SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

Author: Dr. Hiroshi ODA
Japan Aerospace Exploration Agency (JAXA), Japan, h1r0sh10da0714@gmail.com

Mr. Hirohisa Kurosaki
Japan Aerospace Exploration Agency (JAXA), Japan, kurosaki@chofu.jaxa.jp
Mr. Makoto Tagawa
Kyushu University, Japan, makoto_t@aero.kyushu-u.ac.jp
Dr. Toshifumi Yanagisawa
Japan Aerospace Exploration Agency (JAXA), Japan, tyanagi@chofu.jaxa.jp

OPTICAL OBSERVATION, IMAGE-PROCESSING, AND DETECTION OF SPACE DEBRIS IN GEOSYNCHRONOUS EARTH ORBIT

Abstract

We report on optical observations and an efficient detection method of space debris in the geosynchronous Earth orbit (GEO). We operate our new Australia Remote Observatory (ARO) where an 18 cm optical telescope with a charged-coupled device (CCD) camera covering a 3.14-degree field of view is used for GEO debris survey, and analyse datasets of successive CCD images using the line detection method (Yanagisawa and Nakajima 2005). In our operation, the exposure time of each CCD image is set to be 3 seconds, and the time interval of CCD shutter open is about 4.7 seconds. In the line detection method, a sufficient number of sample objects are taken from each image based on their shape and intensity, which includes not only faint signals but also background noise. Then we search a sequence of sample objects aligning in a straight line in the successive images to exclude the background noise sample. We succeed in detecting faint signals (down to about 1.8 sigma of background noise) by applying the line detection method to 18 CCD images. As a result, we detected about 300 GEO objects up to magnitude of 14 among 5 nights data. We also calculate orbits of objects detected using the Simplified General Perturbations Satellite Orbit Model 4(SGP4), and identify the objects listed in the two-line-element (TLE) data catalogue publicly provided by the U.S. Strategic Command (USSTRATCOM). We found that a certain amount of our detections are new objects that are not contained in the catalogue. We conclude that our ARO and detection method posse a high efficiency detection of GEO objects despite the use of comparatively-inexpensive observation and analysis system.

We also describe the image-processing specialised for the detection of GEO objects (not for usual astronomical objects like stars) in this paper.