THEONA, New Version: An Efficient Tool for Orbit Dynamics

Alexei Golikov[1]

[1] *Keldysh Institute of Applied Mathematics,*
125212, Leningradskoe shosse, d.46, kv.72, Moscow, Russia. E-mail: golikov@kiam1.rssi.ru

The Numeric-Analytical satellite theory has been elaborated to support different problems of applied celestial mechanics and space flight dynamics: orbit determination and prediction, maneuver optimization, model parameters determination, planning and designing of satellite mission, mission analysis etc. The software based on this theory are realized and approved during 10 years of works in the Ballistic Center of the Keldysh Institute of Applied Mathematics, the Russian Academy of Sciences. Now I develope a new version of software called THEONA. It provides fast calculations with good accuracy for wide classe of satellite orbits on orbit dynamics problems.

The THEONA's scheme combines methods of analytical integration and quadrature formulae. To integrate analytically it use special functions:

well-known (Jacoby functions, Legendre functions, Newcomb polynomials) and new functions I proposed. Hansen coefficients are a particular case of these new functions. Analytical integration takes into account all essential perturbations: gravity field (any number of harmonics), air drag (full standard models of atmospheric density), third body attraction (using DE405/or DE403/or DE118 ephemerides), solar radiation pressure with shadow effects. Besides, using methods with quadrature formulae we can to take into account more accurate dynamical model of satellite motion (other perturbations, maneuvers with different duration).

THEONA is valid tool for maany orbit dynamics problems, e.g. space flight control of orbital station and spacecrafts, satellite constellation keeping and formation, space object observation and identification etc. Some examples of using THEONA are presented in this paper.