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Synthesis and Analysis of control system for construction of the ordered groups of small satellites

Alexander I Panferov, Alexander V Nebylov, Sergey A Brodsky and **A E Medina Padron**
State University of Aerospace Instrumentation, Russia

Possible variants for controlling the relative motion of small satellites are considered. The purpose of such control is to create a highly accurate stabilization of an ordered group of satellites operating together on the implementation of the same task. In such groups, control is based on measurements of mutual locations of the satellites that are moving at very close orbits. The purpose of formation and rebuilding of a group of satellites is the solution of various practical tasks, such as monitoring the earth's gravity anomalies, creation of stereoscopic images and others. The purpose of this work is the synthesis of an optimal control system for the center mass motion of active satellites, with the objective of navigation to a specified point in space relative to the reference satellite. Utilization of this procedure in sequence to all satellites in a group allows one to create any kind of configuration. A new optical system of relative orientation and navigation is proposed. Proposed algorithms of processing of the images of the special contrast points of the main satellite on the camera matrix allows to calculate all 6 parameters of relative orientation and navigation of the controlled satellite relatively the main satellite. In solving this problem, random errors of the system relative orientation and navigation, the dynamic properties of actuators, creating control forces and moments of forces, are taken into account. The results of the simulation of the relative motion with different initial conditions are given. Operability of the proposed algorithms is proved for all possible initial conditions. Results of the synthesis of optimal filtering algorithms for primary navigation measurements are obtained. The simulation results are presented and an installation for an actual experiment is described.

Biography

Alexander I Panferov is a Professor of the State University of Aerospace Instrumentation in Saint Petersburg, and the Senior Researcher of the International Institute for Advanced Aerospace Technologies, Russia respectively. He has led many Research and Development projects in the field of aerospace instrumentation, control systems design for the aeroelastic object, micromechanical gyroscopes and systems. He is a coauthor of more than 12 patents and 100 articles in reputed journals.

panferov@aanet.ru