

Hayabusa2 orbit determination using c5++ software

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Hayabusa2 arrived at the target asteroid Ryugu in June 2018 and is currently conducting remote sensing observations with various onboard instruments. So far, we have improved orbit determination software c5++, originally developed for the analysis of satellite laser ranging (SLR) data of the Earth, so that it can be used for the analysis of laser ranging data between Hayabusa2 and Ryugu obtained by Hayabusa2 LIDAR. Then we used it for the estimation of Hayabusa2 trajectory and the GM value of Ryugu. However, in the case of Hayabusa2, it is difficult to determine all of the 6 components of the initial state vector precisely if only LIDAR range data was used, and the simultaneously estimated GM value also had large uncertainty. To overcome this problem, in addition to LIDAR ranging data, we used Automated-Image-Tracking (AIT) data obtained by wide-angle optical navigation camera (ONC-W1) for the estimation of Hayabusa2 trajectory. In principle, LIDAR data gives information on the radial direction and AIT data give the ones on the across and along track directions. Thus, both data sets are complementary and help to improve the precision of the trajectory estimation. For this purpose, we improved c5++ so that it can deal with AIT data as observation data. In the presentation, we will show the results of trajectory and GM estimations using LIDAR and AIT data, and show how much the precision and accuracy are improved compared to the case using LIDAR data only.

Keywords: Hayabusa2, Orbit Determination, Ryugu