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DETERMINATION OF PRECISE ORBIT AND TERRESTRIAL REFERENCE FRAME FROM THE
FIRST SLR OBSERVATIONS IN KOREA

Abstract

In this research, the first Precise Orbit Determination(POD) of satellite and the first Terrestrial Reference Frame(TRF) is determined using the first observation data of the Chinese Satellite Laser Ranging(SLR) system, the Transportable Ranging Observation System(TROS) stationed in Korea. This research is performed using the TROS's Normal Point(NP) observation data of the geodetic LAGEOS-1 satellite. The determination strategy of the Precise Orbit Determination and the Terrestrial Reference Frame is developed using the Normal Point data from the Satellite Laser Ranging system. The SLR system which is the most precise method to observe satellites, measures the distances from station to satellites with the Time Of Flight(TOF) of the laser pulses. As a space geodetic technique, the SLR system measures the precise satellite position, the station position, and their variation. The NASA Goddard Space Flight Center(GSFC) provides the mm level accuracy of the Root Mean Square(RMS) error for the satellite orbits and the TRF solutions. The Precise Orbit Ephemeris(POE), the RMS of range residual, and TRF solutions of the NASA GSFC which is regarded as the true value is investigated. The result shows that the cm level accuracy of range residual RMS and the TRF solutions is obtained with the local observation data of the TROS in Korea. This result indicates that if the global SLR NP data from more stations are processed with long term NP observation data, a mm level accuracy of range residual RMS and the TRF solutions can be obtained. This research shows that it is the first Determination of the Precise Orbit and the Terrestrial Reference Frame with the Satellite Laser Ranging system in Korea, and the results can be used for the validation of other orbit determination systems. To verify and evaluate the results, the repeatability of station position is examined, and the results are confirmed by comparing the orbit accuracy with the Precise Orbit Ephemeris and the TRF solutions of the NASA Goddard Space Flight Center. In conclusion, independent solutions of POD and TRF can be obtained by applying the results of this research when the Accurate Ranging system for Geodetic Observation(ARGO), the first Korean SLR system, is developed by the Korean Astronomy and Space Science Institute(KASI).

Keywords : Precise Orbit Determination, Terrestrial Reference Frame, Satellite Laser Ranging, Transportable Ranging Observation System, Normal Point