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STUDYING THE DRIFT OF A CALIBRATED SOLID INSIDE THE PRESSURIZED CABIN OF THE INTERNATIONAL SPACE STATION

Abstract

The paper discusses methodological support for the space experiment Vector-T conducted in the International Space Station (ISS). The objective of the experiment is to obtain data to improve the accuracy of the ISS motion prediction. High-precision motion predictions for such a complex dynamic object as the ISS require knowledge of the actual aerodynamic acceleration vector. The value of the aerodynamic acceleration applied to the ISS during the orbital flight at the altitudes of 400450 km is fairly small, and it is impossible to measure it directly with accelerometers. Indirect information about the acceleration applied to the ISS can be deduced from observations of the drift of a calibrated solid (such as a small sphere) freely floating inside the pressurized cabin of the space station. Such drift is caused by the fact that the ISS orbital motion is affected by the aerodynamic force, while the orbital motion of solids inside the pressurized cabin, which shelters them from the incident flow, is not. In the case where a solid inside the pressurized cabin is released ("launched") from its mechanical links with the ISS structure without imparting to it any additional velocity impulse, it will be moving with respect to the ISS structure. The trajectory of this motion ("drift") is determined by the following factors: the magnitude and the direction of the aerodynamic acceleration applied to the ISS; the position of the solid "launch" point by the crew with respect to the ISS center of mass. The paper discusses issues involved in the analysis of drift trajectory depending on the following affecting factors: Solar activity; year season; illumination of the orbital segment where the experiment is conducted; orientation of the ISS solar array panels determining the drag, the lift and the side forces; offset of the 'launch' point from the ISS center of mass. The paper comes up with some suggestions on how to select preferable "launch" points inside the ISS pressurized cabin based on the criterion of the maximum drift duration within specified boundaries. The paper addresses the issues of recoding by the crew the data about the drift of a solid with respect to the ISS interior and for acquisition of supporting data required for processing the results. It provides description of algorithms developed to support the experiment session planning, conduct, and data processing.