Asynchronous CORDIC Processor Implementation

B. Sarker, E. Grass, K. Maharatna

IHP Frankfurt (Oder), Germany

Abstract:

The main advantages of asynchronous design are of low power dissipation, high throughput and reduced noise. Keeping in view these advantages, an asynchronous CORDIC processor has been designed and implemented on the in-house 0.25 μm SiGe:C BiCMOS process. The power dissipation and throughput parameters, measured after layout, are quite impressive. The extracted parameters will be given in the full paper during presentation.

This work is a part of the project, which will develop a single-chip wireless broadband communication system in the 5 GHz band, compliant with the Hiperlan/2 and IEEE 802.11a standards. For such a system a large portion of the digital baseband processor has to operate on complex signals which are sampled at a rate of 20 MS/s. The most difficult to implement functional blocks of the baseband processor are FFT/IFFT processor, Viterbi Decoder, and Numeric Controlled Oscillator (NCO). The NCO is used to perform a frequency correction on the incoming signals. A Coordinate Rotation Digital Computer (CORDIC) offers an elegant way of implementing an NCO. This CORDIC has a new algorithm. This novel CORDIC algorithm was designed asynchronously to take into advantages of asynchronous design, the most important ones being the reduced noise. This asynchronous processor has been implemented with D flipflop as datapath elements. In addition, there is another asynchronous implementation of the CORDIC using latches as the datapath elements where the C element is made using gate level elements.

One of the main problems in our present work is the single chip implementation of the system where the digital and the analogue part of the system will be on the same chip. This single chip implementation will encounter the well known but not the well-versed problem of crosstalk between the digital part (the aggressor) and the analogue part (the victim). To get well versed with this problem of crosstalk, we are starting to investigate crosstalk. Therefore, it has been decided to use the asynchronous mode of CORDIC to get to know about the noise pattern during the asynchronous operation compared to the synchronous implementation of the CORDIC. This investigation into the noise behaviour will help us to show the advantages of the asynchronous design compared to the synchronous design in terms of electromagnetic radiation.