: Volume and Radius of a Sphere with boundedness of S1 to Sn.

Sphere $S_{n-1} \subset R_n$	**Volume**	**Radio=1**	**Volume Side**
$S_1 \subset R_2$	$(\pi)r^2$	3,1415	$2(\pi)r$
$S_2 \subset R_3$	$4/3(\pi)r^3$	4,1887	$4(\pi)r^2$
$S_3 \subset R_4$	$½(\pi)r^4$	4,9348	$2(\pi)2r^3$
$S_4 \subset R_5$	$8/15(\pi)2r^5$	5,2637	$8/3(\pi)2r^4$
$S_5 \subset R_6$	$1/16(\pi)3r^6$	5,1677	$(\pi)3r^5$
$S_6 \subset R_7$	$16/105(\pi)3r^7$	4,7247	$16/15(\pi)3r^6$

For a circle (filled) of radius r see: P = Perimeter = $2 \cdot \pi \cdot r$, A = Area = $\pi \cdot r\ 2$, so that

[12] The definition of Kahler variety is as follows: it is an almost-complex endowed with a Riemannian metric g such that g(J(X); J(Y)) = g(X; Y), for any vector fields X and Y , and so rJ = 0, be r Levy connection and then said g is a metric seal. The geometric meaning of Kahler manifolds is that the parallel transport associated with the connection of Levy commutes with the action of the almost-complex structure.

P = 2 · (√ π) · A 1/2. Both the square and the circle have perimeters that are 1-dimensional, so that these relationships between area and perimeter.

When the angles of intersection of the circles are rational multiple 180 degrees (average market value), imposing certain relations between investments consequently establish balance in the Operating Volume of shares.

For example, it is difficult to demonstrate C_1 y C_2 intersect at an angle of (F / N) 180, 0 <m <n, $(I_1 \; I_{2)})^n$ = Identity of a Circle Fractal. To represent the three-dimensional sphere as a topological space and imagine that we can understand easily, using various procedures. Before mentioning some, remember certain elements that are defined in *S*3 by analogy with the two-dimensional sphere, as we delimit:

- Fractal Iteration North N = (0, 0, 0, 1)
- Fractal Iteration South S = (0, 0, 0, −1)
- Fractal Iteration East E = (0, -1, 0,0)
- Fractal Iteration West O = (-1, 0, 0,0)

It is clear that each iteration fractal Charter is a three-dimensional ball, since:

$$x2/1 + x2/2 + x2/3 + x2/4 = 1 \quad (18)$$

$$x2/1+ x2/2 + x2/3 = 1 \quad (19)$$

$$- x2/4 \leq 1 \quad (20)$$

One way to avoid the problems that can occur when the points in a circle outside the circle are reversed (as can occur when investment circles overlap) is to prohibit all combinations involving investment from the inside out, and restricted to the limit is the limit of the orbit of a point, with the restriction that if some point in the orbit x_i disk is limited by $C_{j,}$ then the next orbit point, x_{i+1} , may not $_j$ (x, i) and get 2 options:

i) If the circles C_i bound disjoint disks, then this condition is just the familiar requirement that we have never invested in the same circle on.

ii) If the circles intersect, this condition can be more interesting.

With this restriction, investments [13] will not expand the maps and the limit is restricted in the discs limited by C.

3. Conclusions.

Some instruments such as Fourier Series Harmonic and difference of terms in the Fresnel diffraction adjusting ourselves outside a Hyperspheres geometry in its segment bounded by the ranges of volume operation obtained the following result of market prices in Mexico with respect to the world (is the financial markets self-similar):

		Paris	Franfuk	Londres	Tokio	New York	Mexico
Method							
Harmonic	2008-2009	1.81%	36.00%	2.32%	71.74%	252.64%	1.00%
	2010-2011	2.61%	74.00%	2.31%	18.92%	251.05%	5.00%
Fourier series	2008-2009	0.73%	28.00%	4.67%	1.73%	332.53%	0.03%
	2010-2011	0.93%	69.00%	0.22%	0.88%	345.66%	23.00%
Unlike terms	2008-2009	3.35%	4.00%	4.00%	1.87%	296.73%	2.00%
	2010-2011	3.96%	4.00%	2.08%	1.29%	264.31%	3.00%
Three-dimensional sphere	2008-2009	1.87%	0.04%	13.93%	0.05%	97.37%	1.80%
	2010-2011	1.83%	0.04%	7.73%	0.04%	87.41%	2.03%
Fresnel diffraction	2008-2009	1.57%	1.00%	0.93%	0.43%	25.68%	78.00%
	2010-2011	1.53%	1.00%	1.03%	0.66%	23.15%	78.20%

Regarding the scalar quantization represents each value with an index to a table set consists of a subset of securities called codebook *(A-SF-DF-ET-DF).*

[13] Represent loans of money upon which a company expects to obtain some future performance, either, for the realization of an interest, dividends or by selling to a higher value on acquisition cost. These are loans of money which a company or organization decides to keep for a period exceeding one year or operating cycle, counting from the date of the balance sheet.

With respect to the Harmonic Series Fourier difference Dimensional Sphere Terms and the highest yield is in New York with twice the investment and an acceptance rate of 52.64%-45.66%-64.31% and 7.41% respectively.

With respect to the Fresnel diffraction is generated the highest return our Mexican Stock Exchange with a margin of 78%, syntactic techniques for generating fractals discussed with these five methods are a pleasant and familiar natural almost fractal sets with low R^2, although its usefulness to larger spaces is almost immediate.

One reason for its popularity is that objects are processed really are symbols related to geometric primitives rather than numerical developments may be less easy to understand *(more so in our field of action)*. The idea is to generate certain default rules through a sequence of chains converging to a fractal *(Mandelbrot set)*. The study of fractals is transferred in this way, regardless of the initial space dimension, the domain of infinite words.

In every transaction there is a chance that the price changes, and after a certain time horizon, there is a total change in the price. We got the price change *(since the cumulative distribution obeys a cubic law conversely, the probability distribution function for differentiation)* and obeys a law quartic *(fourth time)* reverse.

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