Paper ID: 7701
student

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

Author: Mr. Yoshihide Aoyanagi
Hokkaido Institute of Technology, Japan, r09601@hit.ac.jp

Dr. Shin Satori
Hokkaido Institute of Technology, Japan, satori@hit.ac.jp
Mr. Yusuke Takeuchi
Hokkaido Satellite Inc., Japan, hsc-take@hit.ac.jp

PRELIMINARY DESIGN AND TESTING OF ON-ORBIT SPECTRAL CALIBRATION EQUIPMENT BASED ON LEDS WITH BANDPASS FILTER FOR THE HYPERSPECTRAL SENSOR HSC-III

Abstract

The Space Science Industries Program aims to develop the small earth observation satellite. First pico-satellite named "HIT-SAT" was launched in 2006 as the sub-payload of JAXA's M-V-#7th rocket for the purpose of technical training and demonstration. In the second program, the hyperspectral remote sensing in VNIR range is programmed as a main mission. The key requirements of the hyperspectral sensor "HSC-III" instrument call for a GSD (ground Sampling Distance) of 30 m, a spectral range of 400-1000 nm containing 61 band of 10 nm spectral resolution, SNR of >300, and 1n instrument mass of <10kg. The imaging method employs push-bloom technique. The hyperspectral remote sensing is expected to the high accuracy since it observes the targeted object by employing both the geometrical and spectroscopic methods. The application of the hyperspectral remote sensing is such as agriculture, environment monitoring and earth resource exploration. Hyperspectral sensor consists of the telescope and imaging spectrometer. The optical mission equipment in orbit is required a high accuracy and reliability spectroscopic, electrically and mechanically. The geometrical correction is required for the remote sensing data at each time due to the compensation of the satellite attitude vibration. In addition, it is necessary to calibrate the wave length and absolute radiance of the spectrometer in orbit to compensate the aging by space radiation and contamination. The hyperspectral images that have wavelength errors provide erroneous atmospheric correction with potential for erroneous classification of objects. Previews works proposed that spectral sensor is calibrated by the Atmospheric Limb Correction. On the other hand, the calibration process which used oxygen and H2O absorptions are not enough accuracy. This paper proposes LED as on-board calibration subsystem to ensure high standard hyperspectral sensor. For spectral and relative radiometric calibration provides visible LEDs, near-infrared LEDs and diffused panel in front of the spectrometer entrance slit. The diffused panel provides three positions for earth observation mode, radiometric calibration, spectral calibration mode, and LED array monitoring mode. Each LED equipped with Bandpass filter because ambient temperature is known to affect the spectrum of a LED. Bandpass filter is transmits only the required spectrum by applying the interference of thin film. The on-board calibration subsystem was evaluated to compare with conventional method using spectral line of mercury. The performance was excellent so that 0.02 nm spectral calibration accuracy was achieved. We plan to evaluate the subsystem by temperature test and thermal vacuum test.