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GENESIS – GENERATOR OF SPECTRAL IMAGE SIMULATIONS

Abstract

GENESIS is an end-to-end simulation of hyper-spectral (HS) imaging by a space-craft payload. The main purposes of GENESIS are to analyze payload performance at various geometric and atmospheric conditions, to test sensor design influence on performance, and to verify the HS data analysis algorithms and routines on a large variety of images. The simulation product is a hyper-spectral cube of synthetic image raw data at sensor output. GENESIS is divided into several sub-modules. The first one is the scene generator which creates the synthetic ground to be imaged, including an object that can be embedded in it. The ground is characterized spatially by division of the region into several polygons, each has its own texture, and a specific set of materials composing it. The ground is characterized spectrally by the spectral reflectance of the materials composing it which are taken from a materials data-base containing 1nm-resolution spectral reflectance of a large variety of backgrounds and objects. Another part of the scene generation is atmosphere modeling, which is based on MODTRAN 5.0 model interpreted by a FLAASH based algorithm. Due to MODTRANs built-in flexibility, various atmosphere profiles are available, with different aerosols compositions, different amounts of water vapors, different atmospheric paths, etc. The second module of GENESIS is the renderer, which calculates the geometric projection of the top-of-atmosphere (TOA) ground reflected radiance on the sensor, according to the sensor position and attitude. ective region, and is used as an itThat is, the renderer calculates the radiance at the entrance to the imager. The last module of GENESIS is the sensor model, which is based on the detailed and comprehensive IRISIM sensor model, developed by DVP technologies Ltd. IRISIM, initially designed for modeling of panchromatic images in the LWIR region, was suited in GENESIS to the reflerative band-by-band imaging model. The imager parameters such as optics properties, detectors characteristics, electronics, etc. are updated for each band (if needed). In this talk the main parts of GENESIS will be presented, along with few examples of the end-products of the simulator, and their contribution to the complex process of HS remote-sensing system design.