SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

Author: Mr. Jonas Radtke
Technische Universität Braunschweig, Germany, j.radtke@tu-bs.de

Mr. Sven Kevin Flegel
Technische Universität Braunschweig, Germany, sven.flegel@fhr.fraunhofer.de
Mr. Johannes Gelhaus
Technische Universität Braunschweig, Germany, j.gelhaus@tu-bs.de
Mr. Marek Moeckel
Technische Universität Braunschweig, Germany, m.moeckel@tu-bs.de
Mr. Vitali Braun
Technische Universität Braunschweig, Germany, v.braun@tu-bs.de
Mr. Christopher Kebschull
Technische Universität Braunschweig, Germany, c.kebschull@tu-bs.de
Dr. Carsten Wiedemann
Technical University of Braunschweig, Germany, c.wiedemann@tu-braunschweig.de
Dr. Holger Krag
European Space Agency (ESA), Germany, holger.krag@esa.int
Dr. Klaus Merz
European Space Agency (ESA), Germany, klaus.merz@esa.int
Prof. Peter Voersmann
Technische Universität Braunschweig, Germany, *(email is not specified)*

REVISION OF STATISTICAL COLLISION ANALYSIS FOR OBJECTS INSIDE OF SATELLITE CONSTELLATIONS

Abstract

Assessing the collision risk for objects on Earth orbit is of high interest when evaluating the impact of space debris on future space flight. At this, synchronized objects like constellation satellites (as for example Iridium) have to be considered as a special case. These objects are in general spread on their orbit in such way that they can collide only in very rare cases. Thus, this intentional distribution of objects has to be considered when calculating possible collisions. One possibility for calculating collisions is the so called orbit-trace method. Simulations with a software from ILR for long time analysis of collisions (LUCA – Long Term Utility for Collision Analysis), which uses this method for collision determination, show that too many inter-constellation collisions occur between objects with similar mean motions and inclinations. Main reason for this over-representation is the calculation of orbit intersections by the orbit-trace method: this method only checks for a crossing of orbits without taking into account the in-track position of the objects, which is crucial when treating synchronized objects though. To account for special cases, a filter has been developed and appended to the used orbit trace method. This filter uses a multistep query for all objects, in which at first co-planarity and possible intersections of orbits are checked. Furthermore, it is investigated if the attitude of orbits to each other and their shape allow head-on collisions. During the next step, synchronized objects are being recognized. These are additionally checked for their proximity. Depending on the results of the single queries, it is decided if a collision is assumed to be possible. In the scope of the paper, the special case of collision risk for synchronized objects is examined. Using LUCA,

first possible collisions are shown both for defined synchronized target objects as well as for a complete population, using the orbit-trace method without the filter. This is followed by a description of the implemented filter and of its derivation methodology. Finally the effectivity of the filter is demonstrated, which leads to a more realistic collision analysis for example within constellations. Thereby, again both defined target objects as well the influence of the filter on the collisions in the whole population during one simulation period is investigated.