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ASTRODYNAMICS SYMPOSIUM (C1)
Attitude Dynamics - Part 1 (5)

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SATELLITE ATTITUDE ESTIMATION BY MEANS OF TEMPERATURE MEASUREMENTS. NUMERICAL APPROACH

Abstract

Thermal balance equations express a dynamic equilibrium between incoming and outgoing heat fluxes. Such fluxes depend on the features peculiar of sources, on the geometrical and thermo-optical parameters of the spacecraft and on its orbital and attitude dynamics. Under the assumption that the orbital and thermo-optical parameters can be considered known with a fairly good level of confidence, it is possible, by measuring the temperature in suitably located points onboard the spacecraft, to reverse the thermal equations and solve them for the attitude angles. The idea has already been proposed in a previous work of the principal author; in that time, with reference to a geometrically simple spacecraft moving along a particular orbit, the algorithm for reconstructing the attitude with an analytical approach, was presented. In the present paper a more general study, including albedo radiation and elliptical orbits, enumerates the cases taken into consideration and shows the usefulness of rough models for albedo to settle ambiguous situations. The work has been carried out following a numerical approach and making use of software devoted to spacecraft thermal analysis. The thermal mathematical model of the system has been assembled in such a way to obtain the temperature values recorded by the sensors located in known positions. These values represent an input for the reconstructing algorithm which proceeds by put and take technique. The hypothesis is, indeed, that the attitude, reconstructed step by step, obeys, at least in the short period, a free evolution dynamics which is described by the jacobian elliptic functions. Once provided the inertia tensor, the task is to fit the reconstructed data with those provided by the analytical solutions.