The Truth of Riemann Conjecture Revealed in Three Dimensional Space

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Abstract This article reveals that the Riemann Hypothesis can be attributed to the combined effect of two geometric projections within three-dimensional real space: the projection of the function's non-trivial zeros onto the complex plane, and the projection of the singularity at the point S=1 on the real axis onto the real number plane.

Key words: singularities ; non-trivial zeros; Infinite Projection

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1. Introduction

The Riemann hypothesis posits that all non-trivial zeros of the Riemann Zeta function $\zeta(s)$ lie on the critical line Re(s)=1/2. While computational verification supports this claim for over 10^{13}zeros[1], a rigorous mathematical proof remains elusive.

We study non-trivial zeros on the complex plane. However, the possibility that they are points in three-dimensional real space cannot be ruled out. If non-trivial zeros exist as such points (as illustrated in Figure 1), then we must consider their influence on a given complex plane within this real space.

Since the non-trivial zeros of the Riemann zeta function are intimately related to its singularities, and the key singularity lies at S=1 on the real axis, our analysis can be focused on the relationship between this singularity and the zeros on the complex plane. By considering the infinite iterative projection of the singularity's influence onto the critical axis, we can derive a constrained region for the real parts of the non-trivial zeros on that axis. This, in conjunction with the defining property of the non-trivial zeros, leads to the conclusion that all such zeros must lie on the line $\mathrm{Re}(s) = 1/2$.

2. The Form of Existence of Non-trivial Zeros

We study non-trivial zeros on the complex plane. However, the possibility that they are points in three-dimensional real space cannot be ruled out. If non-trivial zeros exist as such points (as illustrated in Figure 1), because the projection of a point in three-dimensional real space onto a complex plane is the real part of the zero point, then we must consider their influence on a given complex plane within this real space. (Any $\{\mathrm{Re(z)}\ \mathrm{o}\ \mathrm{Re(x)}\}$ plane in three-dimensional space may be designated as a complex plane)

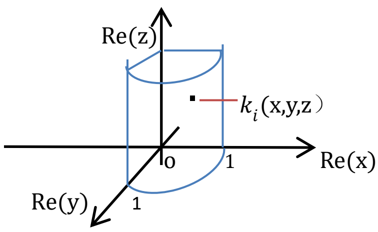

Fig1

According to the domain of non trivial zeros, there are: $0 \le x < 1, 0 \le y < 1, 0 \le z < \infty$. So the Non-trivial Zeros is inside the blue fan-shaped cylinder, if set $\{\mathrm{Re(z)}\ \mathrm{o}\ \mathrm{Re(x)}\}$ is complex plane, So after projecting k_i onto the complex plane, the real part of k_i can be determined on the $\mathrm{Re(x)}$ -axis

3. Projection of S=1

The simulated three-dimensional spatial coordinate diagram is shown below. Re(z) coincides with Im.

Because the projection is performed in the { Re(x) o Re(y)} plane, it is independent of the complex plane. The Im axis in Figure 3 only indicates the presence of complex planes and singular points. The projection of the K point onto the complex plane gives its real coordinate k_i on the Re(x).

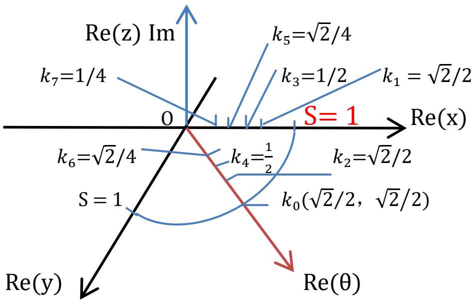

Fig2

In Fig2, set the Re(θ) axis through the origin O, Re(θ) on real number “Re(x)- Re(y)plane” , Re(θ) average segmentation angle $\pi/2$, Re(θ)
intersects with the arc at point k_i Fig2
$\because Ok_i = 1,\ \therefore k_0(\mathrm{x},\ \mathrm{y}) = k_0(\sqrt{2}/2,\ \sqrt{2}/2)$.

3.1 Infinite projection of singularity

Since in the "Re(x)–Re(y) plane," all points within the quadrant containing the Re(θ)-axis satisfy the domain of definition for both the poles and the non-trivial zeros of the Riemann Zeta function, we can, with the aid of the Re(θ)-axis, project S=1 infinitely within the interval from 0 to S=1. See Fig2 k_1, k_2, k_3 ...

Since on Re(x) , the segments k_1=$\sqrt{2}/2$ ~ S = 1 are all projections of S =1 on Re(x), that is in the segments k_1=$\sqrt{2}/2$ ~ S =1, all points are equivalent to pole, and S=1is Points where the Zeta function is Undefined or not parsed, [1] if these points are meaningful on Re(x), then they are also meaningful on the arc，when S=1, This is obviously contradictory to the non trivial zero critical zone Re(x)< 1. So here cannot be any 'non trivial zeros' within segment:
k_1=$\sqrt{2}/2$ ~ S = 1 of “Im − Re(x)plane” .

This defines nested **zero-free regions** (ZFR)

3.2 Boundaries of (ZFR)

Since these ZFR are interrelated, so corresponding to, of k_1=$\sqrt{2}/2$~S =1 on Re (x), there should also be a (ZFR) on Re(θ). it is k_2=$\sqrt{2}/2$~S=1 in Fig2.

Project k_2 from Re(θ)onto Re(x)and mark it as k_3, $k_3 = 1/2$.

1/2 ~ $\sqrt{2}/2$ is a newly added (ZFR)on Re (x) and the newly added the (ZFR)on Re(x) will also affect the (ZFR)on Re(θ).

This forms a connection between two (ZFRs)'s, where $k_1 = \sqrt{2}/2$ is their Boundaries.
since the angle between Re(x)and Re(θ) is $\pi/4$, sowhen projecting from Re(x) onto Re(θ). each time the projection will reduce the projection value by $\sqrt{2}$ times.

The mathematical expression is $k_n = \sqrt{2}^{-n}$, when n → ∞, $\sqrt{2}^{-n} = \sqrt{2}^{-\infty} = 0$.

That is to say, after infinite projection $\sqrt{2}/2$~S=1 (ZFRs) between Re (x) and Re (θ), in 0 <Re (x) < 1is composed of countless different(ZFR).

Because the junction of two ZFR segments is a projection of a singularity.so non trivial zeros can only appear on the boundary where two(ZFR) intersect. For example, the first boundary line is$\sqrt{2}/ 2$.

In 0 <Re (x) < 1, we can get boundary line : $\sqrt{2}/2$, 1/ 2, $\sqrt{2}/ 4$, 1/ 4, $\sqrt{2}/ 8 \ldots \sqrt{2}^{-n}$, n=1,2,3,4...
Since the non trivial zeros of the Zeta function in 0 <Re (x) < 1, [2]and the range between 0 and 1 is(ZFR), sothe non trivial zero point of the Zeta function is located on the boundary between two (ZFR) in 0 <Re (x) < 1.

Sincein$\zeta(s) = 2^s\pi^{s-1}\sin\frac{\pi s}{2}\Gamma(1-s)\zeta(1-s)$, $\zeta(s)=\zeta(1-s)$ [3] Symmetry constrains the position of the zero point, For the critical line 1/2, there is only a $\sqrt{2}/2$ boundary line on the right side,

but $\frac{\sqrt{2}}{2}-\frac{1}{2}=\frac{\sqrt{2}-1}{2}$,$\left(\frac{1}{2}-\frac{\sqrt{2}-1}{2}\right)=\frac{2-\sqrt{2}}{2}$ is not the boundary of (ZFR), so in critical line 1/2, Unable to find symmetrical boundary lines.

5. Conclusion

On the complex plane, no matter how one calculates the real part of a zero, it cannot escape the constraints set by the boundary lines generated from projecting the singularities onto the real plane.

The infinite projection of S=1 in Re(x) generates ZFRs whose boundaries coincide with the critical line Re(s)=1/2R. This provides a geometric rationale for the Riemann hypothesis.

So, the Riemann hypothesis is correct.

Prove completion

1. The authors declare that there are no conflicts of interest regarding the publication of this paper.
2. All references cited in this paper are from publicly available online sources.

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