Proceedings of the 9th International Symposium on Radiative Transfer, RAD-19
June 3-7, 2019, Athens, Greece

RAD-19 IR05

A BACKUP SYSTEM OF A SATELLITE ORIENTATION BASED ON RADIATIVE INVERSE PROBLEMS APPROACH

Aleksey V. Nenarokomov[1*], Evgeny V. Chebakov[1], Sergey A. Budnik[1], Andrey B.Nadiradze[1], Dmitry L. Reviznikov[1], Dmitry M. Titov[1], Irina V. Krainova[1]

[1] Moscow Aviation Institute, 4 Volokolamskoe Hgw., Moscow, 125993, Russia

ABSTRACT. A reliable control of current orientation of a spacecraft is a very important task in aerospace engineering. This makes important to elaborate a backup or replacement system which can be used for the verification or correction of the orientation. It seems natural to use various conditions of radiative heating of the design elements of different orientations with respect of the Sun and strongly radiating or reflecting planets of the Solar system. In the case of an ordinary slow variation of the vehicle orientation in space, the temperature measurements can be used to distinguish different integral (over the spectrum) radiative flux to various surfaces of a specially designed thermal sensor with several facets. An analysis of a possibility of such an engineering solution is a subject of the present study. The mathematical problem to be solved isone of the so-called inverse heat transfer problems, and its solution is not a simple task. Therefore, the main efforts of the authors are focused on solution of this ill-posed problem. The known methods of the inverse problem's regularization are modified to take into account special features of the heat transfer problem under consideration. The resulting algorithm is verified using the typical case problems. It was shown that one can obtain sufficiently accurate results on the bases of a limiting set of relatively simple temperature measurements. The latter enables us to consider the method suggested as a promising way to elaborate a series simple backup/replacement system of an approximate retrieval of a spacecraft current orientation. This statement is confirmed by calculation for one of the typical trajectory of a vehicle in the Solar system.