

## Abstract

Within our modern society we expect integrated circuit (IC) technology to provide more and more processing capacity and bandwidth. For long, this was enabled by diminishing feature sizes of each new generation of IC technology, delivering more performance for the same footprint and energy budget. However, nowadays the increasing performance per Watt is not increasing as fast as before and new techniques are investigated to improve energy efficiency.

One of the main techniques is to reduce the supply voltage of the digital circuitry as much as possible. To guarantee correct operation of the digital device, in many cases the operating frequency has to be reduced as well. However, in case the application can tolerate minor errors, voltages can be reduced to such an extent that (random) errors are allowed to occur. To evaluate this probabilistic behavior of digital circuitry, correct models are crucial.

Besides reducing supply voltages, approximate computations can be exploited to reduce power consumption. To use these techniques, the error resilience of the application has to be analyzed. Within the Statistical Approximation Modelling approach (SAM) errors are injected in computationally dominant kernels of iterative workloads and effects are assessed using a quality function. Within Adaptive-SAM, approximate iterations are followed by iterations using exact computations.

Furthermore, using approximations of signals can have large consequences on architectural level. In case of a full digital beamforming system, high resolution, high power analog-to-digital converters (A/D converters) have to be used for each antenna. By using approximate computing techniques, the beamforming architecture can be drastically redesigned resulting in the use of a low resolution, low power A/D converter for each antenna and a single high resolution, high power A/D converter.

## Biography

André B. J. Kokkeler has worked more than 6 years at Ericsson as a system engineer and 8 years at the Netherlands foundation for research in astronomy (ASTRON) as a scientific project manager. In 2003 he joined the University of Twente where he currently is appointed as Associate Professor.

He has a background in telecommunication, mixed signal design and signal processing. Currently, his main interest lies in the area of the design of low-power architectures for telecommunications and computationally intensive applications.