Determination of orientation of space vehicle Sich-1M from the date of ferroprobe magnetometers and Solar detector

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On 24 December 2004 a launch of the satellite “Sich-1M” was made. Unfortunately instead of the planned orbit with the altitude of near 670 km the satellite went up to the elliptical orbit with the altitude 280 km. In addition the satellite got some swing. The motion of the satellite in such dense atmosphere layers decreases its lifetime down to one year. At the end of December the gravitational beam was pulled out from the satellite, which partly stabilized its motion. Oscillations of the satellite set inessential limitations on realization of scientific tasks of the project “Variant” because there is a possibility to determine the satellite orientation for a given time moment with the help of measurements of ferroprobe magnetometer FZM or onboard magnetometer. The device FZM measures three components of magnetic field Bx, By, Bz of the Earth in coordinate system of the satellite. To determine the satellite orientation we have used the fact that each of the component of the magnetic field at the present time moment is a function of geographical coordinates of the satellite (latitude, longitude, height over sea level), its orientation and components of a vector of Earth magnetic field in this point, calculated from magnetosphere model. Thus, having direct satellite measurements of Bx, By, Bz at given time moment in given point, orbital elements and position of the satellite on the orbit and using the standard model of Earth’s magnetosphere one can calculate the satellite orientation as function of time. For the calculation we have used the magnetosphere model “The International Geomagnetic Reference Field” (IGRF) which empirically calculates the components of magnetic field of the Earth. Coefficients of IGRF model are based on accessible information sources including geomagnetic measurements of observatories, rocket and satellite measurements. Solution of the problem has been carried out using method of Gauss-Newton.