Abstracts

Doppler Tracking of Planetary Spacecraft

P.W. Kinman. "Doppler Tracking of Planetary Spacecraft." 1992 Transactions on Microwave Theory and Techniques 40.6 (Jun. 1992 [T-MTT] (Special Issue on Microwaves in Space)): 1199-1204.

This article concerns the measurement of Doppler shift on microwave links that connect planetary spacecraft with the Deep Space Network. Such measurements are made by tracking the Doppler effect with phase-locked loop receivers. A description of equipment and techniques as well as a summary of the appropriate mathematical models are given. The two-way Doppler shift is measured by transmitting a highly-stable microwave (uplink) carrier from a ground station, having the spacecraft coherently transpond this carrier, and using a phase-locked loop receiver at the ground station to track the returned (downlink) carrier. The largest sources of measurement error are usually plasma noise and thermal noise. The plasma noise, which may originate in the ionosphere or the solar corona, is discussed; and a technique to partially calibrate its effect, involving the use of two simultaneous downlink carriers that are coherently related, is described. Range measurements employing Doppler rate-aiding are also described.

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