

Program GALACTICA for the Solution of the Space Problems

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The high-precision method for integrating differential equations of the gravitational interaction of point-mass bodies is developed. On the basis of a computer program Galactica the various problems of celestial, stellar and space dynamics have solved.

With this program Galactica one can compute interaction of any number of bodies that are permitted by the RAM and the speed of the computer. It is developed the technology and the number of additional programs to create files of the initial conditions and to analyze the results of integrating of differential equations of motion.

The program Galactica have be used to solve the next problems.

1. The evolution of the orbits of the planets and the Moon for 100 million years [1] - [2]. Such integration of differential equations for the period no one exercised before. The periods and amplitudes of the oscillations of the bodies' orbits were obtained and the stability of the Solar System is established.
2. For research of influence of the Sun to the Earth climate the missions to the Sun are planning. The task of optimum flight to the Sun was considered [3]. It is determined that the gravimanoevre at the Venus reduces by 20% of the initial velocity of the spacecraft and in a few times reduces flight time.
3. The evolution of the asteroid Apophis in 1000 years [4] - [6]. According to the calculations the minimum distance Apophis with the Earth will occur April 13, 2029. The experts of NASA are finding probability of encounter of Apophis with the Earth in the 2036-37 years. We found that in the coming 1000 years the Apophis's approach at April 13, 2029 will be minimal.
4. The evolution of the asteroid 1950DA for 1000 years [7]. The experts of NASA are thought that there is the probability of encounter the asteroid 1950DA with the Earth in 2880. We have found that the asteroid 1950 DA to the time period in 1000 will double-pass near the Earth at a distance of about 2.25 million km: in 2641 and 2962.
5. The transformation of the trajectories of the asteroid Apophis and 1950DA in the orbits of satellites [4] - [7]. With this program Galactica the asteroids' parameters are identified which necessary to transform them into satellites and the evolution of these satellites are studied.
6. The compound model of the Earth's rotation and the evolution of its axis [2], [8]. The Earth is regarded as a set of bodies located along the equator. The movement of one of these bodies simulates the motion of Earth's rotation axis. The evolution of motion of the Earth's axis was calculated for 110 thousand years, the oscillation periods are determined and established that the Earth's axis precesses relative to the moving axis of the Earth's orbit.
7. The compound model of the Sun rotation and its influence on the planet [9] - [12]. The Sun rotates with a period of 25.38 days. With the program Galactica the influence of compound model of the solar rotation to the nearest planets was found. The calculations give the excess rotation of Mercury's perihelion, which is explained by other mechanisms.
8. Multilayer ring structures [13]. The structure consists of several rings, each containing several bodies. The evolution of several variants of these structures was calculated and the stable and unstable structures were received.

References

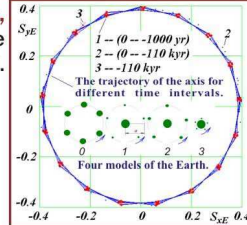
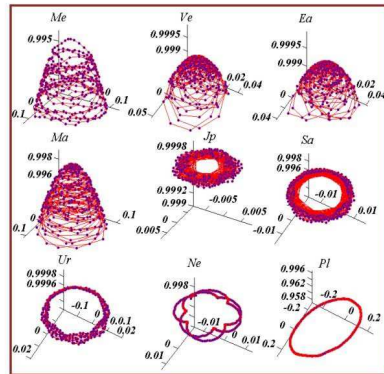
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**PROGRAM GALACTICA
FOR THE SOLUTION OF SPACE DYNAMICS TASKS**

- Dynamics and evolution of the Solar system bodies.
- Passive movements of spacecrafts.
- The evolution of the assembly of bodies, including galaxies.

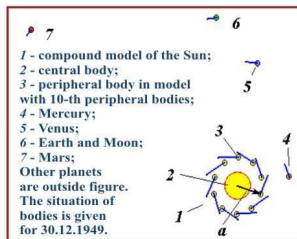
THE EXAMPLES OF SOLVED PROBLEMS AND SOME RESULTS

1. The evolution of the orbits of planets, Moon and Sun for 100 million years. The stability of Solar system is established.

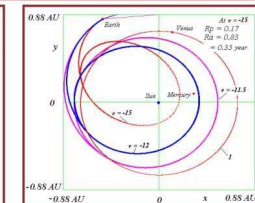
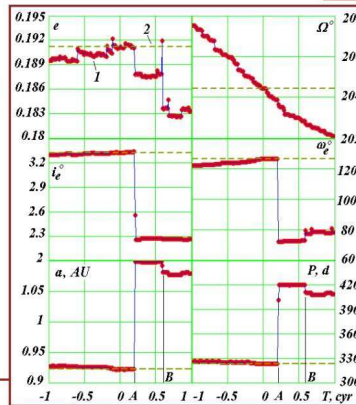


2. Compound model of rotation of the Earth. The Earth's axis rotates around mobile axis of its orbit and oscillates relatively it.

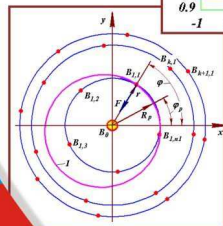
3. Compound model of rotation of the Sun. The surplus of rotation of the perihelion of Mercury is caused by the rotating Sun.



4. Evolution of movement of asteroids Apophis and 1950 DA. In nearest one thousand years Apophis only once, April 13, 2029, will approach to the Earth on close distance, which equals 38-39 thousand km. At this moment (point A on the time axis T) the orbital elements have a break.



5. Optimal flight to the Sun. The gravimanevr at the Venus reduces by 20% of the initial velocity of the spacecraft. Trajectories and orbits of the spacecraft at start 10.01.2001, with different initial velocities v. After action of Venus (at the site of intersection of its orbit) the spacecraft goes to an elliptical orbit. 1 - the orbit of Venus.



6. Multilayer ring structures. Identified stable and unstable structure. At the figure presented below the two bodies are thrown in opposite directions.

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Fig. 1. View of planshet at the Exhibition "Year of Russia in Spain. Scientific, technical and innovative achievements of Russia", 12 -15 May, 2011, Madrid.

The presentation on the stage of the hall in Power Point format is contained in the form of archived files and Gal5Vid5.part1.rar, Gal5Vid5.part2.rar and Gal5Vid5.part3.rar each to 23 Mbt at: <http://www.ikz.ru/~smulski/Gal5Vid/>. In this archive the file Galact5MdE.ppt is itself presentation in English, as well as of its sound and video files.

This report is also available on YouTyube in the form of a video: <https://youtu.be/uDc-DmTCcZk> and in the form of a presentation: <https://youtu.be/Z17B3F4oPEI>.

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