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NEW FUTURE SPACECRAFT NAVIGATION TOOL:INTERFEROMETRY TECHNOLOGY BASED ON ANTENNA ARRAY

Abstract

The emission of deep-space spacecraft helps human exploration scope extend from near Earth to deep space, and the high accuracy navigation of deep-space spacecraft is the basic of aerospace exploration activity in deep-space mission. Since the detection range of spacecraft extend, the received signal from deep-space spacecraft become weaker and weaker, and the signal-to-noise ratio(SNR) is lower and lower. A new navigation tool of deep-space spacecraft called Interferometry Technology Based on Antenna Array is proposed in this paper. It utilizes the capability of signal receiving and processing in antenna array

technology, and utilizes the capability of high accuracy measuring in interferometry technology, and combines the two technologies for high accuracy measuring in low SNR condition in deep space exploration missions. Firstly, the signal of deep-space spacecraft is received by two or more antennas in an antenna array, the received signals are respectively processed by delay correction and Doppler frequency correction, and then full spectrum combining in real time is executed. After the signals which are processed by antenna array technology, then the combined signal from two or more antennas is processed using interferometry technology, such as very long baseline interferometry(VLBI), differential one-way range(DOR), differential one-way Doppler(DOD), same beam interferometry(SBI), to extract the information of delay and delay rate caused by the motion of deep-space spacecraft. Finally, various measurement errors, such as transmit medium error, clock error, station position error, antenna phase center error, system error etc, are corrected by corresponding methods. A high brightness radio source can be utilized for correcting almost all errors in the technology of Interferometry Technology Based on Antenna Array. The high accuracy measurement information of delay and delay rate is obtained after error correction, and the measurement information can be effectively used in deep-space spacecraft's navigation missions.