Faculty of Electrical Engineering & Computer Science
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An FPGA-Implemented Receive Circuit for LiDAR Signal Processing.

ABSTRACT - Masterthesis

In the past decade, the attractiveness of a Lidar sensor has earned a noticeable importance in the automobile business sector. And it has a wide range of application in autonomous driving; distance measurement, target detection, imaging, etc.

The focus of this thesis is on the Lidar sensor receiver's Signal Processing. Dissimilar types of unipolar code sequences combination are used as signal to modulate light through the Lidar Transmitter and upon striking on an object, a reflected known signal corrupted with additive noise is processed in the Lidar Receiver. The signal is processed accordingly, and at one point an Analog-to-Digital-Converter (ADC) connected with the Field Programmable Gate Array (FPGA) Mezzanine Card (FMC-122) from "For Digital Signal Processing" (4DSP) is employed for converting the received Analog Signal to Digital Signal, which is connected to the Xilinx Kintex-7 FPGA (Device XC7K325T) chip, which consist of the Digital Signal Processing (DSP) unit for this project.

In order to find the presence of the transmitted signal in the received signal in the DSP unit, implementation of a detection algorithm is necessary. This is accomplished with FPGA-based implementation of a set of parallel Matched Filters (MF). The transmitted code sequences are stored in the memory elements. The matched filtering correlation operation are to be implemented on the FPGA chip. The set of different MF is processed in a parallel manner, so as to realize a real-time discrimination of the individual code sequences.

Additionally, the evaluation and testing of the output results of the correlator needs to be addressed, as well as the method to detect the signal peak.