

Measurement of FPGA ring oscillator noise, and analysis using the Allan Variance method

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Abstract

The noise of oscillators is often used as a source of entropy for true random bit generators. Oscillator noise can be characterized in frequency domain or time domain terms. The Allan Variance method, as formulated by David W. Allan and his associates while at the US National Institute of Standards and Technology (NIST), is a useful time domain technique which, unlike the classical variance, converges for common oscillator noise sources such as flicker noise and random walk noise. Power-law slopes approximating the variance taken over different time intervals may provide insight into the oscillator noise physics. In this paper, the noise of some FPGA-based oscillators are measured and analyzed using the Allan Variance method, with the aim of achieving a better understanding of these oscillators for use in FPGA true random bit generators.