ASTRODYNAMICS SYMPOSIUM (C1)
Optimization (1)

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DIRECT TRAJETORY OPTIMIZATION OF A SOFT LUNAR LANDING CONSIDERING A LANDING SITE

Abstract

The Lunar landing trajectory consists of three phases: a de-orbit phase, a coast phase, and a powered descent phase. In this paper, the direct trajectory optimization of a soft lunar landing and the desired landing site are simultaneously considered during the powered descent phase. The desired landing site is not usually considered while conducting trajectory optimization of the soft lunar landing. However, after the de-orbit burning, a situation could be occurred to change the trajectory because of a hazard avoidance, navigation uncertainty, etc. Also, the analysis of the trajectory and control histories considering the landing site could be applied to other analyses, such as cross-range and divert capability. Thus, the trajectory optimization considering the landing site within a range of the thrust available is one of the most important problems for the soft lunar landing. In general, a typical primary trajectory design performance index is to minimize the fuel consumption, so the performance index is defined to minimize the lander's fuel consumption. The de-orbit and the coast phase are assumed as the Hohmann transfer, which allows a transfer between the parking orbit and the powered descent phase with the minimum fuel consumption. To convert the optimal control problem into the parameter optimization problem, a Legendre Pseudospectral Method, which has been widely used in recent years, is used, and C code for Feasible Sequential Quadratic Programming (CFSQP) is used as the Nonlinear Programming (NLP) solver.