Intermediate orbit for general planetary theory in elliptic functions

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We discuss practical construction of the intermediate orbit for general planetary theory in elliptic functions along lines described in Brumberg (1992,1994) and Klioner (1992).

For the first-order intermediary we demonstrate that the intermediary in the form of Fourier series with respect to elliptic anomaly defined as

$$w_{ij} = \frac{\pi}{K(k_{ij})} F\left(\frac{\pi}{2} - \frac{1}{2}(\lambda_i - \lambda_j), k_{ij}\right), \quad k_{ij}^2 = \frac{4a_i a_j}{(a_i + a_j)^2},$$

is by far more efficient than the classic Fourier series involving anomalistic variable $\lambda_i - \lambda_j$. Here a_i is the major semi-axis and λ_i is the mean longitude of the i-th planet, F is the elliptic integral of the first kind and K is the complete elliptic integral of the first kind.

We also discuss problems which we encounter when constructing second- and higher-order intermediary orbit. The main problem here is to take integrals involving elliptic anomalies for two or more couples of planets.

References

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