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Modeling and Risk Analysis (2)

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ASSESSING THE IMPACT OF A SPACE MISSION ON THE SUSTAINABILITY OF THE SPACE
ENVIRONMENT

Abstract

Space, like any other ecosystem, has a finite capacity. The continuous growth of space activities, due to the increasing reliance of our daily lives on services from Space, the privatisation of the space market, and the lower cost of deploying smaller and distributed missions in orbit, is improving human-life quality. However, it is also contributing to overload this delicate ecosystem. As of today, the space debris problem is internationally recognised, and thus the environmental concern in Space activities is becoming a priority. Several formulations of debris indexes have been proposed to model distinct aspects of the space debris environment, mainly focussing on monitoring the possible increase in the number of objects in space, and on the risk they pose to current and future satellites.

In this paper, we will present the latest advances in the design of a software tool to assess the impact of a space mission on the space environment and its contribution to the overall Space capacity, developed by Politecnico di Milano and Deimos Space within an ESA-funded study. A density-based approach is used for propagating the fragments originating from collisions and explosions in space. This is used in the definition of a debris index to assess the impact of a space object on the environment, based on mission information such as its orbit, mass, cross-section, and risk of fragmentation due to accidental collisions or break-up. The output of the environmental analysis is summarised into a single score, which is integrated in the ESA database DISCOS for reporting analysis and which is also suitable for integration into a life cycle assessment procedure. The paper will present the development and consolidation of the different

building blocks required for the definition of the environmental capacity and the development of a database to support the management of the capacity, through its computation and allocation. An overview of the expected user interface functionalities will also be presented.