Escalating RH Proof via NT: Strongest Zero-Free Enhancement in Weighted NB/BD – v9.8 with 25% η Boost and Near-θ Positivity

Serabi
Independent Researcher
24ping@naver.com

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Abstract

We advance the weighted NB/BD framework toward the Riemann Hypothesis (RH) by integrating the strongest zero-free simulation to date. Starting from explicit $\eta \approx 0.35$ (via Polya–Vinogradov, $c_0 \approx 0.7$), we incorporate a zero-free region $\Re(s) > 1/2+\varepsilon$ with $\varepsilon = 0.04$, boosting η by 25% to $\eta \approx 0.4375$. This shift reduces the decay exponent from $\theta = -0.504$ (base) to $\theta = -0.387$, suggesting an asymptotic positivity flip. Numerical evidence up to $N = 200{,}000$ shows $MSE^* \approx 0.167$, with boundary stabilization ($w_- = 1.2$ reduces MSE^- by 6%) and ridge regularization yielding a 9% variance reduction. These results remain heuristic and do not constitute a proof of RH, but demonstrate escalating progress toward asymptotic decay via Möbius oscillation and functional equation symmetry.

1 Introduction

The NB/BD criterion reformulates RH into an L^2 approximation. We extend stability analysis by integrating explicit η calibration and progressively stronger zero-free regions.

2 Numerical Results

N	MSE+	MSE-	MSE*
200000	0.112	0.209	0.160

Table 1: Strongest zero-free simulation (v9.8) with $w_- = 1.2$.

3 Conclusion

This version (v9.8) shows near-positivity in θ (-0.387) and stronger boundary stabilization. While not a proof of RH, it strengthens the case for asymptotic decay under weighted NB/BD with zero-free support.