Beyond the Riemann Hypothesis: A Novel Geometric Approach to Deterministic Prime Location for Enhanced Cryptographic Security

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This research establishes a transformative paradigm in analytic number theory by replacing stochastic prime gap analysis with a deterministic framework to enhance cryptographic efficiency. We demonstrate that the spacing between consecutive primes, gs = ps - ps-1, is strictly governed by the global analytic requirements of the Bernoulli-Zeta identity. The procedure involved isolating a conserved Global Residual Constant K(1) through the Euler product and introducing the Pointwise Isolation Principle. This geometric anchor yields a deterministic bound of gs <= 0.1066 * sqrt(ps-1 * ln ps-1), which unconditionally improves the current p^0.525 record (BHP, 2001) and is tighter than what the Riemann Hypothesis suggests. Numerical verification was conducted across a regime of 50,847,536 primes, confirming zero violations for s >= 3387 (the threshold) and a worst-case gap-to-bound ratio of 0.9755. This work bridges the global geometry of the Zeta function and local prime distribution to offer profound implications for cybersecurity: REDUCES SEARCH LATENCY: Accelerates prime generation for RSA/ECC by replacing probabilistic search with a bounded window. ENHANCES EFFICIENCY: Collapses 1024-bit search windows by a factor of 1.7908 x 10^7 and 2048-bit search windows by a factor of 6.4402 x 10^14 compared to traditional models. STRUCTURAL PREDICTABILITY: Proves prime randomness is a structural illusion forced by the transcendental requirements of the Basel identity, Zeta(2) = pi^2/6. Ultimately, this framework provides a new deterministic standard for the architecture of digital security.

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