

Passive Thermal Control in Small Satellites – Up-to-Date Tendencies and Advanced Components

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The main idea of the given lecture is to present the survey of current tendencies in small satellite passive thermal control concepts. This information can be rational and useful for posterior missions due to intensive dissemination of the satellites of such type. For this purpose the available world-wide literature references and lessons learned by the National Technical University of Ukraine during the elaboration of thermal control hardware for micro-satellites Magion 4, 5, BIRD and autonomous thermal control systems for far interplanetary missions VEGA, PHOBOS have been used. The main parameters taken into consideration for analysis are the following: satellite sizes, mass, power consumption, orbit parameters, altitude control peculiarities and thermal control description. It was defined that some variants of passive thermal control concepts are widely used, excepting autonomous temperature regulation for sensitive components such as batteries, high precision optics, some types of sensors. The practical passive means for realisation of passive thermal control design such as surface finishing, insulation, optical coatings, heat conductive elements, thermal gaskets, heat pipes, low conductive elements are described, and the examples of their implementation in satellites thermal control are demonstrated. The special attention is devoted to simulation software used in the thermal control design. The review of commercially available software is proposed. The points of the interest are the technical abilities, hardware requirements, simplicity in exploitation and the possibility to use in everyday practice, cost, which are analysed. Some practical samples of usage of finite-element packages and method of lumped parameters for simulation of thermal passive control systems are considered. The information about software tools for heat pipe selection and design is proposed.