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Author: Prof. Aleksey V. Nenarokomov
Moscow Aviation Institute, Russian Federation, aleksey.nenarokomov@mai.ru

Mr. Evgeny Chebakov
Moscow Aviation Institute (National Research Institute, MAI), Russian Federation, ChebakovEvgeny@yandex.ru
Mr. Sergey Budnik
Moscow Aviation Institute, Russian Federation, sbudnik@mail.ru
Prof. Dmitry Reviznikov
Moscow Aviation Institute, Russian Federation, reviznikov@inbox.ru
Mrs. Irina Krainova
Moscow Aviation Institute, Russian Federation, igrid@mail.ru
Prof. Andrey Nadiradze
Moscow Aviation Institute (National Research Institute, MAI), Russian Federation, riame@sokol.ru
Mr. Dmitry M. Titov
Moscow Aviation Institute (State Technical University), Russian Federation, tdm@cosmos.com.ru

ATTITUDE CONTROL SYSTEM OF A MICROSATELLITE BASED ON INVERSE PROBLEMS METHODOLOGY

Abstract

A reliable and robust attitude control system of a spacecraft is one of the main design tasks without which most missions cannot be performed. This circumstance imposes certain criteria on the development of the orientation system of vehicles in outer space. For a reliable control of the current orientation a combined system of the orientation, sensor redundancy and backup systems are used. A combined system usually includes solar sensors and magnetometers for small satellites such as CubSat. The main goal of this paper is the analysis of the possibility to elaborate a reliable orientation system for a spacecraft. This system uses radiation heat flux sensors based on the inverse problems methodology. It can be used for verification or correction of the angular orientation of the vehicle. Unfortunately, in majority of practical situations the direct measurements of heat flux are problematic. These difficulties can be overcome with the use of some indirect thermal measurements combined with an inverse problem technique. The problem of retrieval of the angular orientation of a spacecraft demands to solve two inverse problems sequentially. The first one is the estimating of heat fluxes absorbed by spacecraft surface. The second one is the determining of orientation angles based on the estimated values of radiative heat fluxes. This issue is complicated because it is necessary to estimate the spacecraft orientation during spaceflight. To overcome this difficulty, the observation problem using the Kalman filter was considered.