SPACE DEBRIS SYMPOSIUM (A6)
Space Debris Removal Issues (5)

Author: Prof. Fabio Santoni
University of Rome "La Sapienza", Italy

Dr. Emiliano Cordelli
Italy
Dr. Fabrizio Piergentili
University of Rome "La Sapienza", Italy

ROCKET BODY ROTATIONAL STATE ESTIMATION BY REMOTE OPTICAL OBSERVATIONS

Abstract

The growth of the orbital debris population is being a concern to the international space community in the last decades. To better preserve the near Earth environment for future generations, remediation measures, such as active debris removal (ADR), must be considered as an effective means to stabilize, or even reduce, the future LEO debris population. It has been suggested by many authors that removing large mass objects, such as rocket bodies, is indeed a priority. The rotational state of candidate objects may be critical for the ADR mission and the measurement of the object rotational state, even if not very accurate, could be a very useful information in preliminary ADR mission planning. For partially operative satellites useful information on the attitude could be obtained by telemetry. For non-operative objects, such as rocket bodies, one must refer to remote observations. In the case of rocket bodies, which usually have a simple cylindrical shape, the determination of the rotational state can be performed by the analysis of the light curves, using a simplified mathematical model. In this paper the results of an observation campaign devoted to the determination of uncontrolled tumbling rocket bodies rotational state by ground-based optical observations are presented. The photometric analysis was performed in order to extract light curves from photos obtained by a CCD camera. The rotation axis direction and angular speed have been determined comparing actual measurements with theoretical predictions obtained in the simplifying assumption of cylindrical, diffusely reflecting cylinders. The angular speed is evaluated by the light curve period. The direction of the rotation axis is evaluated by measuring the difference between the maximum and minimum tumbling rocket bodies' apparent magnitude. This evaluation can be performed from a single observing site, by combining measurements collected during a suitable observation time span. The results achieved for the objects CZ-3B RB 37151 and SL-12 RB 37140 are reported, showing a good agreement between determinations obtained in completely different observation geometries.