

High-precision numerical theory of the rigid Earth rotation taking into account the geodetic perturbations

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The present investigation is a development of the previous research (Pashkevich, 2000). The equations of the rigid Earth rotation taking into account the most essential relativistic perturbations – the geodetic perturbations – are modified. As a result, the numerical theory of the rigid Earth rotation is constructed, which is more adequate to the kinematical solution of the semi-analytical theory SMART97 [1]. The initial conditions of the numerical theory are determined by the kinematical solution of the semi-analytical theory SMART97. In the previous investigation [2] DE403/LE403 ephemeris was used for generating the perturbations of the disturbing bodies. In the present investigation by means of the numerical experiments it is discovered that for constructing a high-precision numerical theory of the Earth rotation the ephemeris DE404/LE404 can be used instead of the ephemeris DE403/LE403. The ephemeris DE404/LE404 is less precise than DE403/LE403 but is valid over significantly longer time interval. The numerical theory based on DE404/LE404 ephemeris and numerical theory based on DE403/LE403 ephemeris are practically identical over the common time interval of these ephemerides. The results of the mathematical description of the behaviour of the residuals between the numerical theory and SMART97 kinematical solution depend essentially on the time interval of comparison. It is necessary to note that the comparison of these theories over the several thousand year time interval gives more correct qualitative description of the behaviour of the residuals.

The possibility of extending the time interval of the semi-analytical theory of the rigid Earth rotation SMART97 to several thousand year time interval is discussed.

The results of the present research are as follows.

a) The high-precision (at microarcsecond level accuracy) numerical theory of the rigid Earth rotational motion dynamically adequate to the ephemeris DE404/LE404 has been constructed,

b) The numerical investigation of the rigid Earth rotational motion, taking into account the geodetic perturbations over long time interval, has been carried out.

References

1. Bretagnon P., Francou G., Rocher P., and Simon J. L. SMART97: A new solution for the rotation of the rigid Earth, *Astron. Astrophys.*, 1998, **329**, 329–338.
2. Pashkevich V. V. New development of the numerical theory of the earth rotation, In: *Journées 2000: J2000, a fundamental epoch for origins of reference systems and astronomical models*, (N. Capitaine, ed.), 2000, 169–176.