

SPACE EXPLORATION SYMPOSIUM (A3)
Moon Exploration – Part 3 (2C)

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ANALYSIS OF THE SAFETY OF SOFT-LANDING IN TOUCH DOWN PROCESS OF CHANG'E-3
INFLUENCED BY LUNAR TOPOGRAPHY

Abstract

The safety of lunar soft-landing in touch down process is mainly impacted by three aspects: the characteristics of buffering gear of lunar lander, the dynamic parameters (such as mass, velocity and attitude) in touch down process and the lunar topography. Nowadays, the impacts of the buffering gear and the dynamic parameters on soft-landing safety have been well studied, but the study on the impacts of lunar topography is lacking. This is mainly caused by two reasons: Firstly, it is hard to get the real lunar topographic data in the scale of landing probe; secondly, the candidate landing area is usually large and the terrain variance is great, so the calculating time of dynamic simulation in the entire area is unacceptable. The common approach is simplifying the lunar terrain into a slope of single gradient, and applying the Monte Carlo simulation algorithm to optimize the design by changing the parameters of buffering gear and dynamics. The method above does not consider the uncertainty of complicated lunar terrain and cannot quantitatively evaluate the probability of landing safety in given area. This paper mainly studies the landing safety influenced by the lunar topography. Firstly, according to digital topographic model based on the real lunar exploration data in large scale and statistical topographic model in small scale, the lunar topography model with equivalent slope is obtained; Secondly, in order to improve the simulation efficiency, the Monte Carlo simulation algorithm is modified by the latin hypercube sampling algorithm. This paper discusses the application of this method on the calculation of soft-landing probability of the candidate landing area of Chang'E-3.