SPACE SYSTEMS SYMPOSIUM (D1)
Enabling Technologies for Space Systems (2)

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OVERVIEW OF A COMPACT OPTICAL SAR PROCESSOR PROTOTYPE FOR SPACE-BASED APPLICATIONS

Abstract

Synthetic aperture radar (SAR) processing is based on the acquisition of multiple radar echoes to emulate a large radar antenna aperture (hence the name synthetic aperture) providing the ability to produce high resolution images. Radar technology is a powerful tool providing enhanced day and night imaging capabilities, even when the region to be observed is cloudy or the atmosphere dense. SAR systems can be found in multiple applications either airborne or space-based. SAR systems typically generate huge amounts of information generally in the form of complex data, which are difficult to compress. Processing this data to yield images with real values, which are easier to compress, require important processing capabilities. For interplanetary missions and unmanned aerial vehicle (UAV) systems, this may put important burden on power consumption, weight, and size. Optical processor architectures provide inherent parallel computing capabilities that could be used advantageously for SAR data processing. Onboard SAR image generation would provide local access to processed information paving the way for real-time decision-making. This could eventually benefit navigation strategy and instrument orientation decisions. Moreover, for interplanetary missions, onboard analysis of images could provide important feature identification clues and could help select the appropriate images to be transmitted to Earth and consequently help bandwidth management. This could ultimately reduce the data throughput requirements and the related transmission bandwidth. This paper reviews the work performed in the analysis of SAR image generation using optical processor and in the design of a compact optical SAR processor prototype that

could relax constraints related to power, weight, and size requirements. Various requirements such as resolution, processing capabilities, weight and others are reviewed. Optical reconstruction results of ASAR satellite signals acquired will be presented