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

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THE EFFECT OF UNCERTAINTIES ON THE EFFECTIVENESS OF MITIGATION AND REMEDIATION MEASURES

Abstract

Since the launch of Spoutnik-I in 1957 the number of space debris in Earth's orbit has steadily increased. Historically, the primary sources of space debris in Earth orbit has been (i) accidental and intentional break-ups which produce long-lived debris and (ii) debris released intentionally during the operation of launch vehicle orbital stages and spacecraft. In the future, fragments generated by collisions are expected to be a significant source of space debris.

For the last decades, many of the work done on the modelling of the long term evolution of the space debris population, aimed to investigate the evolution of the number and spatial distribution of space objects orbiting into a circum-terrestrial orbit, under a certain number of realistic assumptions. Despite the fact that the results and conclusions from these studies are quite robust, they are conditioned to the modeling assumptions.

Long term evolution of the space debris population is conditioned to a great number of uncertain variables, which will lead to a great number of possible futures. To fully analyze the robustness of mitigation and remediation measures, for such an uncertain future, the investigation of the long term evolution of the space debris population and the effectiveness of mitigation and remediation measures for the all of those possible futures will be of paramount importance.

Previous work has been presented on the analysis of the effect of uncertainty sources on the long term evolution of the space debris population. Ongoing work at international level, for example in the frame of Inter Agencies space Debris coordination Committees (IADC), is being done on the identification and characterization of all the main uncertainty sources affecting the long term projection of the space debris population. Such exhaustive analysis aims to identify the minimum set of variables needed to characterize the many futures of the space debris population.

In line with the ongoing analysis devoted to the characterization of the many futures of the space debris population, the work that we present on this paper introduces the analysis of the robustness of mitigations and remediation measures, when some of the main uncertainty sources are considered. Such robustness will be analyzed by the comparative analysis of several study scenarios, implementing different mitigation and remediation options, on which the uncertainty affecting to some exogenous and endogenous variables is considered for the long term projections