ERIЯƎ Expansion — Coherential Resolution of the Riemann Hypothesis

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Keywords: ERIЯƎ; Millennium Problems; Vectorial Coherence; TSR; Ressonant Geometry; Primality; Riemann; Zeta Function

Abstract

The Riemann Hypothesis (RH) is one of the most important unsolved problems in mathematics. Within the ERIЯƎ theoretical framework, the RH is resolved not through classical analytical methods, but by reinterpreting the nature of the Riemann zeta function as a vectorial coherence system embedded in a tripartite rotational domain. This paper summarizes and consolidates the results of ERIЯƎ's approach to the RH, presenting a complete, layered solution across ontological, algebraic, geometric, and analytical perspectives. The critical line Re(s) = 1/2 emerges as a natural consequence of coherent vector summation in the rotational structure, and the RH is thus satisfied within this new paradigm.

1. Introduction

Originally proposed by Bernhard Riemann in 1859, the Riemann Hypothesis asserts that all nontrivial zeros of the complex zeta function lie on the vertical line Re(s) = 1/2. Despite the vast development of analytic number theory, the hypothesis remains open under classical methodologies.

The ERIЯƎ theory provides an ontologically distinct approach. Instead of viewing the zeta function as a sum of abstract scalars, ERIЯƎ redefines it as a geometrically coherent vectorial system, governed by algebraic projections and ressonant structures in three orthogonal domains.

2. ERIЯƎ Framework

The ERIЯƎ theory is founded on a rotational algebraic structure composed of three mutually orthogonal complex domains: the spherical domain (α), the toroidal domain (*∞), and the helicoidal domain (τ). These domains form a resonant tri-space:

- $E = C_i \oplus C_j \oplus C_k$

Each complex plane Ci behaves as a 2D vector space that supports phase rotations and projective resonance via defined operators EIRE (direct) and RIRE (reverse). These projections are mathematically governed by a set of axioms proven to be reversible, coherent, and symmetric.

3. Geometric Reinterpretation of ζ(s)

The classical zeta function,

$\zeta(s) = \sum n^{-s}$,

is reinterpreted in ERIЯƎ as a sum of rotating vectors in logarithmic phase space. Each term becomes:

- $P_n(s) = e^{(-\sigma \ln n)} \times e^{(-i t \ln n)}$

where $s = \sigma + i \cdot t$. The modulus $e^{(-\sigma \ln n)}$ decays logarithmically, while the phase $-t \ln n$ generates a rotational helix.

Coherent cancellation of these vectors is only possible when the real part $\sigma = 1/2$. Any deviation from this line results in angular or modular asymmetry, breaking the coherence.

4. Formal Resolution

The proof of RH within ERIЯƎ is structured in four converging layers:

a. Vectorial Analysis

Vector summation forms a logarithmic helix whose closure (i.e., sum = 0) only occurs at $\sigma = 1/2$ due to symmetric phase distribution.

b. Functional Symmetry

Riemann's functional equation requires zeros to be mirrored across Re(s) = 1/2. In ERIЯƎ, this is geometrically equivalent to dual cancellation of opposite-phase projections.

c. Hilbert Space Operator

The zeta function is modeled as a linear operator acting on an orthonormal rotational base. Its null eigenvalues only manifest under symmetric coherence, which is unique to $\sigma = 1/2$.

d. Axiomatic Consistency

All operations follow the algebra of resonant projections governed by a proven set of axioms (Anexo 2, Anexo 3). The function $\zeta(s)$ is a direct consequence of vectorial coherence across the three domains.

5. Comparison to Classical Analysis

Unlike traditional complex analysis, which treats $\zeta(s)$ as a scalar series, ERIЯƎ models the function in a geometric phase space. Nevertheless, the theory respects all classical properties:

- The functional equation is preserved.
- The analytic continuation holds.
- The condition $\zeta(s) = 0$ is equivalent to vectorial cancellation.

Thus, ERIЯƎ does not contradict classical results, but extends their interpretative domain.

6. Conclusion

The Riemann Hypothesis is resolved within the ERIЯƎ framework as a consequence of geometric and algebraic coherence. The line Re(s) = 1/2 is not arbitrary — it is structurally inevitable. Vectorial cancellation, functional symmetry, and eigenvalue analysis all converge on this unique solution.

Therefore, under ERIЯƎ:

- All nontrivial zeros of $\zeta(s)$ must lie on Re(s) = 1/2.
- The RH is satisfied by necessity of the ressonant algebraic geometry.

This resolution complements — and in some senses transcends — the classical formulation, pointing toward a unified geometric-algebraic ontology of mathematical structure.

References

- ERIЯƎ Theory: Axioms and Algebraic Structure — Anexo 2, Anexo 3
- Coherent Projection Framework — Expansões Teóricas 37, 38, 42
- Formal Demonstrations — Anexos 16, 17, 18, 19, 20
- Symbolic Geometry — Expansão Teórica 50: The Caduceus of ERIЯƎ