A study on Initial conditions for Satellite Formation Flying using State Transition Matrix

Hyo-Joon Bang, Sang-Young Park and Kyu-Hong Choi
Department of Astronomy and Space Science
Yonsei University.

Traditionally in the two body problem, when we assume the circular orbit, Hill's equation has been used for describing relative motion. However, it is difficult to use Hill's equation in the case of the long period prediction because of the increasement of the errors caused by perturbations. To compensate this errors, we can use extended Hill's equation. An analytic solution considered the eccentricity and perturbations of chief satellite orbit can be used for the relative motion of formation-flying satellites. This strategy use a novel method called the geometric method using State Transition Matrix. The main goal of present study is to determine the initial conditions using the geometric method to maintain the feature of the formation flying accurately. To achieve the goal, we should find the State Transition Matrix for maintenance of the formation by considering the eccentricity and orbit perturbations. Then, we obtain the initial conditions to minimize the formation errors by analyzing the difference of orbital elements between a chief and a deputy satellite. At the last, the results are compared with those from traditional methods using numerical techniques. We analyze and discuss the characteristics of good initial conditions for satellite formation flying.