論 文 の 内 容 の 要 旨

論文題目　Integrated Optimization of Guidance Navigation and Control Strategy for Deep Space Exploration via Stochastic Trajectory Optimization Approach（確率的軌道最適化を用いた深宇宙探査における航法誘導制御方策の統合的最適化）

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In deep space exploration with micro/nano-spacecraft, the relatively high cost of trajectory correction and orbit determination is an important issue. In this study, a method is proposed to optimize the scheduling of the trajectory correction and the orbit determination in an integrated manner to minimize the amount of control required for trajectory correction. The problem is formulated by using the stochastic trajectory optimization technique. The stochastic trajectory optimization problem is converted into a deterministic optimization problem by parameterizing the probability distribution, and the optimization is solved numerically. The coupling effect between the true and estimated values of the state is considered, and both of them are defined together as augmented states. The probability distribution of the augmented state is parameterized, and the propagation of the parameters is formulated. It is shown that the parameters depend on the trajectory correction time and the orbit determination time. The objective function and constraints are evaluated from those parameters, and the trajectory correction time and orbit determination

time are optimized. The errors of uncertainty propagation methods were evaluated in the dynamics of two-body and circular restricted three-body problems. The optimization problem was solved for the Hohmann transfer trajectory in the two-body problem and the nominal trajectory of the micro-deep space probe PROCYON in a more realistic problem. These numerical simulations show the validity of the proposed method.