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SPACE DEBRIS SYMPOSIUM (A6)
Modelling and Risk Analysis (2)

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EVALUATION INDEX FOR THE RANKING OF LEO OBJECTS

Abstract

The aim of this work is to define and test a novel index to rank abandoned objects in LEO. It takes into account the physical characteristics of a given object, its orbit and the environment where this is located. It can be computed either for a specific epoch or as an average for a given interval of time. This evaluation criterion is not thought to be applied in principle to active objects, since they are able to perform avoidance maneuvers and thus could theoretically avoid most of the collisions with debris larger than 10 cm. Moreover the index is useful only for large objects. Small, 10 cm sized, objects, thought possibly very dangerous as projectiles, do not represent a threat to the environment at large if fragmented, since they would not generate large debris clouds.

The environment is considered in terms of spatial density of objects as a function of time. For this purpose, a reference simulations of the evolution of the space debris environment, spanning 200 years (considering the population of objects larger than 10 cm from the MASTER 2009 population), is performed with SDM 4.2. For this reference case a scenario where the space activities are performed in way similar to the one adopted in the last decade is simulated. In particular no new explosions are considered and no avoidance maneuvers are performed. A post mission disposal scenario according to the 25-year rule is adopted, with a 60% compliance to this rule (i.e., only 60% of the spacecraft are actually de-orbited at end-of-life). The resulting spatial density is recorded every year and stored.

The definition presented will help especially in the definition of active removal scenarios, e.g. in the ranking of the perspective mission targets. To illustrate this, the resulting index for objects in the initial population at the epoch of January 1, 2020 with semi-major axis lower than 9000 km and mass larger than 100 kg will be shown and some 'merit' classes derived.