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DESIGN SIMULATION AND LABORATORY TESTING OF 3D MODULAR ROBOTIC ARM FOR LUNAR MISSION

Abstract

Robotic arms have recently become the center of attention for research and development, and the lunar rover concept is one of the most innovative ideas that have emerged from it. Robotic arms are heavily featured in sample collection, lunar surface manipulation, and other interactions during lunar exploration. However, like traditional robotic arms, they often have stiff structures and limited functionality, which reduces the efficiency to do various tasks on the moon surface. This lack of flexibility and versatility in the arm reduces operational task efficiency in the moon. Therefore, there is a need for a modular robotic arm that features an interchangeable claw system and an extendable arm mechanism to enhance its adaptability on the moon. Through simulation-based research, development, and partial real-life testing in the lab, we can test its functionality. In this paper, we will present a robotic arm tailored for lunar exploration, focusing on two embodiments: the interchangeable claw and the extendable arm. These characteristics are meant to improve the arm's ability to adapt and execute a lot of activities on the moon. This paper represents the design methodology, kinematic analysis, and simulation results for the Lunar Robotic Arm to improve the task efficiency and operational effictiveness in the lunar surface.