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Propose a Solution That Confirms the Riemann Hypothesis is Correct

DUC THANH LE[1], THUY THI THU LE[2]
[1]University of Transport Ho Chi Minh City,
Ho Chi Minh, Vietnam

[2]University of Transport and Communications
No. 3, Cau Giay Street, Lang Thuong Ward, Dong Da District, Hanoi 100000, Vietnam

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Abstract
Bernhard Reimann proposed his hypothesis in 1859. Until now, after 165 years of existence, no one has yet proven this hypothesis. Due to the nature of the hypothesis's contribution to modern mathematics. It is necessary to prove the hypothesis. The approach to solving the problem is using classical physics and mathematical knowledge to find a value that satisfies the constraint. Then, prove that this value is unique. To do this, the author uses MATLAB (2023a) calculation software. The results of the research process show the correctness of the hypothesis. However, the specific characteristics of the current calculation tool still need to be met, so more appropriate programs are needed in the future to solve the problem. Many theories have been proposed to solve the Reimann hypothesis but have failed. This article has resolved and ended the lack of proof for the Reimann hypothesis

Keywords: Reimann, Hypothesis, Mathematics, Prove, Solution.

1. Introduction

Bernhard Reimann proposed a conjecture about the non-trivial zero points of the Zeta Reimann function. The non-trivial zeros of the Riemann zeta function all have a real part of 1/2. The Zeta Reimann function is defined as follows: [web24, PB07].

$$\zeta(s)=\sum_{n=1}^{\infty}\frac{1}{n^s}=\frac{1}{1^s}+\frac{1}{2^s}+\frac{1}{3^s}+....$$

Leonhard Euler proved this series using the Euler product.

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$$\zeta(s)=\prod_{p\ prime}\frac{1}{1-p^{-s}}=\frac{1}{1-2^{-s}}\cdot\frac{1}{1-3^{-s}}\cdot\frac{1}{1-5^{-s}}\cdot\frac{1}{1-7^{-s}}\cdots\frac{1}{1-p^{-s}}\cdots$$

s: is an argument whose real part is greater than 1

ζ:convergent, which proves no zero point in this domain.

If the real part s > 1, then the Zeta function can be expressed as follows :

$$\left(1-\frac{2}{2^s}\right)\zeta(s)=\frac{\sum_{n=1}^{\infty}(-1)^{n+1}}{n^s}=\frac{1}{1^s}-\frac{1}{2^s}+\frac{1}{3^s}-\ldots$$

The right-hand side converges, even when s > 0, except for the case s = 1

In the region 0 < Re(s) < 1. The Zeta function is satisfied:

$$\varsigma(s)=2^s\pi^{s-1}\sin\left(\frac{\pi s}{2}\right)\Gamma(1-s)\varsigma(1-s)$$

If s is an even negative integer $\zeta(s)=0$ Because $sin\frac{\pi s}{2}=0$ the functional equation

(where s is a positive integer, the sin function will be eliminated by the gamma function)

Reimann said: Any non-trivial point is satisfied: $Re(s)=\frac{1}{2}$

2. Methods

Use physics knowledge combine with mathematics to express the constraint the describes the Reimann hypothesis in a different way. At the same time, it proves the monovalence of the solution, there by providing the solution.

2.1 Recall Some Concepts in Mathematics [TNN13]

Definition 1 (Mapping definition). The mapping from set E to set F is a rule; the relationship between E and F is such that when it affects any element x of E, it will create one and only one element y of F.

Mapping symbol: f: E → F

Definition 2 (Injective definition). $f: E\to F$

f is injective (one-to-one) if: $f(x_1)=f(x_2)\Rightarrow x_1=x_2$

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Definition 3 (surjective definition). Mapping $f : E \to F$ is surjective if $f(E) = F$

Definition 4 (Bijective definition). Bijective definition

f: $E \to F$ is bijective if if it is both injective and surjective.

Consider two sets E and F, f is a bijective from E to F then.

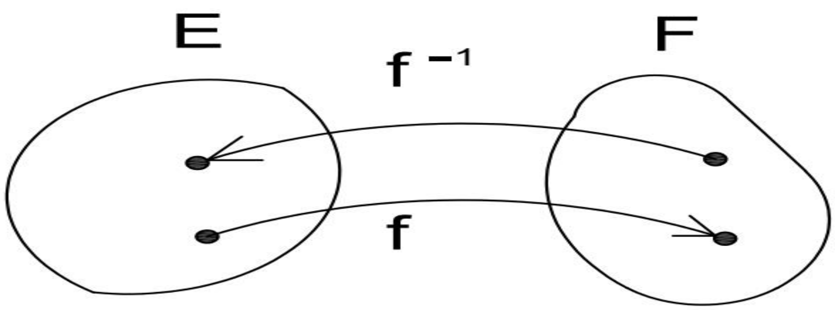

Figure 1: Illustration depicting the definition of bijection in mathematics

For each y ∈ F there is one and only one x ∈ E so that y = f (x) ;

(There is one because f is surjective from E to F, and there is only one because F is injective from E to F)

The bijective f: E → F creates a mapping from F → E. This mapping is called the inverse mapping

of the mapping f denoted f^{-1}.

Thus, if f is bijective, f^{-1} is also bijective.

Consider circle (C) , diameter d

We have bijective f : C → d, and bijective f^{-1} : d → C

Given point A ∈ (C), if we project A perpendicularly onto d we will have only point T1; projecting T2 onto (C), we will have only value B.

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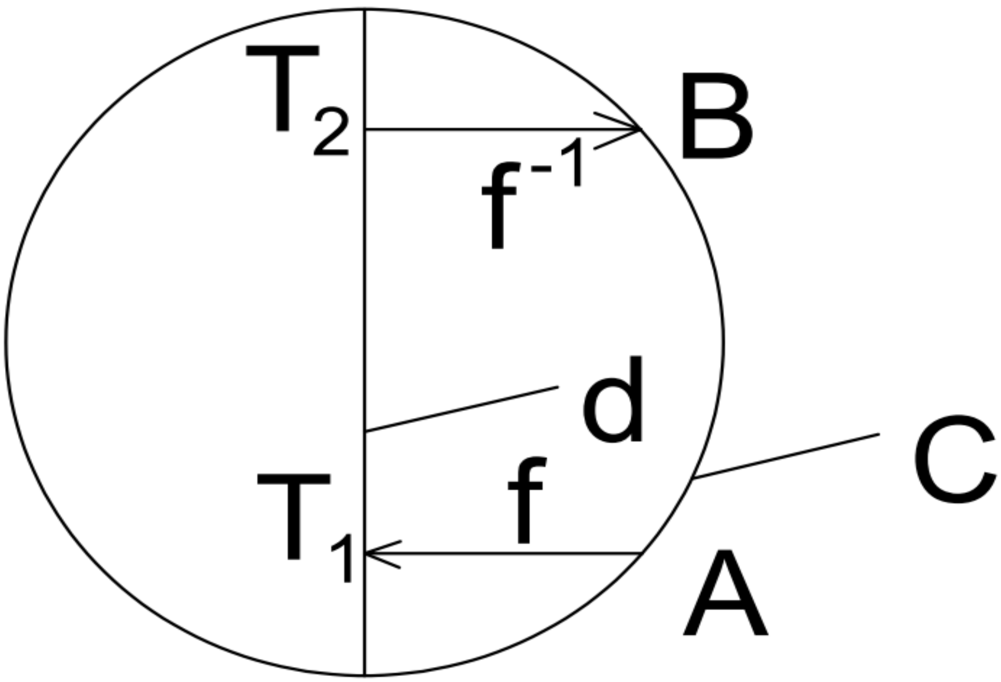

Figure 2: The Illustration depicts the monovalence, the one-to-one correspondence between a circle and a straight line

The above basic knowledge, which forms the foundational bedrock of our understanding, is crucial in proving the Reimann hypothesis.

2.2 The Aguments Lead to the Assertion That the Hypothesis is Correct [TNN13, Ser96, EH91, Nea06, Cho03, Duf98, KS03, PB07].

Given a circle with center O and radius R (symbol C(O, R)) and any curve, call this curve an equation (because the graph of $\varsigma\left(\frac{1}{2}+it\right)=0$ is very complicated, so to keep it simple without losing generality.

$$\varsigma\left(\frac{1}{2}+it\right)=0$$

assumed the shape as Figure 3

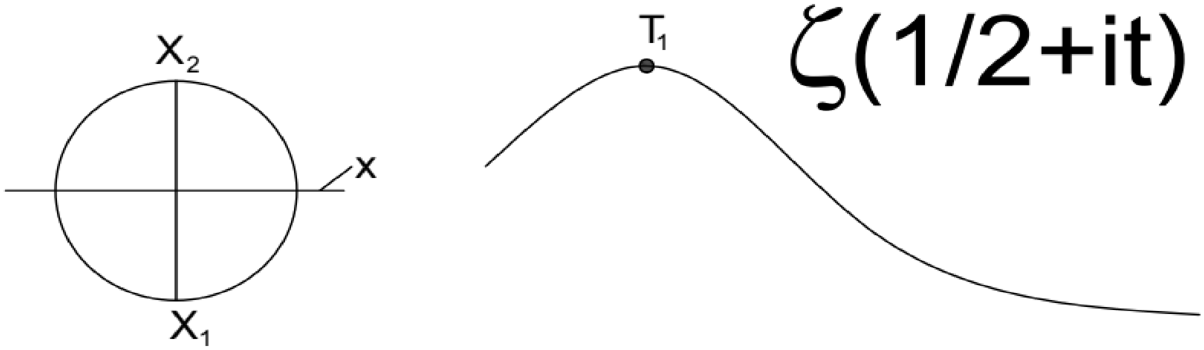

Figure 3: Describe how to construct the new zeta function

Set the initial conditions of the problem as: X1 coincides with T1 Line C(0,R) touches the line at $X_1 = T_1$

Illustration as shown below

x ∈ [-R; R]

it is easy to see that x = 0 when projecting X_1, X_2 perpendicularly to x, and this value is unique. Another critical point to note is that R is a function whose value changes and is not constant.

For simplicity, instead of letting the circle roll without slipping on the path $\varsigma\left(\frac{1}{2}+it\right)=0$ with the initial contact point $X_1 \equiv T_1$

Circle C (O, R) is wound around by $\varsigma\left(\frac{1}{2}+it\right)$ We can imagine the zeta function being stretched out like a thread; this thread is wound around a core – which is circle C.

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The Reimann hypothesis can be restated with the following equivalent assumption: When $\varsigma\left(\frac{1}{2}+it\right)$ keeps wrapping around the circle C (O, R) when passing through, there will be a value that satisfies $t_0 := \left\{t_0 \in R, \varsigma\left(\frac{1}{2}+it_0\right)=0\right\}$

t_0 will have the value corresponding to X_1, X_2, and otherwise no other value is satisfied

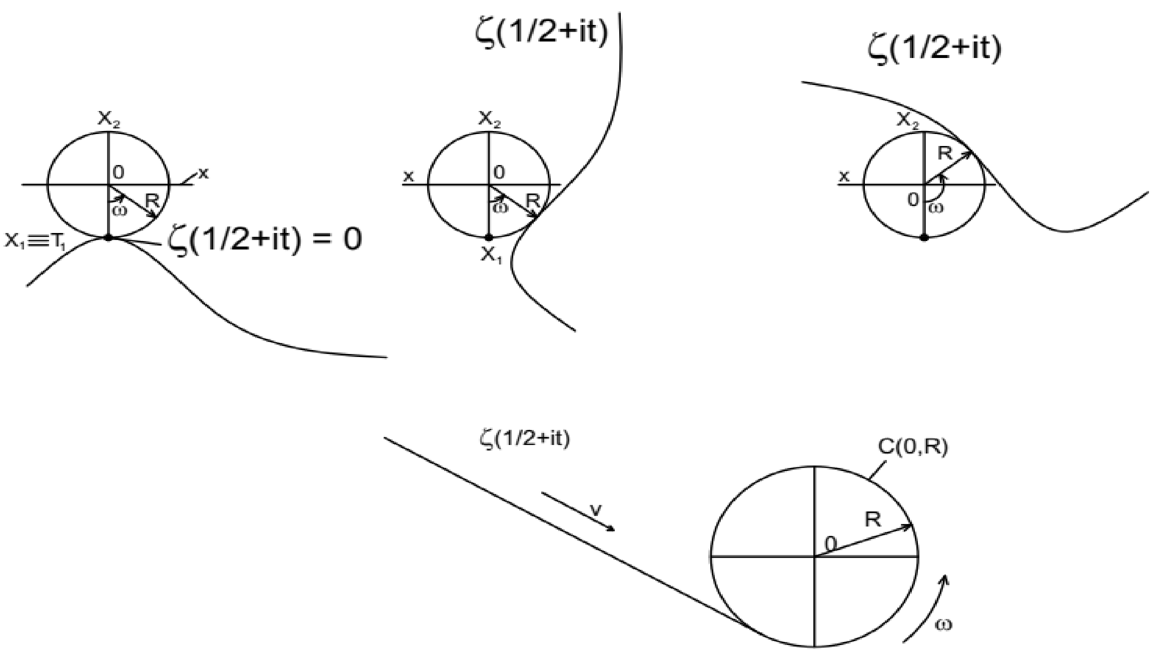

Figure 4: The geometric characterization of the zeta function is different from the traditional one

In classical physics, when there is a point mass m moving in a circle, the following will be drawn.

• Velocity v of m :

$$v = \omega.R \Rightarrow \omega = \frac{v}{R}$$

• Acceleration a of m

$$a = \frac{v^2}{R} \Rightarrow R = \frac{v^2}{a}$$

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In mathematics and physics, if we know the distance, we will obtain the following:

• The distance derivative will give the speed, and the velocity derivative will provide the acceleration.

• Because mass and time are not involved in proving the hypothesis, we can ignore the physical properties of the above formulas, keeping only pure mathematical properties. The following is deduced:

Consider the displacement distance described by

$$\zeta\left(\frac{1}{2}+it\right)$$

$$v=\zeta'\left(\frac{1}{2}+it\right)$$

v is the first derivative of the zeta function:

$$a=\zeta''\left(\frac{1}{2}+it\right)$$

a is the 1st derivative of v, and also the 2nd derivative of the zeta function

Since ζ is wrapped around the circle, ζ can be calculated as follows

$$\zeta=\omega.R(\sec)$$

Sec: time.

Because time does not participate in the calculation object, we let sec = 1.

$$\zeta\left(\frac{1}{2}+it_0\right)=\omega.R=v=\zeta'\left(\frac{1}{2}+it_0\right)$$

Based on this equation, we can calculate the corresponding t_0 value. From there, we draw the conclusion that the Reimann hypothesis is correct. To calculate t_0, the article relies on MATLAB 2023a software, and the following is the proposed algorithm.

2.3 Matlab Programming Code to Solve the Problem.

THE PROGRAMMING CODE[HHN09]

```
global z t R v a w anpha anpha1 tp i

syms z t R v a w anpha anpha1 tp i
```

```
v = zeta(1,0.5 + t*1i)
a = zeta(2, 0.5 + t*1i)
R = (v2)/a
w =v/R
anpha = [13, 20, 24 27 31 35 40 42 45 49]
(OR anpha = [13, 20, 24 29 31 36 40 43 47 49])
(OR anpha = [13, 20, 24 29 32 37 40 43 47 49])
for i = 1:10
z(i) = vpasolve(zeta(0.5 + t*1i)==zeta(1, 0.5+t*1i),t,anpha(i))
anpha1(i)=z(i)
tp(i) = vpasolve(zeta(0.5 + t*1i)==0,t,anpha(i))
```

Table 1. The solution value t_0 has been proposed for comparison in the following table:.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1	14.134	13	14.102-0.7342i	13	14.102-0.7342i	13	14.102-0.734i
2	21.022	20	21.050-0.658i	20	21.050-0.658i	20	21.050-0.658i
3	25.010	24	24.963-0.625i	24	24.963-0.625i	24	24.963-0.625i
4	30.424	27	21.050-0.658i	29	30.513-0.603i	29	30.513-0.603i
5	32.935	31	30.513-0.603i	31	30.513-0.603i	32	32.840-0.589i
6	37.586	35	30.513-0.603i	36	40.958-0.575i	37	39.621-0.568i
7	40.918	40	40.959-0.576i	40	40.958-0.575i	40	40.958-0.575i
8	43.327	42	40.959-0.576i	43	43.233-0.548i	43	43.233-0.548i
9	48.005	45	40.959-0.576i	47	48.515-0.537i	47	48.515-0.537i
10	49.773	49	49.668-0.588i	49	49.668-0.558i	49	49.668-0.558i

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Column V(1) contains available reference values (recalculated using MATLAB (2023a), numbered sequentially from $H(1) \rightarrow H(10)$

Columns V (3), V (5), V (7) are the results corresponding to the values in columns V (2), V (4 , V (6) Although the results Matlab returns are 30 values, there are duplicate values, so the table only has ten reference values and 10 calculated values by Matlab. These ten values appear in column V (7)

3. Results

The Reimann hypothesis is completely correct. The difficulties in proving it have been resolved. Using physical-mathematical models has overcome this barrier.

This shows that the Reiman hypothesis

$$\zeta\left(\frac{1}{2}+it\right)$$

replaced by equation:

$$\zeta\left(\frac{1}{2}+it_0\right)=\zeta'\left(\frac{1}{2}+it_0\right)$$

is entirely correct

The computer calculation also proves that t_0, ζ and ζ' have the properties of bijective and confirms that the Reimann hypothesis is correct.

4. Discussion

The main challenge in proving the Reimann hypothesis consists of two issues:

•First: prove the uniqueness of t

• Second, the value of t must be calculated by describing its relationship with another function.

From there, we confirm the correctness of the proof method.

Previous studies have yet to be able to resolve these two issues.

This article's solution proves that the Reimann hypothesis ceases to exist and opens up further research directions for mathematics.

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