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LUNAR ROVERS SUSPENSION SYSTEM DESIGN OVERVIEW

Abstract

Lunar rovers are expected to play a significant role in future space missions where they should travel long distances over challenging terrains. By the capacity limitation of a lander, the rover should have several constraints such as volume, mass, amount of energy, etc. However, in order to navigate, traverse a hostile terrain, and reach accurate science stations, the rover must have a high degree of mobility and low-power-consumption technology. The suspension system is the key issue of the degree of mobility. The mass, mobility performance, stability of the rover, and the power consumption are the factors that drive the design of the suspension. A four-wheeled rover using skid steering can achieve the same goals as the six or eight wheeled mobility systems while having high reliability and mechanical simplicity. Based on existing rover drive architectures and suspension systems, there are several popular approaches that are commonly used. For instance, the six-wheel differencing suspension has six steerable wheels, allowing the rover to turn in place and avoid skid steering. Additionally, the complicated linkage suspension system gives the rover the ability to traverse obstacles much greater than the diameter of its wheels. Other rovers also use a differencing suspension, but only with four wheels and two rocker arms. This configuration can be done with four steerable wheels, or alternatively use a skid steering approach. This method boasts some benefits of the rocker-bogie system by providing a level of ground compliance; however, its main advantage is in its comparatively simple design, as it requires fewer wheels, axles, linkages, and motors. Traction of the wheels can be accomplished through different ways such as using springs and dampers or free pivoting. Springs and dampers are frequently used for high-speed vehicles to absorb shock loads from driving over rough terrain. Besides, using springs and dampers will complicate the system along with increasing the mass. The aim of this paper is to evaluate the design and performance of a four-wheeled lunar rover's suspension system employing a passive differential gear rather than a rocker-type suspension system. Tests and field experiments clarify the stability and traversability capabilities of the four-wheeled rover through passive differential gear on rough terrains.