Calibration of Satellites' Retro-reflectors Center

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Satellite Laser Ranging system measures the distance from SLR station to satellite's Retro-reflectors using the round-trip travel time of laser pulse. The position of retro-reflectors on satellites needs to be corrected which is helpful improving the accuracy of precise orbit determination (POD) and geodetic parameters, especially the TRF and GM. Numerical simulation and theoretical analysis have demonstrated the Center-of-Mass (CoM) corrections depend on system operating modes of SLR stations due to satellite signature effects. By statistic analysis over long-time series it showed the short-arc orbit determination precision has indeed undergone general improvement comparing to the situation of traditional global uniform CoM correction. The mean precision improvement on residual RMS is approximately 0.4 mm for Lageos-1/2 and 0.6 mm for Etalon-1/2. As the current requirements on SLR data processing for relevant applications have achieved sub-centimeter even towards millimeter level, it is necessary to take in the effect of system-dependent CoM correction. CoM is related to incident angle, structural alignment of retro-reflectors, station position and operating modes. Because the reflecting probability of photons for retro-reflectors is proportional to the cross sections of retro-reflectors, we can get the probabilistic model by calculation of the cross section area of corner reflectors. The corrections of CoMs of several spherical satellites are calculated. And for the planar array retro-reflectors, the CoMs of COMPASS are also tested and analyzed.

Keywords: Satellite Laser Ranging; Precise Orbit Determination; Center-of-Mass Correction; COMPASS