

FPGA implementation of a DFT based demodulator for BFSK

(MSc. Assignment)

Introduction

One of the well-known challenges in wireless communication systems is frequency offset cancellation. Frequency offset resulting from either Doppler shift or mismatch between local oscillators in the transmitter and receiver may considerably degrade system performance. In Ultra-Narrowband systems for Internet of Things (IoT) and Wireless Sensor Networks (WSN) the problem of frequency offset is even more severe. Conventional techniques to overcome frequency offset in these scenarios can be too costly and power hungry to be suitable for low power nodes. In light of the abovementioned facts one may think of exploiting demodulation and detection schemes which are able to tolerate frequency offset which is the topic of this assignment.

Assignment

Short-Time DFT based demodulator for BFSK is an offset tolerant demodulation scheme. Short-Time DFT (ST-DFT) in our application is obtained via calculating the DFT of a signal over one symbol period. The information about frequency components obtained using such an analysis can be used for detecting BFSK modulated data.

The assignment is based on an ST-DFT demodulator for BFSK from a work recently published by CAES group. The goal is to implement the demodulator using an FPGA and investigate a low power and efficient hardware design. The main component of such a system is FFT. Hardware implementation issues including FFT architecture and required fixed point resolution are expected to be investigated. The results can potentially lead to a publication in international conferences.

Student Profile

The following expertise and background are recommended:

- Knowledge of digital design and hardware description languages (VHDL/Verilog)
- Experience with FPGA implementation and prototyping would be a plus
- You do not need a deep background in telecommunication systems but you need to be willing to learn some basics if necessary (we would be glad to help); thus, if you already have a basic knowledge of telecommunications/ digital signal processing it would be very handy (again not crucial)

Contact

MSc. Siavash Safapour (s.safapourhajari@utwente.nl)

Dr. André Kokkeler (<mailto:a.b.j.kokkeler@utwente.nl>)