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

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A SIMPLIFIED APPROACH TO ANALYZE THE SPACE DEBRIS EVOLUTION IN THE LOW EARTH ORBIT

Abstract

During the past 60 years the number of objects on Earth orbits has increased. So has the risk of collisions, which is likely to be the main driver for space debris generation in the future. This is important for example in densely populated regions like the sun-synchronous orbit at around 800 km altitude. In order to predict the development of the debris environment on future orbits numerical simulations can be used. These simulations are usually based on initial assumptions like the launch rate, the probability distribution of success of post mission disposal measures and the likelihood for catastrophic collisions. The computationally expensive Monte Carlo method is employed for the random sampling of the defined events. Additionally, a propagator needs to process the objects to determine potential collision partners, increasing the demand for computing power even further. In this paper an analytical model is presented, which is based on source and sink mechanisms, like launches, collisions and explosions. In this approach different altitude shells and diameter bins, as well as four different object classes for intact objects and fragments, each on circular and eccentric orbits are considered. By using pre-computed tables, for orbital lifetimes and decay rates, the computational effort and complexity of the model is decreased. The model can be adjusted to reflect different forecasts by altering the decay and collision rates. The paper concludes by showing preliminary results and a discussion of the generic approach, which allows the model to be fitted against more computationally expensive Monte Carlo simulations.