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Algorithm for Finding the Velocity of an Object Using Frequency Modulated Continuous Radar System.

ABSTRACT - Masterthesis

The aim of the Master thesis is to develop an algorithm to find the velocity of an object using a continuous wave (CW) radar system and 90 GHz W-BAND frequency modulated continuous wave (FMCW) radar system. In recent years, radar has gained an importance in many fields like automation, defence, ships and security. The thesis deals with the digital signal processing techniques used for CW and FMCW radar system to extract the velocity of an object. In the thesis the various signal processing techniques are described in detail together with the implementation and validation.

The radar module is developed at Fraunhofer IAF and Fraunhofer IZM. Fraunhofer IPA deals with the digital signal processing techniques of the radar system. The thesis involves the fundamental theoretical background and the working principle of the CW and W-BAND FMCW radar system, the implementation of the algorithms to extract the velocity for single and multiple objects, the implementation of the Kalman filter for linear models to track an object position and finally the validation of the simulated results with the real time measurement results. Many algorithms already exist based on the specification of the radar, but in this thesis the focus is on the one-dimensional FFT method used for FMCW radar for finding the velocity of an object. By changing the internal coding, the radar module can be used either as CW radar or FMCW radar. The typical FMCW radar has a serious problem of ghost targets in multiple targets situation and to resolve this problem a two-dimensional FFT method is adopted. The working principle of two-dimensional FFT to reduce the ghost target problem is presented in the thesis.

Firstly, the simulation is done for various signal processing techniques in MATLAB. The simulation is performed for single and multiple objects in Matlab for both types of radar system. The simulation results are then validated by the real time data results. Finally, the discrete time linear Kalman filter is implemented to optimally estimate or track the position of an object.