

EARTH OBSERVATION SYMPOSIUM (B1)
Earth Observation Sensors and Technology (3)

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STUDY OF HADAMARD TRANSFORM SPECTRAL IMAGER FOR FAINT OBJECT DETECTION

Abstract

The multiplexing advantages of Hadamard Transform Spectrometer (HTS) make this type of instrument a different approach to spatial-target detection other than Fourier Transform spectrometer (FTS). The signal to noise ratio (SNR) merit and no moving parts of HTS opens the door to various spatial applications, especially in the field of object detection, in which the target is in low illumination condition. Two kinds of Hadamard transform spectrometer using advanced spatial light modulator (Digital Micro-mirror Device, DMD) are introduced. The first type of HTS, which uses DMD on the second image plane, can implement the function of spectral domain encoding, and is optimized for applications require high spatial resolution. While the other type of HTS sets DMD at the first image plane as programmable-silts. Compared with the former one, this type of instrument is specialized for the use of high-precision spectral signature discrimination. In this paper, the author initiates a general discussion over the merits and features of these two kinds of HTS and, from the aspect of instrument implementation, presents a particular study of the system design considerations and the operating principles of both HTS. Experimental results acquired by our prototype HTS also prove the SNR enhancement and the validity of mask positioning methods.