

# Semi-analytical models of satellites motion for Russian Space Surveillance System

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Three types of integration methods of equations for celestial body motion are known. They are numerical, analytical and semi-analytical methods. The techniques of first two types are widely applied during long time. The methods of last type have attracted attention of the experts after the launch of the Sputnik 1 satellite. The authors suppose that this development was caused mainly by requirements of space surveillance systems (SSS).

The stages of development of the semi-analytical satellites motion model for Russian SSS are considered. This development was caused by a lot of circumstances connected with the computer resources improvement, with the measurements accuracy growth and increasing of their quantity, with the more accurate modeling of perturbing factors (geopotential, atmosphere), with the growth of number of catalogued satellites. The essential influence of perturbing factors of a different nature makes impossible the obtaining of the analytical solution of acceptable accuracy. The averaging method developed by the Russian scientists was used as the methodical foundation for the development of considered semi- analytical algorithms.

The 'Summation of perturbations of each revolution' technique was applied at the first stage (beginning of 1960). This is a first order method of finite differences.

At the second stage (1970-1980) the osculating elements at ascending node were used as the averaged ones. The perturbations of the first and second order were taken into account.

The transition to classical averaged orbital elements was hereinafter executed. Thus the number of the taken into account perturbing factors was increased essentially.

The entity of each of the considered methods and their characteristics are given.