

National Aeronautics and Space Administration



TECHNOLOGY SOLUTION

Sensors

Real-Time LiDAR Signal Processing FPGA Modules

Processing LiDAR data into high-resolution 3D imagery

Scanning LiDARs generate an immense amount of raw digital data which must be processed as quickly as possible in order to generate 3D imagery in real time. In order to accomplish this task for the nextgeneration 3-D scanning LiDAR known as the Goddard Reconfigurable Solid-state Scanning LiDAR (GRISSLi), NASA Goddard Space Flight Center has developed a FPGA module capable of processing an arbitrary number of waveforms rapidly and in parallel. This innovation enables a high-resolution 200 KHz time-of-flight solution, allows a system to process an almost limitless number of received laser pulses for LiDAR applications in real time, and is limited only by available FPGA resources.

BENEFITS

- Processes an almost limitless amount of laser pulses in real-time
- Highly efficient: uses the minimum FPGA resources feasible
- Produces high-resolution images



THE TECHNOLOGY

The developed FPGA modules discern time-of-flight of laser pulses for LiDAR applications through the correlation of a Gaussian pulse with a discretely sampled waveform from the LiDAR receiver. For GRSSLi, up to eight cross-correlation engines were instantiated within a FPGA to process the discretely sampled transmit, receive pulses from the LiDAR receiver, and ultimately measure the time-of-flight of laser pulses at 20picosecond resolution. Engine number is limited only by the resources within the FPGA fabric, and is configurable with a constant. Thus, potential time-of-flight measurement rates could go well beyond the 200-KHz mark required by GRSSLi. Additionally, the engines have been designed in an extremely efficient manner and utilize the least amount of FPGA resources possible.

APPLICATIONS

The technology has several potential applications:

Real-time 3D imaging

PUBLICATIONS

Patent No: 11016183

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GSC-17215-1, GSC-TOPS-173

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NP-2016-11-2241-HQ