Exploration of Near Earth Asteroids (4)
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RESEARCH ON MICRO NEAR EARTH ASTEROID EXPLORATION MISSION DESIGN AND KEY TECHNOLOGIES

Abstract

Near Earth Asteroid exploration motivates the breakthrough in the fundamental science and engineering problems such as origin of solar system, evolution of life, and asteroid impact defense. Meanwhile, it is a gateway to verify the new technologies in deep space exploration. However, up to now, the asteroid exploration missions are usually of long development cycle, large size and high cost, which make the design and implementation of an asteroid exploration mission solely by one country very difficult and even impossible. In order to solve the problems of traditional asteroid exploration missions, an integration design concept of satellite platform is introduced, which lowers the platform weight, reduces the volume, and makes the system more powerful and flexible. Aiming to increasing the function density and fulfilling efficient function integration, novel integration methods such as electric-heat integration should be introduced. The multi-target and multi-objective capability of the mission can also be obtained. Meanwhile, the involved key technologies for asteroid exploration mission design including object selection and orbit optimization, deep space platform design, navigation and autonomous planning, and deep space communication, control, and teleoperation are summarized. The research progress of key technologies is reviewed and the future develop trend is also introduced. Furthermore, based on the certain mission objective, multiple mission constraints, and performance requirement, a complete Near Earth Asteroid exploration mission model based on micro satellite platform is proposed. The specific orbit optimization, navigation, guidance, and control, and autonomous mission planning technologies are discussed as well. Actually, this mission model is also suitable for other small body and deep space exploration missions. Finally, the international cooperation strategies for the technology research and results sharing are discussed. Based on the potential cooperation between different countries and universities and industrial organization, not only the research capability can be improved, but also international cooperative researches on deep space exploration can be provoked.