

Dynamical Reference Frame - Current Relevance and Future Prospects

Planetary and lunar motions are no longer used to establish inertial space for astronomical reference systems. The ICRF is the fundamental reference frame, and its sources are assumed to have negligible motions with respect to inertial space. Consequently, detection of frame rotation by the use of dynamics is no longer a key ingredient of modern-day astrometry.

The dynamical frame still exists, however, as realized by the planetary and lunar ephemerides. The relative distances and angles between the bodies, as well as the inertial mean motions, are determined almost entirely from the accurate ranging observations - a process completely independent of any outside sources or catalogues. The orientation of the dynamical frame, on the other hand, is established by fitting the ephemerides to the ICRF-based VLBI observations of orbiting spacecraft.

The accuracy of the ephemerides of the innermost four planets is limited by the presence of the asteroids, whose perturbations cannot be accurately modeled due to their mass uncertainties. The accuracy of the five outer planet ephemerides is determined by the limitations of the optical data to which those ephemerides are fit.