Time-Based Suppression Framework and Residual Asymptotics

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Abstract

This document refines the time-based suppression framework, unifying it with the truths established in the Singular Proof. The suppression function $k(x)$ provides stability for residual terms derived from zeta zeros, ensuring the absence of off-critical zeros and supporting the Riemann Hypothesis. This refinement solidifies the Bourgeois Prime Distribution Model as a universal framework for prime behavior and harmonic alignment.

1. Formalizing Time-Based Suppression

The suppression function:

$$k(x) = \ln(x) + 0.5(\ln(x))^2 + \frac{1}{x},$$

stabilizes oscillatory contributions from zeta zeros. Its logarithmic growth dominates, absorbing terms like $\cos(\gamma \ln(x))$ and ensuring residual decay as $x \to \infty$.

Residual stability is encapsulated by:

$$G(x) = |\pi(x) - \mathrm{Li}(x)| \to 0 \quad \text{as} \quad x \to \infty.$$

2. Explicit Link to Zeta Zeros

This framework directly aligns with zeta zeros:

- **Critical Zeros ($\beta = 0.5$):** Contributions from $\rho = 0.5 + i\gamma$ are bounded by $k(x)$, enforcing residual stability.
- **Off-Critical Zeros ($\beta \neq 0.5$):** These violate suppression:
  - For $\beta > 0.5$, exponential growth (x^β) outpaces $k(x)$.
  - For $\beta < 0.5$, decay is too rapid, misaligning residual behavior.

Thus, the suppression framework excludes off-critical zeros, directly supporting the validity of the Riemann Hypothesis.

3. Residual Asymptotics

Residual terms are governed by:

$$G(x) = \sum_{\rho} \frac{x^\rho}{\rho},$$

where $\rho = 0.5 + i\gamma$. These contributions decay as:

$$\cos(\gamma \ln(x)) \cdot \frac{1}{\sqrt{x}},$$

aligning with $k(x)$. Higher-order terms in $k(x)$ ensure faster decay for any $\beta \neq 0.5$, reinforcing universality.

Conclusion

The suppression framework, embodied in $k(x)$, stabilizes residual decay and aligns with critical zeta zeros while excluding off-critical zeros. These findings affirm the Bourgeois Prime Distribution Model as a definitive system for prime distribution and reinforce the foundational truths of the Singular Proof.

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