

High-Level Synthesis of a Generic Fast-Fourier-Transform Accelerator for IoT Applications

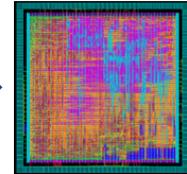
Introduction

The Fast-Fourier Transformation (FFT) is a key building block for many communication systems being used in OFDM systems for example. With throughput requirements highly dependent on the actual communication link a generic FFT hardware accelerator is desirable for an easy re-use. Here, a High-Level-Synthesis approach, for which the

hardware accelerator is modelled in a high programming language such as SystemC or C, provides the necessary flexibility.

```
void runFFT(cdouble samples[], int fft_size) {  
    // Return for trivial cases  
    if (fft_size <= 1) return;  
  
    // Definition of half size arrays  
    cdouble * even = new cdouble[fft_size/2];  
    cdouble * odd = new cdouble[fft_size/2];  
  
    // Radix operations for single stage  
    for (int k = 0; k < fft_size/2; ++k) {  
        cdouble w;  
        w.real = cos(-2 * 3.1415 * k / fft_size);  
        w.imag = sin(-2 * 3.1415 * k / fft_size);  
  
        radix2(samples[k], samples[k+fft_size/2], w,  
              even[k], odd[k])  
    }  
  
    // Recursive call for half-sized FFTs  
    runFFT(even, fft_size/2);  
    runFFT(odd, fft_size/2);  
  
    // Combine output  
    for (int k = 0; k < fft_size/2; ++k) {  
        samples[k] = even[k];  
        samples[k+fft_size/2] = odd[k];  
    }  
}
```

HLS



Short Project Description

The goal of this project is to develop a generic FFT description in C language which can be synthesized to an integrated circuit. The benefit of the approach is proven by synthesizing FFT accelerators for different throughput requirements and compare implementation costs to state-of-the-art FFT implementations.

Prerequisites

- Interest in signal processing and VLSI design
- Basic knowledge in SystemC or C is helpful

What you will learn

After the project you will be able to design digital integrated circuits using a High-Level-Synthesis design flow. In addition, you get familiar with one of the most important building blocks in modern communication systems.

Contact

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