RadaScan: A local reference, high resolution radar, dynamic positioning sensor

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Abstract

This paper details the concept and processing principles behind RadaScan, a local reference radar sensor, capable of relaying accurate navigation to dynamic positioning systems. RadaScan represents a next generation in Sensor technology. It is a swept radar system capable of tracking multiple targets and providing relative position and heading feedback at 3Hz to a host system.

An overview of the design principles of the sensor and target system is presented. It considers the technology behind the sensor; a FMCW microwave radar system illuminating a retro-reflective target capable of introducing a unique identification code by modulation of the radar carrier. This design allows the radar to easily detect its targets even within a cluttered offshore working environment, dominated by large installation structures.

A description of the digital signal processing flow that interprets the raw radar return to an accurate position and heading estimate is presented. Consideration is given to the DSP hardware requirements to achieve the data throughput whilst working within cost and space constraints. The use of FPGA technology for front end real-time radar signal processing is demonstrated to be an optimum solution for the DSP needs of the system. Using an FPGA, continuous radar data processing rates of 50MB/s are achieved across 4 input channels. This data throughput allows the system to process incoming targets at a rate of 10Hz.

The paper further considers the algorithms developed for automatic detection of targets using Constant False Alarm Rate (CFAR) principles applied in the frequency domain, and the use of target tracking filters, originally developed for ballistic missile radar trackers, to control hardware feedback loops.

The paper concludes by presenting position data from the sensor, demonstrating the accuracy and overall specification that can be achieved for a local reference position and heading fix using RadaScan.

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