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PERFORMANCE EVALUATION AND APPLICATIONS OF FLEXIBLE LEGGED LANDING SYSTEM

Abstract

Flexible legged landing systems have the potential to expand the scope of exploration of rocky planets and natural satellites. The limitations of rigid legged landers greatly restrict robotic exploration missions to smooth, flat plains. However, several promising areas that are believed to hold valuable information about the origin and geological evolution of the celestial body are inaccessible to rigid landers and hence inadequately investigated. But with the versatility and enhanced stability offered by flexible landers, scientific investigation of rough terrains and rugged topographies may soon become possible. To evaluate the performance of the flexible landing system, its operational limits were determined. Typical topographic features of the regions of scientific interest on Mars and Earth's Moon were modeled, which include the heavily cratered southern hemisphere of Mars and the intriguing lunar south pole. The landing operation was simulated on these terrain features, and the system's stability and shock absorption capability were observed in order to assess its functionality and efficiency. Possible failure modes of the flexible system were also identified. Based on the overall performance of the system at various landing site conditions, some possible future applications of flexible landers were suggested. The flexible system was found to be capable of landing stably on significant slopes and undulations, thus resulting in fewer landing site restrictions. Therefore, such systems can be used for imaging, collecting soil samples, and deploying small rovers at areas of interest hitherto unexplored. Thus, flexible legged landers may be worthy of consideration for several types of missions, such as on-site analysis of rock, soil or gas samples and unmanned sample return missions.

Keywords: Flexible landing system, rough terrain, performance evaluation, operational limits, possible applications.