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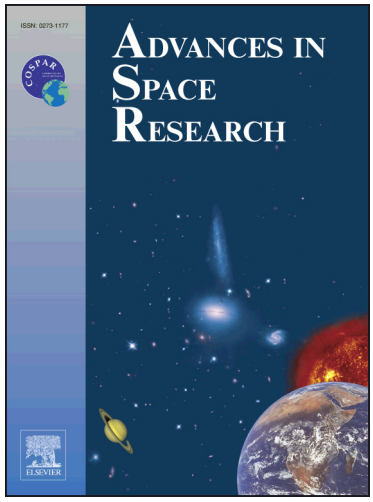

Hopping Trajectory Optimization for Surface Exploration on Small Bodies

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ACCEPTED MANUSCRIPT

Hopping Trajectory Optimization for Surface Exploration on Small Bodies

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Abstract

Surface exploration is an important way to improve the understanding of small bodies. Considering the irregular and weak gravity field near a small body, the movement of the surface explorer is generally achieved by hopping. In this paper, a guidance algorithm method based on convex optimization approach for pinpoint hopping movement on a small body is developed in order to improve the stability and accuracy of surface exploration. We formulate a fuel-optimal control problem for the single pinpoint hopping and convert it into a second-order cone programming (SOCP) problem which can be solved effectively by primal-dual-interior points method. A multi-hopping scenario is also proposed for the long-distance transfer. To certificate the performance of the proposed guidance algorithm, a full set of simulations are conducted and the effectiveness are analyzed.

Keywords: small body; gravity field; pinpoint hopping; convex optimization; long-distance transfer

1. Introduction

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