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DESIGN AND DEVELOPMENTAL CHALLENGES OF LUNAR ROVER FOR MOON EXPLORATION

Abstract

For aiming an unmanned robotic mission to moon for the exploration of lunar atmosphere and mineralogy, it is essential to have an industrial and instrumental rover. Typical lunar surface are amenable to travel by wheeled nailed vehicles on steep unconsolidated slopes and strewn rock fields. The rover must design to tolerate the harsh lunar day and night thermal environment. The primary design limiting environments are extreme thermal, radiations, dust environments, vacuum and terrainability are of secondary importance. The rover must overcome the obstacles of minimum height 150 mm and craters of 100 mm width. It needs to climb up slopes of minimum 29 degree and down 30 degree. Several robust elements of the locomotion systems are identified and analyzed to ensure the overall functionality of the locomotion system and appropriate interfacing with other rover systems. The primary motions associated with the behavior of the rover are longitudinal, lateral and yaw motions. Rover is the integration of locomotion, navigation, communication system and science equipment. The Rocker Bogie is of six-wheel all-terrain vehicle, consisting of center body with each side attached to different chassis, known as a rocker. The back of each rocker has one wheel, while the front is connected to another chassis (the bogie) with two wheels each via an unactuated pitch joint. Six independent wheels mounted on an articulated passive suspension system for gearing the vehicle. Such elements include gross wheel sizing, actuator sizing and geometric clearances. With these elements sized appropriately, a first cut of the locomotion design and mass budget can be completed. The design of these elements is to be carried out in such a way that, all limbs has to perform exceptional bending and torsional capability with minimum volume and mass fraction. The center of gravity should be as low as possible for better stability of the vehicle and the rover should be visually appealing. This technical note outlines the preliminary design and configuration of six wheeled rover, material requirements for sustaining in the adverse environment, lunar environmental issues and behavioral study of moon environment. Five degrees of freedom manipulator is mounted on the front runner of the rover to monitor the day–to-day activities like solar cell cleaning, sample testing and passing command during imbalance stage while traversing on high terrain surface etc. The detailed kinematics of the five degree of freedom manipulator is generated by using Denavit-Hartenberg (DH) algorithm and presented.