SPACE DEBRIS SYMPOSIUM (A6)
Poster Session (P)

Author: Dr. Dong-Hyun Cho
KARI, Korea, Republic of

Dr. Hae-Dong Kim
Korea Aerospace Research Institute (KARI), Korea, Republic of
Mr. Sang-Cherl Lee
KARI, Korea, Republic of

ANALYTICAL APPROACH FOR THE SPACE DEBRIS COLLISION AVOIDANCE MANEUVER

Abstract

Since the launch of Sputnik the space environment is steadily worsening owing to increase of the operational satellite but also debris. In this situation, the collision accident between Iridium-33 satellite and Kosmos-2251 satellite promoted awareness of the space debris. For this reason, there are many research and project for the space debris collision risk management system in most countries to protect their operational satellite. To protect their own satellite, this system must be able to calculate the collision probability and design the collision avoidance maneuver. For this collision avoidance maneuver, the operator must consider the decrease of the collision risk, but also the cost for the maneuver. For this reason, the optimization approaches are applied in this problem. There are various optimization algorithms. However, these optimization algorithms require huge computing power and much iteration. In spite of this workload, these approaches provide the exact and cost-beneficial solution. For these reason, it is adopted in most collision avoidance systems. For this situation, in this paper, the analytical approach for the space debris collision avoidance maneuver is introduced to provide the initial values for these optimal approaches. For this analytical approach, the mathematical model is firstly required. The Hill's equation for the relative motion between two satellites which have similar circular orbit is first candidate for this model. However, this model is very simple, so it cannot be described the real motion. Thus the solution is not useful. Therefore, in this paper, the precise orbit propagation model is adopted as the mathematical model of the operational satellite and space debris. And the analytical solution is suggested for the initial value of optimal approaches.