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USE OF THE HIGH SENSITIVE ELECTROSTATIC ACCELEROMETER FOR ORBIT
PERTURBATION EFFECTS INVESTIGATION ON BOARD OF LEO SPACECRAFT

Abstract

Presently the research of space satellites motion and availability of accurate determination of their positions including precise orbital elements are giving rise to higher interest not only of specialists on astrodynamics (for design and prediction of spacecraft orbit) but also in various science disciplines such as geophysics, geodesy or navigation. Besides the gravitational force a number of perturbing factors influence a spacecraft's trajectory on the low Earth orbit (LEO). It is possible to divide these perturbations into two basic groups: gravitational and non-gravitational. The magnitude estimation of the non-gravitational perturbations effecting on orbiting spacecraft is possible by two principal methods. The first is analysis of the spacecraft orbit elements variations and the second is the direct measurement of perturbative accelerations by sufficiently sensitive accelerometer installed on spacecraft board. We analyze benefits and negative aspects of both methods. We discuss in the paper the requirements for project of small space platform intended for research of high atmosphere density variation at altitudes 400 - 1000 km. Besides important aspects as mission objectives, concept and design we specify needed performances of the acceleration sensor. As an instrument usable for perturbative accelerations measurement is investigated the high sensitive triaxial electrostatic accelerometer MAC04 developed recently in the Czech Republic. The main stages of development of this device, description of the measurement principle, instrument performances, control concept and application of the accelerometer in space research projects are presented in the paper. Major emphasis will be placed on aspects of accelerometer orbit operation, in-flight calibration problem and flight verification of accelerometer performances.