

# A Comprehensive Model of $1/f$ Noise for True Random Number Generators

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## **Abstract**

By utilizing fractional Brownian motion, this work develops an analytically tractable model for  $1/f$  noise in TRNGs, rigorously accounting for non-stationary effects and spectral singularities. This improves upon prior works by eliminating the inaccuracies of short-memory approximations and Monte Carlo sampling.