The connection between dynamical and radio-sources reference frames obtained from radar and VLBI observations of PHOBOS-2 spacecraft

N.V.Shuygina
Institute of Applied Astronomy, Russian Academy of Science
Zhdanovskaya str., 8, St.Petersburg 197042, Russia

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Abstract

The experience of determination of the link between radio-sources and dynamical reference frames is presented. To obtain this connection we used series of Very Long Baseline Interferometry (VLBI) observations of Phobos-2 spacecraft and angularly nearby quasars. Orbit determination of each spacecraft was carried out by numerical integration of relativistic equations of motion taking into account all major planet perturbations. The coordinates of perturbing planets were calculated by the DE200/LE200 ephemerides. So the dynamical reference frame is determined by the equator and equinox of this ephemeris. The resulting spacecraft orbit was fitted to the VLBI and tracing (range and Doppler frequency shift) data by means of weighted least squares procedure with the uncertainties of a few kilometer level. After precise orbit determination using VLBI measurements only we obtained three rotation angles between two reference systems. The radio and ephemeris dynamical frames were found to be coincident in all three axis to less then 80 milliarcseconds.