20th IAA SYMPOSIUM ON SPACE DEBRIS (A6)
Interactive Presentations - 20th IAA SYMPOSIUM ON SPACE DEBRIS (IPB)

Author: Dr. Eun Jung Choi
Korea Astronomy and Space Science Institute, Korea, Republic of, eunjung@kasi.re.kr

Dr. Jin Choi
Korea Astronomy and Space Science Institute, Korea, Republic of, rutcome@kasi.re.kr
Dr. Jiwoong Yu
Korea Astronomy and Space Science Institute, Korea, Republic of, jiwoongyu@kasi.re.kr
Dr. Sungki Cho
KASI, Korea, Republic of, skcho@kasi.re.kr

KASIOPEIA: KASI'S ORBIT PROPAGATION & ESTIMATION, INTEGRATED ANALYSIS SYSTEM FOR SPACE SITUATIONAL AWARENESS

Abstract

The Korea Astronomy and Space Science Institute (KASI), a national space situational awareness organization (NSSAO) in Korea, has been making continuous efforts to build a space situational awareness system to respond to space risks in accordance with the preparedness plan for space hazards since 2014. Accordingly, KASI is operating the OWL-Net (Optical Wild field patrol Network) that can observe LEO and GEO space objects, the only space surveillance system in Korea. And currently radar test-bed to monitor LEO space objects is under development. In addition, the integrated analysis system for SSA is being developed for observation data processing, database management and analysis, and data sharing. Ultimately, the mission of SSA requires space object ephemeris data to reliably predict space risk assessment such as re-entry and collisions prediction. In order to build an integrated SSA system, KASI has developed its own flight dynamic total solution, KASIOPEIA (KASI's orbit propagation estimation, integrated analysis system). The system consists of preprocessing of observation, orbit determination, risk assessment including re-entry and collision risk analysis. The first is a part that processes observation data collected by tracking sensors such as optical telescopes, radar, and RF sensor. This made it possible to merge observation data. The second is the precision orbit determination part applied for the dynamic based Bayesian least square method. Geopotential perturbation, gravity of Sun and Moon, solar radiation pressure, and atmospheric drag were applied for orbit dynamic modeling. In case of optical observation model, the light time delay, annual and diurnal aberrations and parallatic refraction. The observation models for radar and RF sensors were composed of ionospheric and tropospheric delay. In particular, orbits of multi satellites and biases of stations can be estimated simultanesouly. The final part is an analysis for on-ground re-entry prediction and on-orbit collision risk prediction. To avoid unjustified alarm, the intrinsic uncertainties of the problem is also critical for the evaluation of the risk. KASIOPEIA supports the availability of orbit determination, the uncertainties of the estimation and risk windows. Based on the essential requirement of SSA system, this paper outlines various features and algorithms of the KASIOPEIA.