Abstract

The Navigation, Control and Vision System of Lunar Rover

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The lunar rover travels over the rough terrain on the unfamiliar moon surface. The most important task is to "see" the environment and select the optimal path from current point to goal point, this is defined as the vision system. Man and most of the animals have eyes, which can make them sense the world and perceive distance. But the lunar rover isn't intelligent to change position and identify things at the back of the obstacle, so the third "eye" is set up to get more detail information.

The lunar rover we designed is a multiwheel (i.e. 6 wheels), independent drive vehicle. The turning is executed by applying different drive velocities on different wheels. On the uneven lunar surface, the soil each wheel contacts has different physico-mechanical properties. In this situation the same drive command applying to each wheel can't make the vehicle move in straight line. So a control-driven system must be given based on the analysis of multibody dynamics for the lunar rover.

The tasks of navigation system can be stated as follows: to control the movement of the lunar rover according to the planned path and correct the offset distance from it, to study the environment of the lunar surface in time and adjust the planning path rationally, to ensure the safety of the lunar rover without upset, to record the actual path and useful data of each locomotion. The chief elements of navigation system are the attitude sensors and the position sensor that can determine the coordinate of lunar rover on the moon. The above elements must satisfy the following requirements: to tolerate the inclement environment on the moon; no need of periodical parameter correction, low cost and easy to carry out. A scheme of this kind of navigation system is proposed in this paper that can meet the challenges.

Key words: Lunar rover, Navigation System

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月球漫游车的导航、控制及视觉系统

摘 要

月球车是在陌生不平坦的月球土地上运动，首要的任务是能"看"清所在的环境，并挑选出从立足点到达目的地的路径，这就是月球漫游车的视觉。人和绝大多数动物都有两只眼睛，其作用是可以感知主体世界，还能够获得周围物体的距离感。然而漫游车没有人和动物那么灵活，不能变换位置看清障碍物背后的东西，因此，可以赋予它第三只眼睛，以便了解更多的详情。

我们方案中的月球漫游车是多轮（如六轮）、独立驱动的，其转弯靠差动完成，然而月面都是不平坦的，各轮所遇土壤的机械物理性能又不一致，给漫游车各轮同样的驱动指令，它也不一定能够直线运行。这就要求在分析漫游车多体动力学的基础上，构成一控制驱动系统。

导航系统的任务是：指挥月球漫游车；按照规划好的路径运动，并随时对偏离路径的运动予以纠正；及时了解月面环境对规划的路径做更合理的修正；保障漫游车的安全，不使倾斜；记录每次运动的实际路径和各类运动数据。这个系统的中组成部分是：姿态敏感和月球漫游车在月面的坐标位置和确定装置。对这两类装置的要求是：能耐受月球严酷的环境，最好不需进行定期的参数校正，价格便宜，易于实现。本文建议了这样一种方案。

关键词：视觉系统， 导航系统