

## Master Thesis

# On the Implementation of Random Number Generators by Delta-Sigma Modulators

The fast growing markets of digital communication or wireless sensor network systems give rise to information security threats that become more and more critical, especially with regard to the *Fourth Industrial Revolution / Industry 4.0*. Cryptography based on analog circuits may be the right means to achieve very high data security since non-idealities of analog circuits such as metastability or thermal noise are excellent sources for the generation of true random numbers. In contrast to digital algorithms, which are typically used for the implementation of pseudo random number generators, they can thus be used to design true random number generators.



Fig. 1: Random bit sequence for cryptography

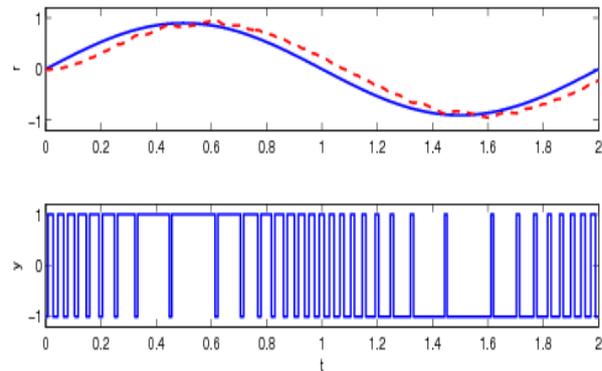


Fig. 2: Analog input signal and digital output bit stream of a Delta-Sigma modulator

Based on Delta-Sigma modulators, the task of this master thesis is to design and implement a low-power random number generator on transistor-level. Its performance, i.e., the randomness of the generated numbers, is to be evaluated using a professional test suite.

### What we expect:

Fun in integrated circuit design, experience with Cadence, as well as a thorough understanding of Delta-Sigma modulators

### What we offer:

Intensive supervision of the thesis, nice work environment, latest CAD and EDA tools for the design of integrated circuits, well equipped laboratory, and free space for own ideas.

**Starting Date:** as soon as possible

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