SCIREA Journal of Mathematics

https://www.scirea.org/journal/Mathematics

February 10, 2020

Volume 5, Issue 1, February 2020

From the Meaning of Infinite Classification to the Conjecture of Twin Prime Numbers

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Abstract:

Background The twin prime conjecture is considered as a classic puzzle in the history of number theory and one of the most famous conjectures, which has always puzzled us. At the International Congress of Mathematicians in 1900, mathematician David Hilbert presented 23 important mathematical problems and conjectures to be solved He included the Bernhard Riemann conjecture, the Twin Prime Conjecture, and the Goldbach's conjecture in the eighth of 23 mathematical problems.

Method Based on the "Differential Incremental Equilibrium Theory" [1], the infinite set of infinite prime numbers is divided, the increment equation of infinite prime numbers is established, and the tree-like set of prime numbers is obtained. Find the twin primes with a minimum unit [1→1] of 2.

Result When a set of prime numbers is infinitely divided, there are 2[1→1] pairs of prime numbers whose gap is equal to 2 and gap is not equal to 2. We gives a complete proof of the twin prime conjecture. It shows that the importance of "Differential Incremental Equilibrium Theory"[1] and infinite classification in twin prime conjecture. In a higher-level ideology, the set infinite partition classification confirms that the minimum unit is 2. It's a new way to prove Twin Prime Conjecture.

Conclusion This paper gives a complete proof of the establishment of the Twin Prime Conjecture.

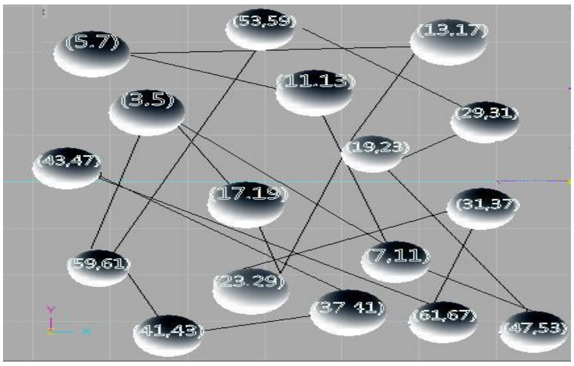
Keywords: Differential incremental equilibrium, Twin primes, Sets, Prime gap, Infinite Classification, Rough set

1. Introduction

1.1. Exist infinitely many prime twins

Based on the "differential incremental equilibrium theory" (1), the set of infinite prime numbers is infinitely divided and establish the incremental equation of sets. Then we get the set of infinite prime number pairs with gap of 2. That is, the set of infinite set of twin prime numbers.

Set relation $\int\sum_{n=\sigma}^{\sigma}(A_\sigma - B_\sigma)$ represents the gap of the prime number pairs. We investigate the relationship between the gap of prime number pairs and twin prime pair.



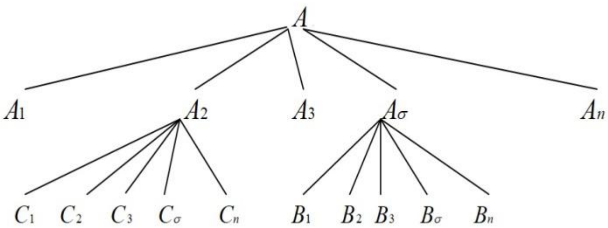


Figure 2. *The set relation* $\int\sum_{n=\sigma}^{\sigma}(A_\sigma - B_\sigma)$ *is defined as gap of prime number pairs.*

$$A_\sigma \rightarrow A_1, A_2, A_3, \ldots, A_n \leftarrow A \ \ Sets$$
$$B_\sigma \rightarrow B_1, B_2, B_3, \ldots, B_n \leftarrow B \ \ Sets$$
$$C_\sigma \rightarrow C_1, C_2, C_3, \ldots, C_n \leftarrow C \ \ Sets$$
$$\cdots \qquad \cdots\cdots$$

$$\int\sum_{n=\sigma}^{\sigma}(A_\sigma - B_\sigma) + \int\sum_{n=\sigma}^{\sigma}(B_\sigma - C_\sigma) + \ldots + \int\sum_{n=\sigma}^{\sigma}(Y_\sigma - Z_\sigma) = A_\sigma \ Sets$$
$$\cdots \qquad \cdots \qquad \cdots \qquad \cdots$$
$$\cdots \qquad \cdots \qquad \cdots \qquad Z_\sigma \ Sets$$

The integral of a sum is the sum of the gaps of the infinite prime pair.

1.3. The set contantly is classified by the gaps of prime number pairs

$$A_\sigma + B_\sigma + \ldots + Z_\sigma = A \quad Sets$$
$$A_\xi + B_\xi + \ldots + Z_\xi = B \quad Sets$$
$$A_\beta + B_\beta + \ldots + Z_\beta = C \quad Sets$$

$$A \cap B \cap C \ldots = \int\sum(A_\sigma \rightarrow B_\xi) \cup (A_\xi \rightarrow B_\beta) \cup \ldots$$

Let: A , B , C, … , Z *by* $A_1, A_2, A_3, \ldots, A_n$

$(A_\sigma \rightarrow B_\xi)$, $(B_\xi \rightarrow C_\beta)$, …, by $(A_m \rightarrow B_{m+\sigma})$

1.4. The form of prime pairs continuous classification set

Figure 1. *The minimum gap of prime number pairs is obtained by infinite classification.*

1.2. Prime number pairs and gap of prime number pairs

Definition sets A, A_1,A_2,A_3,...,A_n and A_σ,B_σ,C_σ,... and B,C,... ; B, B_1,B_2,B_3,...,B_n and C, C_1,C_2,C_3,...,C_n
The kernel differential difference of the above set relation can be expressed in the form of rough set theory as prime number pair and prime pair gap.

$$(\mathrm{U})\int\sum_{m=1}^{m}(A_m) = (\mathrm{U})\int\sum_{m=1}^{m}(A_m \rightarrow A_{m+\sigma})$$

$$(\mathrm{U})\int\sum_{m=1}^{m}(A_m) = (\mathrm{U})\int\sum_{m=1}^{m}(A_m) \rightarrow (\mathrm{U})\int\sum_{m=1}^{m+\sigma}(A_{m+\sigma})$$

$$1 = \frac{(\mathrm{U})\int\sum_{m=1}^{m}(A_m) \rightarrow (\mathrm{U})\int\sum_{m=1}^{m+\sigma}(A_{m+\sigma})}{(\mathrm{U})\int\sum_{m=1}^{m}(A_m)}$$

$$1 = 1 \rightarrow \frac{(\mathrm{U})\int\sum_{m=1}^{m}(A_m) + (\mathrm{U})\int\sum_{m=\sigma}^{m+\sigma}(A_\sigma)}{(\mathrm{U})\int\sum_{m=1}^{m}(A_m)}$$

$$1 = 1 \rightarrow \left[\frac{(\mathrm{U})\int\sum_{m=\sigma}^{m+\sigma}(A_\sigma)}{(\mathrm{U})\int\sum_{m=1}^{m}(A_m)} + 1\right]$$

$$1 = 1 \rightarrow \left[\frac{(\mathrm{U})\int\sum_{m=\sigma}^{m+\sigma}(A_\sigma)}{(\mathrm{U})\int\sum_{m=1}^{m}(A_m)}\right] + [1 \rightarrow 1]$$

Simplify the above formula, take $m + \sigma \rightarrow m$, then $\sigma = 1 \rightarrow \sigma$.

$$1 = 1 \rightarrow \frac{(\mathrm{U})\int\sum_{\sigma=1}^{\sigma}(A_\sigma) + (\mathrm{U})\int\sum_{m=\sigma}^{m}(A_m)}{(\mathrm{U})\int\sum_{\sigma=1}^{\sigma}(A_\sigma)} + [1 \rightarrow 1]$$

$$1 = 1 \rightarrow \left[1 + (\mathrm{U})\frac{\int\sum_{m=\sigma}^{m}(A_m)}{\int\sum_{\sigma=1}^{\sigma}(A_\sigma)}\right] + [1 \rightarrow 1]$$

$$1 = [1 \rightarrow 1] + \left[1 \rightarrow (\mathrm{U})\frac{\int\sum_{m=\sigma}^{m}(A_m)}{\int\sum_{\sigma=1}^{\sigma}(A_\sigma)}\right] + [1 \rightarrow 1]$$

Further simplify, then

$$1 = 2[1 \rightarrow 1] + \left[1 \rightarrow (\mathrm{U})\frac{\int\sum_{m=\sigma}^{m}(A_m)}{\int\sum_{\sigma=1}^{\sigma}(A_\sigma)}\right] \qquad (1)$$

1.5. Create the sets of gaps of twin prime

According to the formula (1), when the prime number set Lim→∞, the gap of the prime pairs is equal to 2, can get the sets of gaps of twin prime pairs continuously.

The sets $\left[1 \to (\cup) \int \frac{\sum_{m=\sigma}^{m} A_m}{\sum_{\sigma=1}^{\sigma} A_\sigma}\right]$ generates a large number of regular, jump-free tree-like adhesions, forming a tree-like radiation relationship.

When $1 = 2[1 \to 1] + \left[1 \to (\cup) \int \frac{\sum_{m=\sigma}^{m} A_m}{\sum_{\sigma=1}^{\sigma} A_\sigma}\right]$ set of prime numbers Lim→∞ , it is infinitely divided by "Differential Incremental Equilibrium Theory"[1], the increment set is generated, and the increment relation equation is generated. And there are infinite pairs of regular, tree-like sets of prime numbers with gap is greater than or equal to 2, the total of which is equal to 1.

2. Distributed sequence, and set equation of gaps of twin prime

2.1. With distributed sequence, Get the set equation of gaps of twin prime numbers

Let $\sigma = 1, \sigma \to m = \sigma, m \to \sigma$

$$1 = 2[1 \to 1] + \left[1 \to (\cup) \frac{\int \sum_{m=\sigma}^{m} (A_m)}{\int \sum_{\sigma=1}^{\sigma} (A_\sigma)}\right]$$

Because $\frac{4+5+6+7}{1+2+3+4}$

$$= \frac{(1+2+3+4)+(4-1)\times 4}{1+2+3+4}, \text{then}$$

$$\frac{4+(5-4)+(6-4)+(7-4)}{1+2+3+4},$$

$$\frac{(1+2+3+4)+(4-1)\times 4}{(1+2+3+4)}$$

According to the mathematical induction method, get:

$$\frac{(1+2+3+4+\ldots+m)+(m-1)m}{(1+2+3+4+\ldots+m)} = 1 + \frac{m(m-1)}{(1+2+3+4+\ldots+m)} = 1 + \frac{m(m-1)}{\sum_{m=1}^{m}}$$

Turn (1) into a general set equation with a sequence expansion form.

$$1 = 2[1 \to 1] + \left[1 \to \left[(\cup) \int \frac{\sigma(\sigma-1)(A_\sigma)}{\sum_{\sigma=1}^{\sigma} (A_\sigma)} + 1\right]\right]$$

Obviously, σ can be writen m

$$1 = 2[1 \to 1] + \left[1 \to \left[(\cup) \int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m} (A_m)} + 1\right]\right]$$

2.2. Set equation of gaps of prime number pairs general solution extended by sequence of numbers

$$1 = 2[1 \to 1] + \left[1 \to \left[(\cup) \int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m} (A_m)} + 1\right]\right] \quad (2)$$

When the gap of prime pairs is greater than 2, the set equation of graph continuous partition is

$$1 = 3[1 \to 1] + \left[1 \to (\cup) \int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m} (A_m)}\right] \quad (3)$$

When the gap of prime pairs is equal to 3, the pair of prime numbers appears jump and tree-like adhesion.

$$\frac{3+4+5+\ldots}{1+2+3+\ldots}, \frac{4+5+6+7+\ldots}{1+2+3+4+\ldots},$$

$$\frac{5+6+7+8+9\ldots}{1+2+3+4+5+\ldots}, \ldots$$

When the gap of prime pairs is ≥ 3, then there is

$$\frac{3\times 4}{1+2+3+4}, \frac{4\times 5}{1+2+3+4+5}, \frac{5\times 6}{1+2+3+4+5+6}, \ldots$$

Can be reduced to

$$\frac{(1+2+3+4)+(4-1)\times 4}{(1+2+3+4)} = 1 + \frac{3\times 4}{1+2+3+4}$$

$$\frac{(1+2+3+4+5)+(5-1)\times 5}{(1+2+3+4+5)} = 1 + \frac{4\times 5}{1+2+3+4+5}$$

According to mathematical induction, we get the general formula of the sequence:

$$\frac{(1+2+3+4+\ldots+m)+(m-1)\times m}{(1+2+3+4+\ldots+m)} = 1 + \frac{(m-1)\times m}{1+2+3+4+\ldots+m}$$

By substituting the above formula into the general set equation of the extended form of number sequence, get:

$$(\cup) \int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m} (A_m)} \leftarrow 1$$

When the gap of prime pairs is ≥ 3, a pair of n-tree forms a jump-tree-like adhesive structure of the relationship.

2.3. Irreducible set relation of infinite prime number, set equation of general solution of the twin prime gaps

Irreducible set relation of infinite prime number, set equation of general solution of the twin prime gaps.

$$1 = 2[1 \to 1] + \left[1 \to \left[(\cup) \int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m} (A_m)} + 1\right]\right]$$

Simplify

$$1 = 2[1 \to 1] + \left[1 \to \left[(\cup)\int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m}(A_m)} + 1\right]\right],$$

$$1 - \left[1 \to \left[(\cup)\int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m}(A_m)} + 1\right]\right] = 2[1 \to 1]$$

$$\left[0 - \quad \to \left[(\cup)\int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m}(A_m)} + 1\right]\right] = 2[1 \to 1],$$

$$(\cup)\int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m}(A_m)} + 1 = 2[1 \to 1]$$

$$\left[(\cup)\int \frac{m(m-1)(A_m)}{\sum_{m=1}^{m}(A_m)} + 1\right] = 2[1 \to 1]$$

$$1 = 2[1 \to 1] + \left[1 \to (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)}\right], then$$

$$1 - \left[1 \to (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)}\right] = 2[1 \to 1]$$

$$(1-1) - \quad \to (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1]$$

$$0 - \quad \to (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1]$$

$$(\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1]$$

To establish the general formula of sequence for getting the gaps of twin primes.

$$\frac{(1+2+3+4+\ldots+m)+(m-1)m}{(1+2+3+4+\ldots+m)} = 1 + \frac{m(m-1)}{(1+2+3+4+\ldots+m)}$$

Prime pairs gaps versus enumerated type equation.

$$(\cup)\int \frac{m(m-1)A_m}{\sum_{m=1}^{m}(A_m)} + 1 =$$

$$(\cup)\int \left[\frac{(3+4+5)A_m}{(1+2+3)A_\sigma}, \frac{(4+5+6+7)A_m}{(1+2+3+4)A_\sigma}, \ldots\right]$$

Set equation with the gap of twin prime is equal to 2.

$$\begin{cases} (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1] \\ (\cup)\int \left[\frac{(3+4+5)A_m}{(1+2+3)A_\sigma}, \frac{(4+5+6+7)A_m}{(1+2+3+4)A_\sigma}, \ldots\right] = 2[1 \to 1] \end{cases} \quad (4)$$

The gap of prime pair is equal to 2, that is, the general set equation of the gaps of twin prime number.

$$\begin{cases} (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1] \\ (\cup)\int \frac{m(m-1)A_m}{\sum_{m=1}^{m}(A_m)} + 1 = 2[1 \to 1] \end{cases} \quad (5)$$

3. Conclusion

We get general solution set equation of the gaps of twin prime as follows.

$$\begin{cases} (\cup)\int \frac{\sum_{m=\sigma}^{m}(A_m)}{\sum_{\sigma=1}^{\sigma}(A_\sigma)} = 2[1 \to 1] \\ (\cup)\int \frac{m(m-1)A_m}{\sum_{m=1}^{m}(A_m)} + 1 = 2[1 \to 1] \end{cases}$$

There are infinite sets of prime pairs with gap equal to 2. The twin prime conjecture is proved.

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