

From Earth Missions to Deep Space Exploration (05)
Poster Session (P)

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SPACECRAFT DOR SIGNAL LOCAL CORRELATION PROCESSING METHOD AND
APPLICATION IN DEEP SPACE EXPLORATION

Abstract

Differential one way ranging (DOR) is an interferometry method to obtain high precision delay in deep space exploration. Two stations track the same spacecraft to obtain high precision deep space spacecraft's angle information. The process of DOR signal local correlation processing shows as follows, the model of DOR local signal is firstly constructed, and this model is used to make local correlation processing with the received spacecraft's radio signal to obtain high precision delay. Compared with the traditional DOR method, DOR local correlation processing method can be more effective in low SNR conditions to get correct measurement information. Firstly, prior delay model is calculated by orbit prediction, and the spacecraft's emission frequency is calculated by effective frequency evaluation method, then the prior delay model and emission frequency are used to construct the DOR local model signal, then correlation phase is extracted by cross-correlation processing. Then, DOR group delay is calculated. This paper introduces the mathematical model of DOR signal local correlation processing in detail, and especially analyzes the technique difficulty in DOR signal local correlation processing method. Based on the theoretical analysis, the algorithm of DOR signal local correlation processing is executed, and this method is verified by simulation, with the simulation measurement precision being about 0.1 ns. Finally, this method is used in China's CE-2 satellite tracking signal, and the measurement precision reaches ns level, thus, this verifies the effectiveness of DOR signal local correlation processing method, and provides an effective technology for precise spacecraft orbit measurement in deep space exploration.