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

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ANALYSIS FOR CHAIN-CRASH RISK OF LEO SATELLITE DUE TO COLLISION BETWEEN IRIDIUM-33 AND COSMOS-2251

Abstract

"The commercial communications satellite, Iridium-33 and a defunct Russian satellite, Cosmos-2251 ran into each other on February 10, 2009 above Northern Siberia, creating a cloud of debris. The impact occurred at 16:56:00 UTC, in an orbital area, at 72.05 latitude, 97.88 east longitude, 788.68km altitude. As a result of theses events, a significant amount of debris including thousands or even tens of thousands of fragments was produced. In this research, the probability of chain-crash between debris generated by collision and the Korean LEO satellite, which has been performing its mission in sun-synchronous orbit with 685 km altitude, was analyzed. The breakup model for catastrophic collision, in which both satellites are totally fragmented, was applied for modeling debris parameters which consist of size, mass, and delta-velocity and so on. And also Monte Carlo simulation was implemented to estimate statistical possibility. Satellite fragmentations generated after collision and Korean LEO satellite were propagated in order to predict the crash possibility. In especial, the orbit of each fragmentation is propagated individually instead of the debris cloud propagation. The SGP4 propagator was used to predict the future orbit. The osculating orbit of the fragments after collision was converted into the mean orbit of Two Line Element (TLE) using Newton-Rhapson iterative procedure. The weekly updated TLE was used for propagation of Korean LEO satellite. The result shows that the evolution of collision fragmentations may increase the additional collision possibility for the Korean LEO satellite.