SPACE DEBRIS SYMPOSIUM (A6)
Measurements (1)

Author: Prof. Fabio Santoni
University of Rome "La Sapienza", Italy, fabio.santoni@uniroma1.it

Dr. Riccardo Ravaglia
Scuola di Ingegneria Aerospaziale, Italy, feanor87@live.it
Dr. Fabrizio Piergentili
University of Rome "La Sapienza", Italy, fabrizio.piergentili@uniroma1.it

ANALYSIS OF CLOSE APPROACH IN GEO USING OPTICAL MEASUREMENTS

Abstract

Earth orbiting spacecraft are exposed to hazardous Micrometeoroid and Orbital Debris environment. These objects can collide at very high velocity, causing significant damages to operational satellites in any orbital regime, from LEO to GEO. Many of these objects are catalogued and regularly monitored, thus their orbital parameters are always updated and can be used to perform a risk assessment analysis based on the probability of impact that can occur between orbiting objects. In order to perform a Close Approach (CA) analysis, the two space objects position and velocity vectors are necessary, as well as the state covariance. These parameters can be obtained from the Two Line Element sets (TLE); however the accuracy of the provided state vectors is not sufficient for accurate collision analyses, and further orbit determination should be performed in order to determine an accurate state vector and the related covariance. This level of accuracy can be achieved by integrating the TLE parameters with optical measures. Nevertheless, to achieve suitable orbit determination results from optical measurements the accuracy of the angular measures is as important as the timing precision: a tenth of a second error on timing can lead to several hundred meters error on the position estimation. In order to accomplish this requirement a Global Positioning System (GPS) receiver is used as external trigger for the CCD camera. In order to evaluate the measurement acquisition system performances the measures accuracy must be determined. To this purpose, several measurements of the Global Position System (GPS) satellites have been collected and compared to their precise ephemeris. About a hundred GPS satellite measures were used to achieve the statistical distributions of the error committed, both Along-Track and Cross-Track, in terms of mean and Standard Deviation (SD) values. Mean values achieved are on the order of magnitude of tenth of arcsecond for both cases, while SD are equal to 3.5 and 3.3 arcseconds for the Along-Track and the Cross-Track errors. In this paper is presented a study case, based on the Close Approach in GEO region between GORIZONT 11 and COSMOS 1738 occurred on 2011 December 22nd, to compare the results obtainable by using TLE only or the accurate orbit determination system based on the observation campaign.