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RESEARCH OF THE SVLBI SYSTEM FOR TRACKING OBSERVATION ON DEEP SPACE PROBES

Abstract

VLBI (Very Long Baseline Interferometry) and relative technologies are almost essential methods for the precision orbit determination of planetary spacecrafts due to the long operating range and high-precision angle resolution. Ulteriorly, SVLBI (Space VLBI) is a kind of technology extension from VLBI making the antenna loaded by a satellite operating on space to achieve better space resolution measurement according to the baseline lengthened between another stations. The time-delay and rate observational models of it mainly involve three types: ground-ground, ground-space and space-space. Because the first is the same as VLBI and current satellite-borne SVLBI antennas are very rare, main researches are concentrated on the second one. While apparently, pure SVLBI stations outrange the atmosphere, so impacts such as the errors caused to the signals and limitations from atmospheric window can be eliminated importantly. Hence, the space-space models of SVLBI are more competent to the tracking observation on probes theoretically. However, the SVLBI stations are kinetic relative to the earth, thus their position accuracy is inferior to ground observational stations. Besides, the intervisibility between the probes and SVLBI stations is influenced by features of orbits and distribution, which will both limit the orbit precision of the probe directly. Based on this, the network structure of the SVLBI tracking observation system has been researched on the paper. The simulation result shows that the methodology is appropriate for deep space probes via fixed quantity and particular orbit settings. Meanwhile, with enough time series similar to VLBI system under the guarantee of observation coverage, the position precision can be promoted half to one order of magnitude larger. In addition, not only are computation models modified from the usual way of extragalactic radio source observed by SVLBI stations and deep space probes by ground stations, but also dynamic numerical modeling approaches to improve the observation geometry are considered and discussed. It's shown that there is a possibility that the precision can be improved further. In conclusion, the SVLBI system used for rapidly growing deep space probes is worth popularizing with broad prospects more than radio astronomy.