

Orbit determination of Mars Spacecraft with Optical Celestial Techniques and X-ray pulsars

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The combination of Multi-source observation data for autonomous navigation of deep space probes is a key issue for probe control and scientific applications. In this paper, we investigated the performance of integrated Optical Celestial Navigation (OCN) and X-ray Pulsars Autonomous Navigation (XNAV) system, the observations of which were simulated to determine the orbit of Mars Pathfinder. The observations of single system OCN and XNAV were simulated in term of Unscented Kalman Filter (UKF) in order to avoid the linearization bias of the orbit dynamical model. The integrated system was realized by Federal Kalman Filter (FKF) in order to inherit the advantage of the single system. Indeed, the results of the experiments show that the biases between nominal orbit and our calculated orbit are within 3 km in 3-axis, which was a very positive evidence to our integrated system's ability.

Keywords: Autonomous navigation, Integrated Navigation, Mars Spacecraft Orbit, Information Fusion