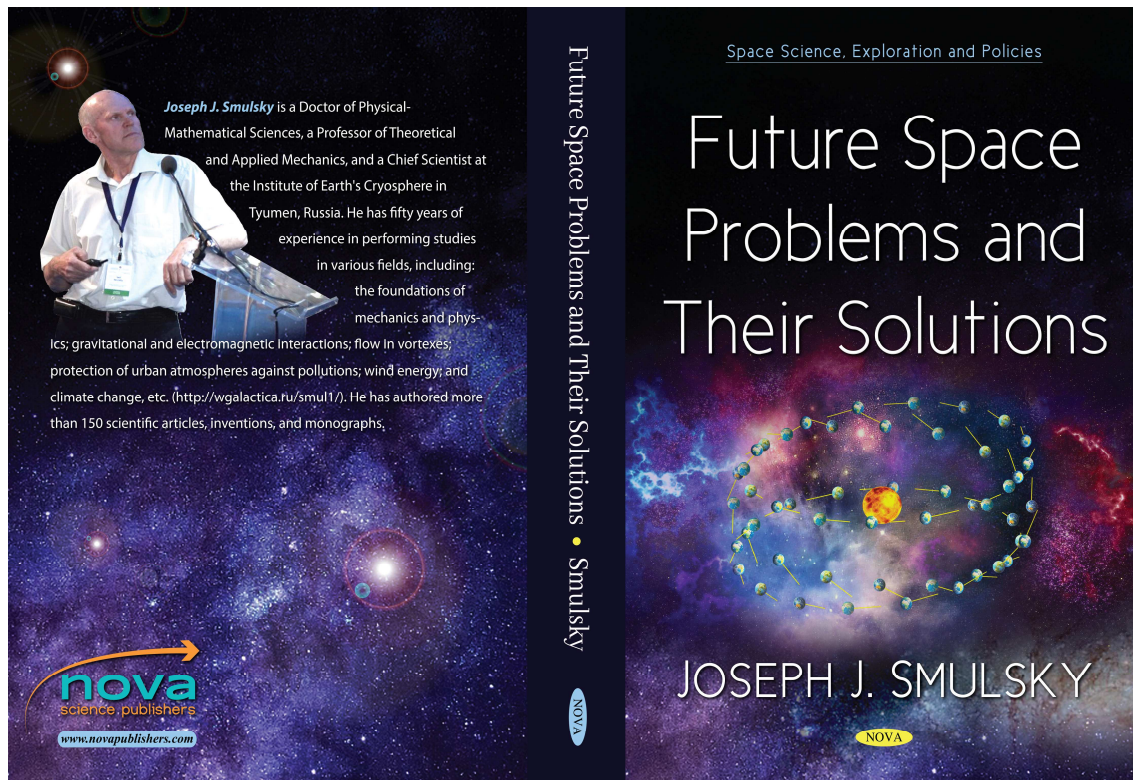


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## **Future Space Problems and Their Solutions**

**Joseph J. Smulsky**

The emergence, existence and development of the surrounding world, both on Earth and throughout the universe, are due to the gravitational interactions of many bodies. This book is devoted to the calculation of bodies' movements in various cases of interaction that are relevant now and in the future. They are developed for the free access of the Galactica system, which is designed to provide the numerical solution for problems of the gravitational interaction of N-bodies. It tackles a whole range of problems: The optimal motion of the spacecraft, the evolution of the solar system for 100 million years, the influence of the Sun on Mercury's perihelion, the motion of near-Earth asteroids, the evolution of Earth's rotation axis, etc. As a result of solving a number of problems, new knowledge about our world was obtained.

The optimal trajectory of the spacecraft approaching the Sun is determined by numerical integration of the equations of motion for spacecraft, planets, the Sun, and the Moon.

Exact solutions to the problem of the Newtonian gravitational interaction of N material points moving around N2 concentric circular orbits are reviewed. Each circular orbit contains N3 located bodies and the body system rotates as an entity. Solutions in various forms were obtained. A computer program has been developed. Structures comprising up to one million bodies have been calculated.

The Galactica system is used for computing movements of two asteroids: Apophis and 1950DA. The evolution of their movement over a span of 1,000 years is investigated. The moments of their closest passages near the Earth are defined. The different ways of asteroid trajectory transformations into orbits of the Earth's satellites are considered.

This book proves that the rate of Mercury's perihelion rotation and relatively motionless space coincides with the Newtonian interaction of the planets and the oblate Sun.

The issues connected with the Astronomical Theory of Ice Ages from the perspective of celestial mechanics are examined. Differential equations of rotational motion are solved with the help of the numerical method without simplification. The evolution of the Earth's axis was examined, and the periods of its oscillations that coincide with the observed ones were obtained. The calculations for a hundred thousand years demonstrate significant oscillation of the Earth's axis. The oscillations of the Earth's axis result in such oscillations of insolation that explain the paleoclimate changes.

The exact solution to the problem, in which the bodies are uniformly distributed over a sphere, were obtained; they move experiencing no mutual collisions. The problem solution allows the formation of several planets – for instance, one hundred planets resembling the Earth and moving under identical conditions with respect to the Sun. The latter possibility opens a way toward unrestricted progress for mankind.

The book describes all the theoretical, practical issues and the Galactica system manual so that even a novice researcher could use it in his/her works.

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