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AN ADAPTIVE SPOKED WHEELED ASTEROID SURFACE ROVER

Abstract

Asteroids are known as the "living fossils" in the solar system, and asteroid exploration is of great significance for revealing the origin of the solar system, planetary evolution, the origin of life, the development of space resources, and asteroid defense. In this paper, an adaptive spoked wheeled asteroid surface rover is designed to realize the automatic roving of asteroids and the autonomous obstacle avoidance of ground obstacles.

Due to the microgravity of the asteroid, in order to achieve the smooth movement of the rover, the spoked wheel is used, which can reduce the rover's travel speed to maintain a stable forward movement and improve the obstacle avoidance efficiency. For objects of general height, the initial length of the three-legged spoked wheel is used to roll to achieve obstacle crossing; For obstacles whose height is higher than the height of the initial spoke wheel, the corresponding algorithm is used to control the adaptive length of the spoke wheel to achieve the length required to cross the obstacle. And drive continuously through the quasi-wheel over its entire circumference, thus the inclined edge quasi-wheel stands firm on the obstacle higher than its radius.

The overall power drive structure of the rover adopts the mechanical structure design of the gear train, and the torque of the drive motor is transmitted to the width wheel block through a series of gear meshing transmissions to make it forward and reverse. The length of the spokes of the wheel set is driven by the lead screw nut, and the spokes are telescopic through the rotary motion of the lead screw nut. The overall control idea is to first judge whether there is an obstacle and the size of the obstacle through visual recognition, and then send the identified data to the main control chip, which carries out path planning, spoke length and body size calculation through visual recognition information and its own attitude information fed back by gyroscope. Finally, the MCU sends control instructions to drive the robot to move to achieve autonomous obstacle avoidance and obstacle crossing. In the future, we will continue to optimize and improve the structure and algorithm of the inspector, and finally achieve all functions such as automatic roving of asteroids and autonomous obstacle crossing.