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Author: Mr. Biradar Vasimpatel
Indian Institute of Space Science and Technology (IIST), India, vasimbiradar5@gmail.com

Mr. Deepak Negi
Vikram Sarabhai Space Centre (VSSC), India, dnegipma@yahoo.com
Dr. Ayyappan GOPALA PILLAI
Indian Institute of Space Science and Technology (IIST), India, ayyappang@iist.ac.in

SPACE DEBRIS FRAGMENTATION MODEL

Abstract

Recent advancements in space research technology for the development of a better society is leading to an increase in demand for Space services. Space services like small satellites are always at constant threat of debris collision which may lead to a Kessler syndrome. The studies are being conducted in tracking small debris in Low Earth Orbit, where Nano Satellite is the future game-changing work for space application. The focus is analyzing small to large size different types of debris like Launch vehicle terminal stage as well as satellite and study the type of impact whether collision or explosion of the said objects. The Model created is providing a brief overview about the future collision and also about the number of fragments generated, area to mass ratio of the fragments and then the velocity of the impacted debris are predicted using the fuzzy logic clustering method which are calculated empirically using TLE data of the fragments dataset. Impact analysis of the satellite is studied and the fragments generated are compared with statistical data available. An approximate model is generated to form the debris band and further analysis on the debris collision probability of the upcoming satellite. The results obtained is compared with the numerical method to show the pros of this model. A detailed debris evolution study is also being done, where the debris cloud generated will create a pulsating ellipsoidal, which at a later time evolves over to generate a toroid band. The results are then validated by using the previous ASAT mission. The main novelty of this article discusses the key understanding of reducing the debris with a detailed study about debris generation.