Implementation of the Sensitivity Time Control Function on Marine Radar Videos

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ABSTRACT

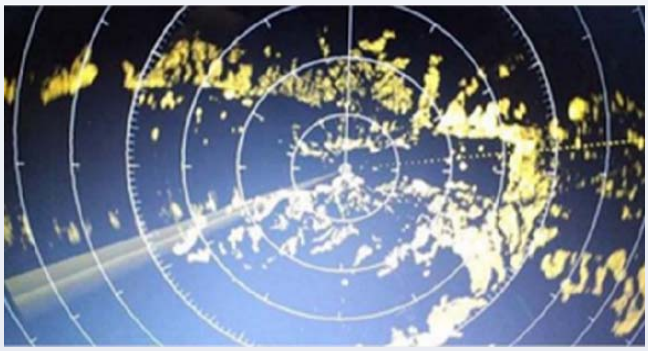

Fig. 1. Scan-Converted Radar Video on Tactical Display

Ships platforms use marine radars for purposes of navigation and search over the sea. These radars provide radar traces in the form of analog radar videos which are displayed on operator consoles. One common problem in marine radar observations, particularly in the presence of high waves, is that radar traces reflected from short distances exhibit high amplitudes whereas those from long distances exhibit low amplitudes. Under such circumstances, radar traces reflected from short distances generate bright responses in a wide area on the operator's screen, possibly preventing the observation of actual traces of interest from longer distances. To alleviate this problem, a common approach is to suppress the amplitudes of traces reflected from short distances and amplify the traces from long distances based on a logarithmic function of distance. This is called **sensitivity time control (STC).** The goal of this project is to design and analyze an STC function that can be integrated into HAVELSAN's digital video distribution system and can be used in the process of digital distribution of marine radar videos.

OBJECTIVES

- *Sea clutter generation*
- *STC implementation on FPGA board*
- *STC implementation on DSP board*

PROJECT DETAILS

Fig. 2. Blackfin BF609 DSP module for producing real time radar signals

A **clutter** is detected returns/echoes from other objects. Targets may include clutter. Clutters can cause serious performance issues with radar systems.

PROJECT DETAILS II

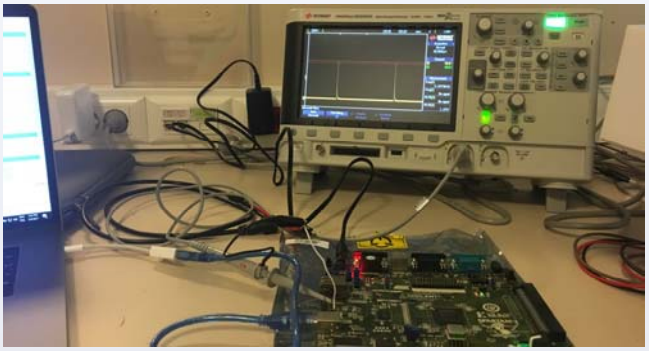

Fig. 2. Spartan 3AN Starter Kit for producing real time radar signals

Mathematical models of sea clutter are used in most phases of maritime radar development. They are particularly used for the prediction of performance and to assess the impact of different radar waveforms, signal processing strategies and so on. The generation of correlated vectors for non-Gaussian clutter is considered for log normal, Weibull, and **K-probability distributions**. Previous results for log normal and Weibull distributions show us K-probability distributions are more feasible for our conditions. MATLAB has been used for sea clutter generation.

Radar traces reflected from short distances saturate the receiver preventing observation of traces a longer distances. To prevent this, Sensitivity Time Control Function has to be introduced. We are suggesting to solve this problem by implementing STC function on FPGA and DSP. In a typical application, the attenuator is set to maximum attenuation during the period of the transmitter pulse. At the end of the pulse the amount of attenuation is reduced in a controlled way according to system requirements.

CONCLUSIONS

Our project is still in progress. An example STC function has been implemented in MATLAB but it is yet to be tested since we couldn‘t find a solution for generating sea clutter data. We try to generate sea clutter data using probability densitiy functions right now. FPGA system is designed and synthesized to work on Spartan 3AN starter kit, which contains 50 MHz oscillator and 12-bit Digital-Analog converter(DAC). System has ARP and ACP with %1 duty cycle, master trigger with period 1 µs, and 12-bit video output, 4096 azimuth angles and total antenna rotation time of ~2s. Furthermore DSP implementation is still in progress.

REFERENCES

An Automatic Sensitivity Time Control System, Krueger, 1964, *IEEE Transactions on aerospace,* vol. 2, number 2, p. 145-150

FPGA Based Real Time Solution for Sensitivity Time Control, Meena D and LGM Prakasam, 2008, *Electronics and Radar Development Establishment(LRDE)*, p. 244-248