Analysis of Four Color Theorem Based on Polynomial-Circular Logarithmic Equation

Wang Hongxuan[1], Zhou Yiyi[2], Wang Yiping[3]

Abstract

The four-color theorem, also known as the four-color conjecture and the four-color problem, is one of the three major mathematical problems in the modern world. The Four color theorem was proposed by a British college student named Goodrich Francis Guthrie in the map coloring. Augustus De Morgan (1806-1871) A letter to Hamilton on October 23, 1852, provided the most original account of the source of the four-color theorem. For a century and a half, in order to prove this theorem, mathematicians are closely related to contemporary mathematical combination, graph theory, topology, generalization, fractal, collection, and computer computing foundation. The concepts and methods introduced are stimulated. The growth and development of topology and graph theory.

In 1975, Bemanh-Hartmanis conjectured that there is a pair of G(•) and F(•) reciprocal. If the proof is true, then the polynomial time can be calculated, with polynomial time isomorphism [1].

In 1983, Chinese mathematician Xu Lizhi said in the "Selection of Mathematical Methodology" that the main point of calculus polynomial is continuous regularization[2]. If anyone can make a very useful relationship structure (S), it is very useful to introduce it, and G(•) and F(•) can perform important inversions [3].

The four-color theorem lies in the sufficiency, necessity, and uniqueness proof of the infinite non-repetition of the "four-four combination" under the infinite block. Most mathematicians think that relying on the existing traditional mathematics system can't solve it, at least it is very difficult. In 1976 and 1994, American mathematicians K. Appel and W. Haken announced the use of electronic computers to obtain the proof of the four-color theorem; through the computer, after 100 billion power (power dimension) calculation.

Mathematicians expect traditional simple mathematical proofs. In this paper, we propose that "any four-color non-repetitive combination of spliced tiles, plus a final closed curve" becomes a polynomial, converted into "abstract circular logarithmic equation without specific element (color) content, and arithmetic four operations. Number (relativistic construction). Conveniently prove the four-color theorem, replacing the 1976 American computer with 10 billion calculations.

I hope this article can provide useful help to relevant scholars, teachers and seniors at home and abroad. If you are not good, please criticize and teach, and welcome exchanges and cooperation.

Keywords: high-order multivariable polynomial, four-color theorem, combination coefficient, average of block, round logarithm

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About the author: 1. Wang Hongxuan Gao Yi (eight) student of Jiangshan Experimental High School, Zhejiang Province, Zhangzhou 324100, China ; 2. Zhou Yuyi, Gao Er (5) student, No. 2 Middle School, Shengzhou, Zhejiang Province, Zhangzhou 324000; 3. Wang Yiping Instructor Senior Engineer, Quzhou City, Senior Engineer Engaged in Mathematics and Power Engineering Research and Teaching Zhejiang Quzhou 324000; Corresponding author: wyp3025419@163.com

1. Introduction

The four-color theorem, also known as four-color conjecture and four-color problem, is one of the three major mathematical problems in the modern world. The Four Color Theorem was proposed by a British university student named Guderim Francis Guthrie in the map coloring. A letter from Augustus De Morgan (1806-1871) to Hamilton on October 23, 1852 provided the most original account of the source of the four-color theorem. For a century and a half, mathematicians have proved that the mathematical meaning of the theorem is closely related to the combination of contemporary mathematics, graph theory, topology, generality, fractals, collections, and the foundation of computer computing. The concepts and methods introduced are stimulated. The growth and development of topology and graph theory.

In 1975 Bemanh-Hartmanis conjectured that there is a pair of G(•) and F(•) reciprocal. If the proof is true, they are all polynomially timed and have polynomial time isomorphism [1].

In 1983, Chinese mathematician Xu Lizhi said in the "Selected Lectures in Mathematical Methodology": The main point of the calculus polynomial is the continuity of regularization[2]. If anyone can very usefully introduce some very important relational structures, S, to be very useful, and have G(•) and F(•) energy inversions, they can make important contributions [3].

The four-color theorem is based on an infinite block, and the sufficient, necessary, and uniqueness proof of the existence of infinite four-four combinations is not repeated. Most mathematicians believe that relying on the existing traditional mathematics system can not be solved, at least very difficult. In 1976 and 1994, the American mathematicians K.Appel and W.Haken announced the proof of the four-color theorem with the aid of an electronic computer; and it was proved by a computer with 10 billion power (power-dimensional) calculations. Mathematicians expect traditional simple mathematical proofs.

In this paper, the block theory establishes an abstract circular logarithm equation with no specific element (color) content and performs four arithmetic operations. It clarifies the basic rules of the mathematical combination and level transformation of the block, and establishes a circular function. The base logarithm is called “circular logarithm (relativistic structure).” It is convenient to prove the four-color theorem, which is a substitute for the 1976 American computer’s proof of 10 billion calculations.

I hope this article can provide useful help to domestic and foreign scholars, teachers, and teachers. Improperly please criticize and teach, welcome exchanges and cooperation.

2. The Basic Concept

2.1. Tile elements, levels, basic tiles

Define the tile: in the range of infinite area (plane, spherical) (Z), any combination of four colors that are not repeated and different from adjacent blocks, splicing without gaps, and finally a block surrounded by closed curves $\{X\}^{K(Z\pm S\pm N\pm P)}$.

Definition element: any graph, block, or layer containing four basic colors called elements $\{X\}^{K(Z\pm S\pm N\pm 4)}$

Define the composition of any graph, block, and level to participate in non-repeating combinations: dimension (S=1, 2, 3,... natural number), hierarchy (N=1, 2, 3,..., natural number), item order (P=4 ,3,2,1):(n⩾3)•4;

$$S=4: \{x_a,x_b,\dots,x_p,\dots,x_q\}\in\{X^4\}^{K(Z\pm4\pm1\pm P)},\ P=(N=1)\cdot4。$$

$$S=5: \{\{x_a\},\{x_b\},\dots,\{x_p\},\dots,\{x_q\}\}\in\{\{X^4\}\}^{K(Z\pm5\pm2\pm P)},\ P=(N=2)\cdot4,\dots$$

$$S=N: \{\{\{\{x_a\}\}\}\},\{\{\{x_b\}\}\},\dots,\{\{\{x_p\}\},\dots,\{x_q\}\}\in\{\{X^4\}\}^{K(Z\pm5\pm N\pm P)},\ P=(N\geq3)\cdot4。,\dots$$

2.2. Tiles and Graphs

Standard basic tiles: Tiles with only a set of four elements (colors) that are not repeated, (±N=1; ±P=4).

Non-standard basic tiles; there are some incomplete combinations (P) in the combination of tiles (±N=1; P=4,3,2,1) that are randomly in an incomplete combination of standard basic tiles.

Composite Tile: Tile (±N•P) combining two or more standard and non-standard basic tiles; (±N⩾2 (arbitrary finite; ±P=4,3,2,1);

Graphics Tile Hierarchy: The combined set of any finite tiles is called the graphic surrounded by the last closed curve. The graph is composed of any power-dimensional polynomial $\{X\}^Z$; (±S⩾1 (arbitrary finite) (arbitrary finite); ±N⩾1; ±P=1,2,3,4).

$$\{X\}^Z=A\{x\}^{K(Z\pm S\pm N\pm0)}+B\{x\}^{K(Z\pm S\pm N\pm1)}+\dots+P\{x\}^{K(Z\pm S\pm N\pm P)}+\dots+Q\{x\}^{K(Z\pm S\pm N\pm Q)};\quad(1.1)$$

$$Z=K(Z\pm S\pm N\pm4);\quad K=(+1\text{ reduction; }-1\text{ expansion});\quad(1.2)$$

Among them: Graph power function: K(Z±S±N±P) respectively represent infinite graph Z; finite graph power S, level N, P : for

Define graphics: four colors: P=4 (four-four combinations), P=3 (three-three combinations), P=2 (two-two combinations), P=1 (one-to-one combinations) not repeating combinations, and finally added A closed boundary curve.

The basic block $\{\{\{1+4+6+4+1\}...\}...\}=\{2^4-1\}=\{4^2-1\}=\{15\}$ values. The number of tile colors that the graph satisfies (completely combined tiles); non-completely combined tiles $\{\{\{2^4-q\}-q...\}-q...\}=\{2^4-q\}=\{4^2-q\}$. The number of tiles that the graph satisfies

2.3. Tiles and Calculus

Blocks are converted to polynomial or integro-differential equations that can be smoothly entered into the block theory. When the traditional calculus arbitrary (N) order sign is transformed into a polynomial calculus power function, it is combined with time to become a dynamic equation.

There are: The differential dynamic equation of the block $\{x^S\}$

$$\begin{aligned}\partial^{(N)}f(x^S)/\partial t^{(N)} &= \partial^{(N-1)}f(x^S)/\partial t^{(N-1)}+\partial^{(N-2)}f(x^S)/\partial t^{(N-2)}+\cdots\\ &\quad+\partial^{(N-p)}f(x^S)/\partial t^{(N-p)}+\cdots+\partial^{(N-q)}f(x^S)/\partial t^{(N-q)}\\ &= A\{x\}^{K(Z\pm S-N\pm0)/t}+B\{x\}^{K(Z\pm S-N\pm1)/t}+\cdots+P\{x\}^{K(Z\pm S-N\pm p)/t}+\cdots+Q\{x\}^{K(Z\pm S-N\pm q)/t}\\ &= \{x\}^{K(Z\pm S-N)/t};\end{aligned}\quad(1.3)$$

Block and integral dynamic equation $\{D^S\}$:

$$\int^N(D^S)dt^N=\int^{(N-1)}\{D^S\}dt^{(N-1)}+\int^{(N-2)}\{D^S\}dt^{(N-2)}+\cdots$$

$$+\int^{(N-P)}\{D^S\}dt^{(N-P)}+\cdots+\int^{(N-q)}\{D^S\}dt^{(N-q)}$$

$$= A\{D\}^{K(Z\pm S+N\pm 0)/t}+B\{D\}^{K(Z\pm S+N\pm 0)/t}+\cdots+P\{D\}^{K(Z\pm S+N\pm 0)/t}+\cdots+Q\{D\}^{K(Z\pm S+N\pm 0)/t}$$

$$= \{D\}^{K(Z\pm S+N)/t}; \qquad (1.4)$$

The above merger, written as a general formula:

$$\{R\}^Z=\{R\}^{K(Z\pm S\pm N\pm 0)/t}+\{R\}^{K(Z\pm S\pm N\pm 1)/t}+\cdots+\{R\}^{K(Z\pm S\pm N\pm p)/t}+\cdots+\{R\}^{K(Z\pm S\pm N\pm q)/t}; \qquad (1.5)$$

Among them, $\{X\}^z$ and $\{D\}^z$ represent the closed curves of the blocks, graphic elements and boundaries, respectively.

In the formula: power function Z = K(Z±S±N±P) (called path integral, history record, calculation time); Z infinite polynomial power function; S element composition polynomial dimension; Z⩾S⩾N⩾P ; K = (+1, -1) Tiles Expanded or Reduced Property: Shorthand: K(Z±S±N), K(Z±S±P), K(Z±S), K(Z±) N), K(Z±P), (Z); +N= ∫ (N)) (Increase area) integration order, -N=∂(N) (reduction area) differential order; (±P) polynomial Block combination order (increase or decrease); (/t) represents the dynamic equation (the general formula does not mark t); {} denotes point group combination and set. The introduction of two "...,..." In polynomials (Z) represents an infinite tile, which is different from the traditional "..." finite calculation. (more than the same)

2.4. Block Combinations and Polynomial Coefficients

According to the Brouwer Center fixed point theorem [4] {D}Z and {X}Z (blocks represent boundary curves, center points, line and block elements) combined blocks (functions, polynomials, geometric spaces) Has equivalence.

Definition: The various combination coefficients in the block are the number of combinations divided by the corresponding unknown or known average block (function), and the average function (average block) is called $(1/C_{K(Z\pm S\pm N)})\cdot R_a,R_b,R_p,\cdots,R_q)\in\{R_0\}^{K(Z\pm S\pm N\pm P)}$.Polynomials often use their average blocks (functions, geometry space, values) as their basis for calculation.

have：

$$\{R_0\}^{K(Z\pm S\pm N)} = [\sum(1/C_{(S\pm N)})\{R\}+\cdots]^{K(Z\pm S\pm N)}$$

$$= (1/C_{(S\pm 0)})\{R\}^{K(Z\pm S\pm N\pm 0)}+(1/C_{(S\pm 1)})\{R\}^{K(Z\pm S\pm N\pm 1)}+\cdots$$

$$+ (1/C_{(S\pm P)})\{R\}^{K(Z\pm S\pm N\pm P)}+\cdots+(1/C_{(S\pm q)})\{R\}^{K(Z\pm S\pm N\pm q)}\}$$

$$= \{R_0\}^{K(Z\pm S\pm N\pm 0)}+\{R_0\}^{K(Z\pm S\pm N\pm 1)}+\cdots+\{R_0\}^{K(Z\pm S\pm N\pm P)}+\cdots+\{R_0\}^{K(Z\pm S\pm N\pm q)}; \qquad (2)$$

$$C_{(Z\pm S\pm P)}=S(S-1)\cdots(S-P)/P(P-1)\cdots(2)(1) = S!/P!; \qquad (3)$$

where: C(Z±S±P)polynomial P term regularization coefficient; coefficient subscript letters represent the combination of elements in the block. ! factorial.

2.5. The boundary of the block and the elements of the block regularization polynomial

The $\{X\}^Z$ unknown element and $\{D\}^Z$ boundary equilibrium curves in the block form a regularized polynomial equation.

There are: polynomial equations:

$$\{X \pm D)^{K(ZN)} = Ax^{K(Z0)} + Bx^{K(Z\pm 1)} + \cdots + Px^{K(Z\pm p)} + \cdots + Qx^{K(Z\pm q)} \pm D; \qquad (4)$$

In the formula, the coefficients (A, B,...P,...Q) contain the number of blocks formed by the combination of different levels.

2.6. Blocks (functions) Regularization Polynomial equations Reduction logarithm equation

In formula (4), when$\{x\}^Z \neq \{D\}^Z$ the relative principle [6] is applied, and the ratio of the unknown to the known function is one to one and the relative symmetry balance is achieved. get the dimensionless function without specific element content, call the circle logarithm (relativistic structure).

assume: $(1-\eta^2)^Z \sim (\eta)^Z = \{x\}^{K(Z\pm S-N)} \cdot \{D\}^{K(Z\pm S+N)} = [\{x\}/\{D\}]^{K(Z\pm S\pm N)}$

get： $$\{X \pm D)^{K(Z\pm S\pm N)} = [\{x\}/\{D\}]^{K(Z\pm S\pm N-0)} \cdot D^{K(Z\pm S\pm N+0)} + [\{x\}/\{D\}]^{K(Z\pm S\pm N-1)} \cdot D^{K(Z\pm S\pm N+1)} + \cdots$$

$$+ [\{x\}/\{D\}]^{K(Z\pm S\pm N-p)} \cdot D^{K(Z\pm S\pm N+P)} + \cdots + [\{x\}/\{D\}]^{K(Z\pm S\pm N-q)} \cdot D^{K(Z\pm S\pm N+q)}$$

$$= [(1-\eta^2)^{K(Z\pm S\pm N\pm 0)} + (1-\eta^2)^{K(Z\pm S\pm N\pm 1)} + \cdots + (1-\eta^2)^{K(Z\pm S\pm N\pm p)} + \cdots$$

$$+ (1-\eta^2)^{K(Z\pm S\pm N\pm q)}] \cdot \{X_0 \pm D_0)^{K(Z\pm S\pm N)}$$

$$= (1-\eta^2)^{K(Z\pm S\pm N)} \{X_0 \pm D_0)^{K(Z\pm S\pm N)}; \qquad (5.1)$$

among them: under the condition of balance： $\{x_0\}^Z = \{D_0)^Z$；

（1）、 $$\{X - D)^{K(Z\pm S\pm N)} = (1-\eta^2)^{K(Z\pm S\pm N)} \{0\}^{K(Z\pm S\pm N)} \{D_0)^{K(Z\pm S\pm N)}; \qquad (5.2)$$

（2）、 $$\{X + D)^{K(Z\pm S\pm N)} = (1-\eta^2)^{K(Z\pm S\pm N)} \{2\}^{K(Z\pm S\pm N)} \{D_0)^{K(Z\pm S\pm N)}; \qquad (5.3)$$

among them: In the logarithmic equation$(1-\eta^2)^Z \sim (\eta)^Z$ it means that one-price and second-order have equivalence.

3. Specification invariance and level limit of circle logarithm

The circular logarithmic equations (also known as relativistic structures, supersymmetric unit matrices) have three gauge invariance theorems and level limits.

3.1, *[Theorem One]* The combination of "positive combination" and "reciprocal combination" after iteration of the elements in the "block-by-multiplication" block hierarchy, with the combination of reciprocal inversion.

It is known that the same group tile elements are multiplied by "combination set" $\Pi_{(Z\pm S)}(R_a, R_b, \cdots, R_p, \cdots R_q)$ (omitting N marks from the same level).

assume: $F(\cdot) = \{x_0\}^{K(Z\pm S-F)} = \{\sum (C_{(Z\pm S)}[\Pi_{(Z\pm S)} (x_a, x_b, \cdots, x_p, \cdots x_q)^K + \cdots]\}^{K(Z\pm S-F)}$；

$$C_{(Z\pm S+F)} = S(S-1)(S-2)\cdots(S-P)(S-F)/F;$$

$$G(\cdot) = \{D_0\}^{K(Z\pm S+G)} = \{\sum (C_{(Z\pm S)}[\Pi_{(Z\pm S)} (D_a, D_b, \cdots, D_p, \cdots D_q)^K + \cdots]\}^{K(Z\pm S+G)};$$

$$C_{(Z\pm S-G)} = S(S-1)(S-2)\cdots(S-G)/G;$$

among them, the regularization combination coefficient $C_{((Z±S±N)}=C_{(Z±S-F)}= C_{(Z±S-G)}$; that is, the number of elements (coefficients) in the same level element combination is the same.

Proof (A): The set of consecutive combinations is divided by the positive plus the combined set, resulting in a set of reciprocal combinations, and vice versa.

have:

$$\{X_{0((Z±S)}+\cdots\}^{K(Z±S)} = \{X_{0(Z±S)}+\cdots\}^{K(Z±S)}$$
$$/ \{X_{0((Z±S+F)}+\cdots\}^{K(Z±S+F)} \cdot \{X_{0((Z±S+F)}+\cdots\}^{K(Z±S±N+F)}$$
$$= [\{X_{0((Z±S±F)}+\cdots\}/\{X_{0(((Z±S)}+\cdots\}]^{- K(Z±S±N+F)} \cdot [X_{0((Z±S±F)}+\cdots]^{K(Z±S+F)};$$

move $[X_{0(Z±S±F)}+\cdots]^{K(Z±S+F)}$to the left of the equal sign (called iteration).You have to add the following combination:

$$\{X_{0((Z±S)}+\cdots\}^{K(Z±S)}/\{ X_{0((Z±S+F)}+\cdots\}^{K(Z±S+F)} = [\{X_{0((Z±S±F)}+\cdots\}/\{X_{0(S±p)}+\cdots\}]^{- K(Z±S±F)}$$
$$= \{(1/C_{(Z±S±G)})^{-1}[\Sigma(\Pi_{(Z±S±G)} (X_i^{-1})^{-1} +\cdots]\}^{-K(Z±S±G)}$$
$$= \{X_{e(Z±S-G)}\}^{K(Z±S-G)} = G(\cdot); \quad (6.1)$$

among them:

$$[\{X_{0((Z±S+F)} +\cdots\}/\{X_{0(Z±S)} +\cdots\}]^{-K(Z±S±F)}= [\{X_{0((Z±S-G)} +\cdots\}/\{X_{0(Z±S)} +\cdots\}]^{K(Z±S-G)}=G(\cdot)$$

same reasoning

$$[\{X_{0((Z±S+G)} +\cdots\}/\{X_{0(Z±S)} +\cdots\}]^{-K(Z±S±G)}=[\{X_{0((Z±S-G)} +\cdots\}/\{X_{0(Z±S)} +\cdots\}]^{K(Z±S-F)} =F(\cdot)$$

proof (B): reciprocity at the same level {S=F±G=P},

have:

$$\{X_{0(Z±S)} +\cdots\}^{K(Z±S)} = \{X_{0(Z±S)}+\cdots\}^{K(Z±S)}/\{X_{0(Z±S)}+\cdots\}^{K(Z±S+F)} \cdot \{X_{0(Z±S)}+\cdots\}^{K(Z±S+F)}$$
$$= \{X_{0(Z±S)}+\cdots\}^{K(Z±S-G)} \cdot \{X_{0(Z±S)}+\cdots\}^{K (Z±S+F)}$$
$$= G(\cdot) \cdot F(\cdot); \quad (6.2)$$

same reasoning

$$\{X_{0(Z±S)}+\cdots\}^{K(Z±S)} = \{X_{0(Z±S)}+\cdots\}^{K(Z±S)}/\{X_{0(Z±S)}+\cdots\}^{K(Z±S-G)} \cdot \{X_{0(Z±S)}+\cdots\}^{K(Z±S-G)}$$
$$= \{X_{0(Z±S)}+\cdots\}^{K (Z±S+F)} \cdot \{X_{0(Z±S)}+\cdots\}^{K(Z±S-G)}$$
$$= F(\cdot) \cdot G(\cdot); \quad (6.3)$$

in the formula: $\{X_{0(Z±S)}\}^{K(Z±S±p)}/\{X_{0(Z±S)}\}^{K(Z±S±p+F)} = \{X_{e(S±p)}\}^{K(Z±S±p-G)}$;

Proof (C): The reciprocal G(•)•F(•) can be inverted.

Set: any {p} level: $(1-\eta_{(Z±S)}^2)^{K(Z±S±P)}=\{X_{e(Z±S)}\}^{K(Z±S-P)}/\{X_{0(Z±S)}\}^{K(Z±S+P)}$;

Have:

$$\{X_{0(Z±S)}+\cdots\}^{K(Z±S±P)}=\{X_{0(Z±S)}+\cdots\}^{K(Z±S±P)}/\{X_{0(Z±S)}+\cdots\}^{-K(Z±S+P)} \cdot \{X_{0(Z±S)}+\cdots\}^{+K(Z±S+P)}$$

Move (iteration)

$\{X_{0(Z±S)}+\cdots\}^{+K(Z±S+P)}$ To the left becomes $\{X_{e(Z±S)}+\cdots\}^{K(Z±S-P)}$

have:

$$\{X_{e(Z±S)}+\cdots\}^{K(Z±S-P)} = \{X_{e(Z±S)}+\cdots\}^{K(Z±S-P)}/\{X_{0(Z±S)}+\cdots\}^{K(Z±S+P)} \cdot \{X_{0(Z±S)}+\cdots\}^{K(Z±S±P)}$$
$$= (1-\eta_{(Z±S)}^2)^{K(Z±S±P)} \cdot \{X_{0(Z±S)}+\cdots\}^{K(Z±S±P)}; \quad (6.4)$$

get:

$$(1-\eta_{(Z±S)}^2)^{K(Z±S±P)}=(1-\eta_{(Z±S)}^2)^{K(Z±S±P+F)}+(1-\eta_{(Z±S)}^2)^{K(Z±S±P-G)}$$
$$=(1-\eta_{(Z±S)}^2)^{K(Z±S+P)} \cdot (1-\eta_{(Z±S)}^2)^{K(Z±S-P)}; \quad (6.5)$$
$$0\leqslant(1-\eta_{(Z±S)}^2)^{K(Z±S±P)} = [G(\cdot) \cdot F(\cdot)]^{K(Z±S±P)}\leqslant 1; \quad (6.6)$$

Equations (6.1) to (6.6) satisfy the same level regularization, "positive combination set" and "reciprocal combination set" can perform isomorphic energy inversion of the "self combination of the average of the set divided by its own combination of sets The mean value is not necessarily 1” or becomes proof of Bemanh-Hartmanis conjecture

***[Theorem 2]* Homologous circle logarithm (type 1 specification invariance)**

Define isomorphic circle logarithms (invariability of the first type of specification), and the self average value divided by its own average value is not necessarily "1".

assume: $\{X\}^{K(Z-S)}=\Sigma\{{}^{KS}\sqrt{\Pi(x_a x_b \cdots x_p \cdots x_q)}\}^{K(Z-S)} \neq D=\Sigma\{{}^{KS}\sqrt{D}\}^{K(Z\pm S)}$;

$$\Sigma[(1/C_{(Z\pm S)})^{-1}\{X_p^{-1}+\cdots\}]^{K(Z-S)}=\Sigma[(1/C_{(Z\pm S)})^{+1}\{{}^{KS}\sqrt{D}\}]^{K(Z+S)}$$

Proof: The isomorphism and expansion of the block uncertainty polynomial regularization equilibrium equation: Certificate: Result of applying *Theorem One*:

have: $Ax^{K(Z\pm S\pm N\pm 0)}+Bx^{K(Z\pm S\pm N\pm 1)}+\cdots+Px^{K(Z\pm S\pm N\pm p)}+\cdots+Qx^{K(Z\pm S\pm N\pm q)}\pm D$

$$=C_{(S\pm 0)}x^{K(Z\pm S\pm N-0)}(A/C_{(S\pm 0)})^{K(Z\pm S\pm N+0)}+C_{(S\pm 1)}x^{K(Z\pm S\pm N-1)}(B/C_{(S\pm 1)})^{K(Z\pm S\pm N+1)}+\cdots$$

$$+C_{(S\pm p)}x^{K(Z\pm S\pm N-p)}(P/C_{(S\pm p)})^{K(Z\pm S\pm N+p)}+\cdots+C_{(S\pm q)}x^{K(Z\pm S\pm N-q)}(Q/C_{(S\pm q)})^{K(Z\pm S\pm N+q)}\pm D$$

$$=C_{(S\pm 0)}x^{K(Z\pm S\pm N+0)}D_0^{K(Z\pm S\pm N+0)}+C_{(S\pm 1)}x^{K(Z\pm S\pm N+0)}D_0^{K(Z\pm S\pm N+1)}+\cdots$$

$$+C_{(S\pm p)}x^{K(Z\pm S\pm N-p)}D_0^{K(Z\pm S\pm N+p)}+\cdots+C_{(S\pm q)}x^{K(Z\pm S\pm N-q)}D_0^{K(Z\pm S\pm N+q)}\pm D$$

$$=x_0^{K(Z\pm S\pm N-0)}+x_0^{K(Z\pm S\pm N-1)}\bullet D_0^{K(Z\pm S\pm N+1)}+\cdots+x_0^{K(Z\pm S\pm N-p)}\bullet D_0^{K(Z\pm S\pm N+p)}+\cdots$$

$$+x_0^{K(Z\pm S\pm N-q)}\bullet D_0^{K(Z\pm S\pm N+q)}\pm D_0^{K(Z\pm S\pm N+0)}$$

$$=\{(1-\eta^2)^{K(Z\pm 0)}+(1-\eta^2)^{K(Z\pm 1)}+\cdots+(1-\eta^2)^{K(Z\pm p)}+\cdots+(1-\eta^2)^{K(Z\pm q)}\}\bullet\{x_0\pm D_0\}^{K(Z\pm S\pm N)}$$

$$=(1-\eta^2)^Z\{0,2\}^{K(Z\pm S)}\{x_0\pm D_0\}^{K(Z\pm S\pm N)}$$

$$=(1-\eta^2)^Z\{0,2\}^{K(Z\pm S)}\{D_0\}^{K(Z\pm S\pm N)}; \qquad (7.1)$$

among them: $(1-\eta^2)^{K(Z\pm S)}=\Sigma[\{X_0\}/\{D_0\}]^{K(Z+S\pm N)}=\Sigma[\{{}^{KS}\sqrt{D}\}/\{D_0\}]^{K(Z\pm S\pm N)}$;

$$=\Sigma(1/C_{K(Z\pm S)})^K\{[{}^{KS}\sqrt{(X_{K(Z\pm S)})}]^{K(Z-S\pm N-P)}+\cdots\}$$

$$/\ \Sigma(1/C_{K(Z\pm S)})^K\{D_{K(Z\pm S)}\}^{K(Z+S\pm N+P)}+\cdots\}^{K(Z+S\pm N)};$$

$$0\leqslant(1-\eta^2)^{K(Z\pm S\pm N)}\leqslant\{1\}^{K(Z\pm S\pm N)}; \qquad (7.2)$$

get: $\{0\}^{K(Z\pm S)}\leqslant(1-\eta^2)^{K(Z\pm 0)}\sim(1-\eta^2)^{K(Z\pm 1)}\sim\cdots\sim(1-\eta^2)^{K(Z\pm p)}\sim\cdots$

$$\sim(1-\eta^2)^{K(Z\pm q)}\leqslant\{1\}^{K(Z\pm S)}; \qquad (7.3)$$

or: $(1-\eta^2)^Z\sim(\eta)^Z=\{{}^{KS}\sqrt{D}/D_0\}^Z$

$$=\left|\begin{matrix}\{{}^{KS}\sqrt{D}/D_0\}^{K(Z\pm S\pm N\pm 0)}\\ \{{}^{KS}\sqrt{D}/D_0\}^{K(Z\pm S\pm N\pm 1)}\\ \{\cdots,\ \cdots\}\end{matrix}\right.$$

$$\{{}^{KS}\sqrt{D/D_0}\}^{K(Z\pm S\pm N\pm p)}$$

$$\{{}^{KS}\sqrt{D/D_0}\}^{K(Z\pm S\pm N\pm q)}$$

$$= \left| \begin{matrix} (1-\eta^2)^{K(Z\pm S\pm N\pm 0)} & 0 & 0 & \cdots & 0 & \cdots & 0 \\ 0 & (1-\eta^2)^{K(Z\pm S\pm N\pm 1)} & 0 & \cdots & 0 & \cdots & 0 \\ \{\cdots, \cdots\} \\ 0 & 0 & (1-\eta^2)^{K(Z\pm S\pm N\pm p)} & \cdots & 0 & \cdots & 0 \\ 0 & 0 & 0 & \cdots & 0 & \cdots & (1-\eta^2)^{K(Z\pm S\pm N\pm q)} \end{matrix} \right| \quad (7.4)$$

The block is compared by the abstract circle logarithm at the same level, and it is obtained that the polynomials have homologous circle logarithm consistency at each level. "~" means isomorphism (equivalent).

***[Theorem 3]*, the unit circle logarithm (the second type of norm invariance).**

Defining homologous circle logarithms: The same level tile (a,b,...,p,...,q) "The collection of each sub-item divided by the total item combination set" has a maximum value of {1}, for less than {1} Still take the {1} level, represented by the hierarchical nature of the collection of tile combinations, to ensure the unity of different combinations within the tile hierarchy, and the position of each sub-item combination within the same level. The block unitary circle logarithm ensures the natural number order expansion of polynomial power functions (hierarchies).

have:

$$(1-\eta^2)^Z \sim (\eta)^Z = \{R_h / R_H\}^Z$$

$$= \left| \begin{matrix} \{R_a / R_H\}^{K(Z\ K(Z\pm S\pm N\pm 0)} \\ \{R_b / R_H\}^{K(Z\ K(Z\pm S\pm N\pm 1)} \\ \{\cdots, \cdots\} \\ \{R_p / R_H\}^{K(Z\ K(Z\pm S\pm N\pm p)} \\ \{R_q / R_H\}^{K(Z\ K(Z\pm S\pm N\pm q)} \end{matrix} \right|$$

$$= \left| \begin{matrix} (1-\eta_a{}^2)^{K(Z\ K(Z\pm S\pm N\pm 0)} & 0 & 0 & \cdots & 0 & \cdots & 0 \\ 0 & (1-\eta_b{}^2)^{K(Z\ K(Z\pm S\pm N\pm 1)} & 0 & \cdots & 0 & \cdots & 0 \\ \{\cdots, \cdots\} \\ 0 & 0 & \cdots & (1-\eta_p{}^2)^{K(Z\ K(Z\pm S\pm N\pm p)} & \cdots & 0 & 0 \\ 0 & 0 & 0 & \cdots & 0 & \cdots & (1-\eta_q{}^2)^{K(Z\ K(Z\pm S\pm N\pm q)} \end{matrix} \right|$$

$$= (1-\eta_a{}^2)^{K(Z\pm S\pm N\pm 0)} + (1-\eta_b{}^2)^{K(Z\pm S\pm N\pm 1)} + \cdots + (1-\eta_p{}^2)^{K(Z\pm S\pm N\pm p)} + \cdots - \eta_q{}^2)^{K(Z\pm S\pm N\pm q)}$$

$$= \{1\}^{K(Z\pm S\pm N)} \quad (8.1)$$

In particular, formula (8.1) is not only $(1-\eta^2)^Z \sim (\eta)^Z$ for the (quadratic) and (primary) equivalents of the logarithm of the circle, and its dimension problem was once determined by Cantor in a straight line. The proof between the plane and the plane is logically equivalent [5]. It is also extended to be isomorphic to any power dimension.

heve: $[(\eta_a{}^2) + (\eta_b{}^2) + \cdots + (\eta_p{}^2) + \cdots + (\eta_q{}^2)]^{K(Z\pm S\pm N)} = [1]^{K(Z\pm S\pm N)}$; (8.2)

or: $[(\eta_a) + (\eta_b) + \cdots + (\eta_p) + \cdots + (\eta_q)]^{K(Z\pm S\pm N)} = [1]^{K(Z\pm S\pm N)}$; (8.3)

(Note: The circle logarithm is represented by a matrix or a horizontal form and has the same meaning).

***[Theorem IV]*, property circle logarithm (type 3 specification invariance)**

Defining the total number of combinations of each sub-item in the same layer at the same level {RH} divided by the average value of the total item combination $\{R_0\}$ to obtain the reciprocal circular logarithm, ensuring that the block combination has three levels: expansion, reduction, and invariance. Nature, called topology. Which: refers to the level of change or not, does not affect the structure of the internal combination).

have: $$(1-\eta^2)^Z \sim (\eta)^Z = \{R_H/R_0\}^{K(Z\pm S)}$$
$$= \{R_0-R_H\}/ R_0\}^{K(Z+S)}+\{R_0-R_H\}/\{R_0\}^{K(Z\pm S)}+\{R_0-R_H\}/ \{R_0\}^{K(Z-S)}$$
$$= [(1-\eta^2) \sim (\eta)]^{K(Z+S)}+ [(1-\eta^2) \sim (\eta)]^{(K(Z\pm S)}+[(1-\eta^2) \sim (\eta)]^{-K(Z-S)}$$
$$=\{0\sim1\}^{K(Z\pm S)} ; \qquad (9.1)$$

Discussion: In each level K (Z±S±N±P), (±P) indicates the increase or decrease of the color combination of the item order; (±N) indicates the increase or decrease of the level (also referred to as integral, differential order).

$$(1-\eta^2)^{+K(Z\pm S)} = [\{R_{ep}\} / \{R_{0p}\}]^{K(Z\pm S)} \leqslant 1, \quad K=+1;$$

A block-level convergence topology;;

$$(1-\eta^2)^{-K(Z\pm S)} = [\{R_{ep}\} / \{R_{0p}\}]^{K(Z\pm S)} \geqslant 1, \quad K= -1;$$

Tile Level Diffusion Topology;

$$(1-\eta^2)^{0K(Z\pm S)} = [\{R_{ep}\} / \{R_{0p}\}]K^{(Z\pm S)} =1, \quad K=\pm0; \qquad (9.2)$$

Call the tile level unchanged;

***[Theorem 5]* Hierarchical isomorphic limit values (phase change point, critical point):**

Infinite blocks establish regularization polynomials, through infinite logarithm equations (point, line, surface, volume, space, hyperspace, high-power polynomials) infinite combinations and sets, their isomorphism, unity, and reciprocity integration The calculation of the level and the combination of stable zero error is obtained. There are isomorphic limit values (phase transition points, critical points) between these levels, units, and reciprocity.

have: $$\{x_0\pm D_0)^{K(Z\pm S\pm N)} = (1-\eta^2)^{K(Z\pm S\pm N)}\{ x_0\pm D_0\}^{K(Z\pm S\pm N)};$$

among them: simultaneous equations: (10.1)(10.2)

$$(1-\eta^2)^{K(Z\pm S\pm N)} = (1-\eta^2)^{K(Z\pm S\pm N)} \cdot (1-\eta^2)^{K(Z\pm S\pm N)}=\{0,1\}^{K(Z\pm S\pm N)}; \qquad (10.1)$$
$$(1-\eta^2)^{K(Z\pm S\pm N)} = (1-\eta^2)^{K(Z\pm S\pm N)} + (1-\eta^2)^{K(Z\pm S\pm N)}=\{0,1\}^{K(Z\pm S\pm N))}; \qquad (10.2)$$

get the solution:

$$(1-\eta^2)^{K(Z\pm S\pm N)} = \{0,1/2,1\}^{K(Z\pm S\pm N)}; \quad (K=+1,-1); \qquad (10.3)$$

where: {0, 1} represents the critical value of the hierarchy, and {1/2} represents the symmetry of the critical value of the internal reciprocity of the hierarchy.

***[Theorem 6]*, Changes in Tile Hierarchy and Polynomial Item Order (Calculus Order Value) (Leaps)**

The regularization polynomial hierarchy (power-dimensional order, order) (Z±S±N)level shows the change of the total combination coefficient value;

There are: polynomial equation hierarchy F{M} :

$$F\{M\}=\{x_0\pm D_0)^{K(Z\pm S\pm M)}= Ax^{K(Z\pm S\pm M\pm 0)}+ Bx^{K(Z\pm S\pm M\pm 1)} +\cdots+Px^{K(Z\pm S\pm M\pm p)}+\cdots^{K(Z\pm S\pm M\pm q)}+D$$

$= (1-\eta^2)^Z\{0,2\}^{K(Z\pm S\pm M)} \cdot \{D_0\}^{K(Z\pm S\pm M)}$; $\Sigma C_{K(Z\pm S\pm M)}=\{2\}^{K(Z\pm S\pm M)}$;

There are: poly nomial equation hierarchy F{Q},

$F\{Q\}=\{x_0\pm D_0\}^{K(Z\pm S\pm Q)} = Ax^{K(Z\pm S\pm Q\pm 0)}+ Bx^{K(Z\pm S\pm Q\pm 1)} +\cdots+Px^{K(Z\pm S\pm Q\pm p)}+\cdots^{(Z\pm S\pm Q\pm q)}+D$

$= (1-\eta^2)^Z\{0,2\}^{K(Z\pm S\pm Q)} \cdot \{D_0\}^{K(Z\pm S\pm Q)}$; $\Sigma C_{K(Z\pm S\pm Q)}=\{2\}^{K(Z\pm S\pm Q)}$;

to: The span between polynomial hierarchy F{M} and F{Q} polynomials:

$F\{M\} /F\{Q\} =\{2\}^{K(Z\pm S\pm M)} / \{2\}^{K(Z\pm S\pm Q)}=\{2\}^{K(Z\pm S\pm[M\pm Q])}$; （11.1）

there are: changes in tile levels do not affect the polynomial hierarchy (item order, calculus) sub-coefficient changes $P = [P_m - P_q]$;

$\{X\}^{K(Z\pm S\pm N\pm m)}/\{X\}^{K(Z\pm S\pm N\pm q))}= \{X\}^{K(Z\pm S\pm N\pm m-q)}$

$=C_{(Z\pm S\pm[M])} / C_{(Z\pm S\pm[Q])} = C_{(Z\pm S\pm[M-Q])}$;

$= S(S-1)(S-p)(S-m)/m!]/[S(S-1)(S-p)(S-q)/q!]$ （11.2）

***[Theorem 7]* The serial/parallel theorem of polynomial (data collection, tile superposition) at tile level**

Defining the block-level polynomials and different types of full data sets. There are "serial/parallel" (called data collection, function collection, and state superposition) between elements, space, and hierarchy to get a complex space (called primary and sub-quantity particle states). Overlay, or Calculus). Completeness and incompleteness based on internal combinations of layers.

Definitions have the same level of combination called parallel equations, and cross-level combinations called serial equations

(1), Define a combination of the same level called the parallel equation, called the parallel equation:

feature: $H=\{\{A\}+\{B\}+\{C\}+ \cdots \}^{K(Z\pm S\pm N)}$ (H stands for parallel, same level combination),

$\{D_H\}^Z = \Sigma_H \{D_A + D_B+ D_C +\cdots\}^{K(Z+S)} = \Sigma_H \{D_A^{+1}+D_B^{+1}+D_C^{+1}+\cdots\}^{K(Z\pm S\pm N)}$;

(2), Definitions There are cross-level combinations of serial equations called serial equations:

feature: $H = \{\{\{\{\{A\} \cdot \cdots B\}\} \cdot \cdots C\} \cdot \cdots\}^{K(Z\pm S\pm N)}$ (H stands for serial, cross-level combinations),

$\{D_H\}^Z = \Sigma_H \{D_A \cdot D_B \cdot D_C \cdot \cdots \}^{K(Z\pm S\pm N)} = \Sigma_H \{D_A^{-1}+D_B^{-1}+D_C^{-1}+\cdots\}^{K(Z\pm S\pm N)}$;

(3) ,Serial/parallel block combination and round logarithm:

Set: power function composition:

$F\{H\} =\{H\}^{K(Z\pm H)}=\{D_A\}^{K\{(Z\pm A)} +\{D_B\}^{K(Z\pm B)}+ \{D_C\}^{K(Z\pm C)}$;

heve: $(1-\eta_{(Z\pm H)}{}^2)^{K(Z\pm H)} = \Sigma_H\{D_A^{-1}+D_B^{-1}+D_C^{-1}\}^{K(Z-H)}/\Sigma_H\{ D_A^{+1}+ D_B^{+1}+ D_C^{+1}\}^{K(Z+H)}$

Serial/Parallel unity, according to the combination of theorem one can convert both positive and negative combinations and reciprocity.

There are:

$$(1-\eta_{(Z\pm H)}{}^{2})^{K(Z\pm H)} = \Sigma_{H}\{ D_{A}{}^{-1}+ D_{B}{}^{-1}+ D_{C}{}^{-1}\}^{K(Z-H)} / \ \Sigma_{H}\{ D_{A}{}^{+1}+ D_{B}{}^{+1}+ D_{C}{}^{+1}\}^{K(Z+H)}$$

Proof: Block serial/parallel polynomial equation isomorphism:

have: $F\{X\pm D_H\}^{K(Z\pm H)}= F\{X\pm D_A\}^{(Z\pm A)}+F\{Y\pm D_B\}^{(Z\pm B)}+F\{Z\pm D_C\}^{(Z\pm C)}+\cdots$

$$= (1-\eta_A{}^2)^{K(Z\pm A)}\{0,2\}^{K(Z\pm A)}\{D_A\}^{K(Z\pm A)}$$

$$+(1-\eta_B{}^2)^{K(Z\pm B)}\{0,2\}^{K(Z\pm B)}\{D_B\}^{K(Z\pm B)}$$

$$+(1-\eta_C{}^2)^{K(Z\pm C)}\{0,2\}^{K(Z\pm C)}\{D_C\}^{K(Z\pm C)}+\cdots$$

$$= (1-\eta_{(Z\pm H)}{}^2)^{K(Z\pm H)}\{0,2\}^{K(Z\pm H)} \bullet \{ D_A{}^K+D_B{}^K+D_C{}^K+\cdots\}^{K(Z\pm H)}$$

$$= (1-\eta_{(Z\pm H)}{}^2)^{K(Z\pm H)}\{0,2\}^{K(Z\pm H)}\{D_H\}^{K(Z\pm H)} \ ; \qquad (12)$$

Equation (12) The serial/parallel equations are uniformly described by the circle logarithm (K=+1, -1) and have very good contact boundaries. Therefore, various combinations between the composite hierarchy and the basic hierarchy can be handled and various Hierarchical blocks, graphics.

Among them: these serial/parallel tiles can be a complete combination and an incomplete combination of randomness.

4. Proof of the Four Color Theorem

The four-color theorem is a well-known mathematical theorem. If you draw a few contiguous finite regions on a plane, you can color these regions with four colors so that the color of each two adjacent regions is different.

For more than a century, mathematicians have racked their brains to prove this theorem. The concepts and methods introduced have stimulated the disciplines of topology and graph theory. In the course of the study, many new mathematical theories have emerged, and many mathematical calculation skills have been developed, enriching the content of graph theory.

The invention of high-speed digital computers prompted more mathematicians to study the "four-color problem." In June 1976, on the two different electronic computers of the University of Illinois, it took 1200 hours to make a judgment of 10 billion. It finally proved the four-color theorem and caused a sensation in the world. However, computer certification has not received universal recognition in the mathematics community. Few experts are not satisfied with the achievements made by computers, and they require a simple and fast traditional written proof method to prove the four-color problem.

This paper consists of four color blocks, plus a final closed curve to form a hierarchy $\{2\}^{K(Z\pm S\pm N)}$, the establishment of polynomial equations converted to a logarithmic equation, to deal with the above calculations. among them:

(1), Solve the computational problem of levels (tiles, spaces, values, functions) by isomorphic circle logarithms.

(2), Through the unitary round logarithm, the arrangement of different combinations at the same level, to solve the position calculation.
In this way, the four-color theorem is converted into a problem of the logarithmic equation, creating a new idea for complex polynomial calculations.

4.1. Proof of the necessity of the four-color theorem

Definition: Composite tiles (four colors are not combined repeatedly) become layers (or composite layers) and then continue to be combined with other adjacent colors to form a new composite layer. So on and so forth.

Yes; four elements with center zero (line) {{(A,B,C,D)}-0}; Z=K(Z±S±N±0); coefficient C(S±N±0)= 1;

{Three elements (line)} and one element {{(A,B,C)}-1}; Z=K(Z±S±N±3); coefficient C(S±N±1)=4;

{Two elements (line)} and two elements {{(A,B)}-(C,D)}; Z=K(Z±S±N±2); coefficient C(S±N±2) =6;

{One element (line)} and three elements {{(A)}-(B,C,D)}; Z=K(Z±S±N±1); coefficient C(S±N±3)= 4;

{Border closure (line)} with four elements {{(0)}-(A,B,C,D)}; Z=K(Z±S±N±0); coefficient C(S±N±4) =1;

The total coefficient of the hierarchy:

$C_{K(Z\pm S\pm N\pm P)}=\{1+4+6+4+1\}^{K(Z\pm S\pm N\pm P)}=\{2^4\}^{K(Z\pm S\pm N\pm P}=\{4^2\}^{K(Z\pm S\pm N\pm P}$;(N≥2) ,p=0,1,2,3,4

In the formula {{{{A}⋯}⋯}⋯}Represents the composite hierarchy.

The combination within the hierarchy can be a combination of full (P=4) and incomplete (P=4,3,2,1,0), and a power function describing Z=K(Z±S±N±P); $\{0\}^{K(Z\pm S\pm N\pm 0)}$ denotes the intersection point (line) of the boundary line or the last closure boundary line (level line), respectively.

The basic block $\{\{\{1+4+6+4+1\}...\}...\}=\{2^4-1\}=\{4^2-1\}=\{15\}$ values. The number of tile colors that the graph satisfies (completely combined tiles); non-completely combined tiles $\{\{\{2^4-q\}-q...\}-q...\}=\{2^4-q\}=\{4^2-q\}=\{N\cdot 15-q\}$. The number of tiles that the graph satisfies

(A), the tiles in the basic tiles, called the basic level (±N=1),

Inside a block, a set of four colors performs a complete non-repeating four-four combination, surrounded by a closed curve, and composed of polynomial quartic equations.

(1), Standard basic blocks: （Z=0；S=0；±N=1；P=4,0）：

$$\{x\}^{K(P)}=Ax^{K(0)}+Bx^{K(1)}+Cx^{K(2)}+Dx^{K(3)}+\{D\}$$

$$= x^{K(P\pm0)}+C_{(P\pm1)}\,x^{K(P\pm1)}+C_{(P\pm2)}\,x^{K(P\pm2)}+C_{(S\pm N\pm3)}\,x^{K(P\pm3)}+D_0^{(P\pm4)}$$

$$= (1-\eta_{(Z\pm H)}{}^2)^{K(P)}\{0,2\}^{K(P)}\{D_H\}^{K(P)}\ ; \qquad (13)$$

The homologous circle logarithm in polynomial coefficients:（P=4,0）

$$(1-\eta_{P)}{}^2)^{K(P)}=(C_{(P\pm0)}+C_{(P\pm1)}+C_{(P\pm2)}+C_{(P\pm3)}+C_{(P\pm4)})/\{2^4\}=1;$$

The logarithm of the unit circle in the polynomial coefficient: (P=4,0)

$$(1-\eta_{HP)}{}^2)^{K(P)} = [\{X\}^{K(Z\pm S\pm1)}-1]=[\{2\}^{K(Z\pm S\pm1)}-1]= 15/(2^4-1)=1;$$

Hierarchical coefficients:$C_{K(Z\pm S\pm N\pm P)}=\{1+4+6+4+1\}^{K(Z\pm S\pm N\pm P)}=\{2\}^{K(Z\pm S\pm N\pm P)}$;(N$\geqslant$2)
(2), Non-standard basic block values:Z=0; S=0; ±N=1; P=4,3,2,1; q=(1~15)=there is an Incomplete combination of values.

$$\{x\}^{K(P)}=Ax^{K(\pm N\pm 4)}+Bx^{K(\pm N\pm 1)}+Cx^{K(\pm N\pm 2)}+Dx^{K(\pm N\pm 3)}+\{D\}$$

$$= x^{K(\pm N\pm 4)}+C_{(P\pm 1)}x^{K(\pm N\pm 1)}+C_{(P\pm 2)}x^{(\pm N\pm 2)}+C_{(S\pm N\pm 3)}x^{(\pm N\pm 2)}+D_0^{(\pm N\pm 0)}$$

$$= (1-\eta_{(P)}{}^2)^{K(P)}\{0,2\}^{K(P)}\{D_0\}^{K(P)};$$

The homologous circle logarithm in polynomial coefficients:（P=4,3,2,1）q=(0~15);

$$(1-\eta_{P)}{}^2)^{K(P)}=(C_{(P\pm 0)}+C_{(P\pm 1)}+C_{(P\pm 2)}+C_{(P\pm 3)}+C_{(P\pm 4)})/\{2^4-q\}=1;$$

The number of unit circle pairs in polynomial coefficients：(P=4,3,2,1)

$$(1-\eta_{HP)}{}^2)^{K(P)} = [\{X\}^{K(Z\pm S\pm 1)}-q]=[\{2\}^{K(Z\pm S\pm 1)}-q]= (0\sim 15)/(2^4-q)=1;$$

Hierarchical coefficients:

$$C^{K(Z\pm S\pm N\pm P)}=[\{1+4+6+4+1\}^{K(Z\pm S\pm N\pm P)}-q]=[\{2\}^{K(Z\pm S\pm N\pm P)}-q]; (N\geqslant 2);$$

(3) Comparison of non-standard basic block values (coefficients)/non-standard basic block values (coefficients):

$$(1-\eta_{HP}{}^2)= \{X\}^{K(Z\pm S\pm P)}/\{X\}^{K(Z\pm S\pm 4)}=[\{2\}^{K(Z\pm S\pm 1)}- q] / [\{2\}^{K(Z\pm S\pm P)}-1]\leqslant 1;$$

where: $(1-\eta_{HP}{}^2)^{K(P)}$, $(1-\eta_P{}^2)^{K(P)}$ denote non-standard hierarchical cell blocks, standard hierarchical cell blocks, respectively

(B) Complete combined set of composite blocks (four colors) (S⩾1; ±N⩾2; P=4);

(1), Standard composite tile features: Any basic tile level is a complete element combination,

$$[\{C_{(S\pm N\pm 0)}\}+\{C_{(S\pm N\pm 1)}\}+\{C_{(S\pm N\pm 2)}\}+\{C_{(S\pm N\pm 4)}\}]^{K(Z\pm S\pm N\pm 4)}=\{1+4+6+4+1\}^{K(Z\pm S\pm N\pm 4)} = \{16\}^{K(Z\pm S\pm N\pm 4)}=\{2\}^{K(Z\pm S\pm N\pm 4)}$$

The tile value in the composite standard basic tile (remove the boundary curve in the tile numerical calculation):

$$\{X\}^{K(Z\pm S\pm N)}=[\{2^4\}-1]^{K(Z\pm S\pm N)}=\{N\cdot 4^2-1]\}^{K(Z\pm S\pm N)};$$

Level internal coefficient (number) comparison: $(1-\eta_{HP)}{}^2)^{K(P)}=1$ (also known as probability)

(2), Non-standard composite blocks (four colors) are called non-integrated combinations of levels (±N⩾1, 2, 3... natural numbers; when P⩽4 are also listed as one level);

Non-standard composite tile features: Any tile hierarchy has a complete mix of incomplete elements.

$$[\{C_{(S\pm N\pm 0)}\}+\{C_{(S\pm N\pm 1)}\}+\{C_{(S\pm N\pm 2)}\}+\{C_{(S\pm N\pm 4)}\}]^{K(Z\pm S\pm N\pm p)}=[\{2\}^{K(Z\pm S\pm N)}-q]\leqslant [\{2\}^{K(Z\pm S\pm N)}-1];$$

Tile values in non-standard composite tiles：P=4,3,2,1,q =[0,1,2,⋯15]

$$\{X\}^{K(Z\pm S\pm N\pm p)}=[\{2\}^{K(Z\pm S\pm N\pm p)}-q]\leqslant \{N(2^4-1)\}^{K(Z\pm S\pm N\pm p)};$$

Non-standard composite block / standard composite block numerical comparison:

$$\{(1-\eta_{HP)}{}^2) / (1-\eta_{P)}{}^2)\}^{K(Z\pm S\pm N\pm p)}= [\{2\}^{K(Z\pm S\pm N\pm p)}-q] / [\{2\}^{K(Z\pm S\pm N\pm p)}-1]\leqslant 1;$$

There is a stochastic probability logarithm and a regular network.
In the formula, the power-dimensional sub-levels ($\pm N_A+(\pm N_B)+...$(with serial and parallel combinations) form the polynomial power-dimensional ($\pm S$); the graphs in the S-dimensional powers contain N levels of various standards and non- Standard ($\pm N$) number of combination tiles:

4.2. Proof of the adequacy of the four-color theorem

Suppose: different combinations of levels (K(Z±S±N), that is, do not follow the (1+4+6+4+1) combination rule, any combination of randomly selected groups forms one or more combinations to form a unit Levels, calculated by levels (K(Z±S±N),

have:

$$\{X\pm D)^{K(Z\pm S\pm N)}=(1-\eta^2)^{K(Z\pm S\pm N\pm p)}\cdot\{[\{x_0\}/\{D_0\}]^{K(Z\pm S\pm N\pm 0)}$$

$$+[\{x_0\}/\{D_0\}]^{K(Z\pm S\pm N\pm 1)}+\cdots+[\{x_0\}/\{D_0\}]^{K(Z\pm S\pm N\pm p)}+\cdots+[\{x_0\}/\{D_0\}]^{K(Z\pm S\pm N\pm q)}\}$$

$$=(1-\eta^2)^{K(Z\pm S\pm N\pm 0)}+(1-\eta^2)^{K(Z\pm S\pm N\pm 1)}+\cdots+(1-\eta^2)^{K(Z\pm S\pm N\pm p)}+\cdots$$

$$+(1-\eta^2)^{K(Z\pm S\pm N\pm q)}\cdot\{X_0\pm D_0)^{K(Z\pm S\pm N)}$$

$$=(1-\eta^2)^{K(Z\pm S\pm N\pm P)}\{X_0\pm D_0)^{K(Z\pm S\pm N)};\qquad(14.1)$$

or:

$$=\{(1-\eta_a^2)^{K(Z\pm S\pm N\pm 0)}+(1-\eta_b^2)^{K(Z\pm S\pm N\pm 1)}+\cdots+(1-\eta_p^2)^{K(Z\pm S\pm N\pm p)}+\cdots$$

$$+(1-\eta_q^2)^{K(Z\pm S\pm N\pm q)}\}\cdot\{X_0\pm D_0)^{K(Z\pm S\pm N)};\qquad(14.2)$$

According to formulas (14.1) and (14.2), the polynomials combining complete and non-intact tiles are uniformly converted into the isomorphism and unity of the circle logarithm, and the hierarchical position calculation and the calculation of the graphic position of the internal combination of layers are unified.

have: $(1-\eta^2)^{K(Z\pm S\pm N\pm P)}=(1-\eta_H^2)^{K(Z\pm S\pm N\pm P)}$;

get $$(\eta)^{K(Z\pm S\pm N\pm P)}=[(\eta_a)+(\eta_b)+\ldots+(\eta_p)+\ldots+(\eta_q)]^{K(Z\pm S\pm N\pm P)};\qquad(14.3)$$

$$(\eta^2)^{K(Z\pm S\pm N\pm P)}=[(\eta_a^2)+(\eta_b^2)+\ldots+(\eta_p^2)+\ldots+(\eta_q^2)]^{K(Z\pm S\pm N\pm P)};\qquad(14.4)$$

where: $(\eta)^{K(Z\pm S\pm N\pm P)}$ $(\eta^2)^{K(Z\pm S\pm N\pm P)}$is complete, it can be fully developed on planes and spheres.

4.3. Proof of the uniqueness of the four-color theorem

$$\{x+D\}^{K(Z\pm S\pm N)}=Ax^{K(Z\pm S\pm N\pm 0)}+Bx^{K(Z\pm S\pm N\pm 1)}+\cdots+Cx^{K(Z\pm S\pm N\pm 2)}+\cdots+Dx^{K(Z\pm S\pm N\pm 3)}+D$$

$$=x^{K(Z\pm S\pm N\pm 0)}+C_{(S\pm N\pm 1)}x^{K(Z\pm S\pm N\pm 1)}+\cdots+C_{(S\pm N\pm 2)}x^{K(Z\pm S\pm N\pm p)}+\cdots$$

$$+C_{(S\pm N\pm 3)}x^{K(Z\pm S\pm N\pm q)}+D;$$

$$=(1-\eta^2)^{K(Z\pm S\pm N\pm P)}\{2\}^{K(Z\pm S\pm N\pm P)}\{X\}^{K(Z\pm S\pm N)};\qquad(15.1)$$

Coefficient (number of combinations):

$$\Sigma C_{K(Z\pm S\pm N)}=[\{2\}^{K(Z\pm S\pm N)}-q]^Z\leqslant\{2^4\}^Z=\{4^2\}^Z=\{(N/4)^2\}^Z=\{(S/4)^2\}^Z;\qquad(15.2)$$

Comparison of relative block level relativity:

$$0 \leqslant \{(1-\eta_H^2)/(1-\eta^2)\}^{K(Z\pm S\pm N)} = [\{2\}^{K(Z\pm S\pm NP)}-q]/[\{2^4\}^{K(Z\pm S\pm N)}-1] \leqslant 1; \quad (15.3)$$

Number of arbitrary tiles:

$$\{D^P\}=(1-\eta_H^2)^{K(Z\pm S\pm N)}\{D_0^P\}$$
$$=\{\{\{1+4+6+4+1\}-q_1\}-q_2\}\cdots\}^{K(Z\pm S\pm N)}$$
$$=\{N\cdot 2^4-q\}^{K(Z\pm S\pm N)} \leqslant \{N\cdot 2^4\}^{K(Z\pm S\pm N)}$$
$$\leqslant \{N\cdot 4^2\}^{K(Z\pm S\pm N)} \quad (15.4)$$

Formulas (15.1)~(15.4) describe that after choosing the average value between levels, there is isomorphism among them and the difficulty of calculating the incomplete combination within the hierarchy is eliminated.

Intuitively, in the plane, on the sphere, in any space, the circle logarithms can be naturalized (mapped) as a combination of networks of S points. In the spherical space of the block {{{{A} -(B,C,D)}...}...}, there are at least three planes, three adjacent boundary curves, and a spatial pattern (triangles) of blocks that make up space. . Or the vertices (regions, tiles) of a trigonal (cone) body (tetrahedron) project (projection) a grid pattern of mutually adjoining edges, and there are four surface boundaries (block regions) associated with each other. Display: Triangular (cone) body Three colors are not enough, five colors are too many, four colors are enough.Therefore, the sum of coefficients (CK(Z±S±N±P)) in the expansion of an arbitral high-power (S) binomial coefficient is equal to$\{\{\{\{2^4\}^{K(NP)}-q1]^{K(Z\pm S\pm N\pm P)}...-q_2\}...-q_p.\}...-q_q\}^{K(Z\pm S\pm N)}$. The mathematical combination and omnidirectional relative positions of arbitrary power (S±N) power polynomials are obtained, and the infinity map can be accurately calculated. The block gets filled with four colors.

In summary, the collection of blocks in the four-color theorem can be a complete and incomplete multi-level composite block. There is a combination of serial groups and parallels to form any composite hierarchy K(Z±S±N±[P]). Tiles, graphics. Becomes an arbitrary high-power dimensional polynomial equation that satisfies four colors, and a sufficiently large plane or sphere area. Because it is a non-repeating combination, it is possible to realize the computation of an infinite combination of four colors in adjacent areas of an infinite area of the graph, which proves the adequacy, necessity, and uniqueness of the four-color theorem.

4.4. Calculation of Grid Block Values in Four Color Theorem

The combination of grid blocks has a non-random grid and a random color distribution, belonging to an incomplete hierarchy of rule combinations.

Have: Z=(Infinite); S=1,2,3,4,... natural number; N=1,2,3,4,…natural number; P=4,3,2,1,0; q=0,1,2,3⋯2^4

$$\{X\}^{K(Z\pm S\pm N)}=(1-\eta^2)^{K(Z\pm S\pm N\pm P)}\{D_0\}^{K(Z\pm S\pm N\pm P)} \leqslant \{2\}^{K(Z\pm S\pm N\pm P)}; \quad (16.1)$$

$$\{D_0\}^{K(Z\pm S\pm N\pm P)} \leqslant [(2^4)-q]^{K(Z\pm S\pm N\pm P)} = [(4^2)-q]^{K(Z\pm S\pm N\pm P)}; \quad (16.2)$$

Special: When the map is mapped to points and grids of the grid, it belongs to a special regularity combination, random color fill, no closed boundary, Special: When the map is mapped to points and grids of the grid, it belongs to a special regularity combination, random color fill, no closed boundary, $[(2^4)-q]^{K(Z\pm S\pm N\pm P)}$,（q=0）,

$$\{D_0\}^{K(Z\pm S\pm N\pm P)}=[(4^2)]^{K(Z\pm S\pm N\pm P)}; \quad (16.3)$$

Comparison of relative block level relativity:

$$0\leqslant\{(1-\eta_H^2)/(1-\eta^2)\}^{K(Z\pm S\pm N)} = [\{2\}^{K(Z\pm S\pm NP)}-q] / [\{2\}^{K(Z\pm S\pm N\pm 4)}-1] \leqslant 1; \quad (16.4)$$

The combination of internal colors:

$$(1-\eta_H^2) = (1-\eta_{h1}^2) +(1-\eta_{h2}^2) +\cdots+ (1-\eta_{hp}^2) +\cdots+ (1-\eta_{hq}^2)\leqslant 1; \quad (16.5)$$

5. Conclusion

The highlight of this paper is to convert the color of the tile (limited to four colors) to the non-repeating combination set {X} and the last closed boundary curve {D} to form a polynomial equilibrium equation {X±D}, which is converted to no specific element. The logarithmic equation $(1-\eta^2)^{K(Z\pm S\pm N\pm P)}$ and the hierarchical unity (called combination probability) $(1-\eta_H^2)^{K(Z\pm S\pm N\pm P).}$ Prove the logarithmic isomorphism (determination of the block, hierarchy, combination), unity (determination of the internal combination of the hierarchy), and the reciprocity and relative symmetry combination of the boundary curve and the combination of elements; making the four-color theorem Become a non-repeating four-four combination set graph, forming any finite hierarchy in infinite tiles

A combination of (Z±S±N±P). The sum of the coefficients ($C_{K(Z\pm S\pm N\pm P)}$) in the expansion of any high power (S) binomial coefficient

$$\{\{\{\{2^4\}^{K(NP)}-q_1]^{K(Z\pm S\pm N\pm P)}\ldots-q_2\}^{K(Z\pm S\pm N\pm 2P)}\ldots-q_p\}^{K(Z\pm S\pm N\pm pP)}\ldots -q_q\}^{K(Z\pm S\pm N\pm pq)}\}^{K(Z\pm S\pm N\pm P)}$$
$$=[\{2^4\}^{K(NP)}-q]^{K(Z\pm S\pm N\pm P)} =[\{4^2\}^{K(NP)}-q]^{K(Z\pm S\pm N\pm P)}, \quad (17)$$

The mathematical combination of arbitrarily power (S±N) power polynomials and the omnidirectional relative position are obtained, and the infinite block can be accurately calculated to obtain four colors.{q} indicates the number of incomplete combinations of each level (q=0, 1, 2, 3, ... 15)

$$[\{2^4\}^{K(NP)}-q]^{K(Z\pm S\pm N\pm P)}\leq\{X\}^{K(Z\pm S\pm N\pm P)}\leq\{2^4\}^{K(NP)}]^{K(Z\pm S\pm N\pm P)} \quad (18)$$

Finally, a sufficiently large high-power polynomial obtains each level by the isomorphic circular logarithm equation "limited to the infinite combination of four colors" (mathematical combination), passing the unit circle of the total coefficient $C_{K(Z\pm S\pm N\pm P)}$ The logarithmic hierarchy formula (1-ηH2) K(Z±S±N±P) and the isomorphic circular logarithm formula $(1-\eta^2)^{K(Z\pm S\pm N\pm P)}$ are calculated. The value required for the four-color theorem "infinite tiles filled with four colors" was successfully replaced by a computer that used 1200 hours, a sufficiently large S ⩾ 100 billion power (dimension) calculation. (proof)

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