

IAF SPACE EXPLORATION SYMPOSIUM (A3)  
Small Bodies Missions and Technologies (Part 2) (4B)

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DESIGN OF A STABLE ASTEROID LANDER FOR A RELIABLE SAMPLE RETRIEVAL MISSION  
OF 99942-APOPHIS.**Abstract**

Asteroid exploration is one way to investigate asteroids by performing in-situ scientific activities and sample returns for investigating fundamental information on the formation and evolution of the solar system. Asteroid landers can provide valuable information by extracting samples, analyzing the composition, and investigating the mineralogy of an asteroid. Amidst immense technological furtherance over asteroid exploration, recent missions have revealed that a wide array of bare rocks can be found on rubble-pile asteroids with landers encountering great rebound uncertainties is a hindrance to the mission. Developing dynamical evolution models for landers that interact with rough surfaces can be challenging. The paper discusses the design of a Lander system for in-situ exploration, including sample retrieval and transfer mechanism from 99942 Apophis Asteroid. The mission focuses on the stability of a lander on the rough surface of rubble-pile asteroids. The presented model gives a stable landing scenario by combinative study of asteroid's and lander's dynamics. The study includes discussion on motion and dissipation of energy, Polyhedron methods are utilized for gravity model, Bekker-terramechanics theory is referred for studying the forces over the regolith. The design intends to provide theoretical and computational scrutiny over designing softwares such as Autodesk Fusion 360, OpenVSP with iterative computational aided simulational operations on ANSYS.

Keywords: Asteroid; Lander; Sample Retrieval; Mission Design; 99942-Apophis