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HUMANOIDS IN SPACE

Abstract

As space exploration advances, the contribution of robotics has grown to a greater extent with time enabling them to perform tasks, on their own, in space and on alien planets as well as to support human missions in space. Humanoid robots, designed to mimic human form and function, offer significant advantages in interacting with human-designed infrastructure, operating tools, and assisting astronauts in complex tasks. The skills of adaptation and agility that humanoid robots have are such that in future deep space missions, lunar bases, and Martian colonization initiatives they could very well be chosen for the teams. The study is dedicated to the question of the possibility, the problems concerning, and the scenarios for application of humanoid robots in space exploration. The research was aimed to find out if they are useful in performing extravehicular activities (EVAs), maintain habitat, and do some scientific research and at the same time, if possible, identify any shortcomings with regard to power use, mobility, and decision making by AI. Case studies of current humanoid robotic technologies, like NASA's Robonaut, ESA's Rollin' Justin, and JAXA's experiments, is presented. Key performance metrics such as locomotion efficiency, dexterity, adaptability to microgravity are studied as well as other Simulations and experimental data from analogs sites are reviewed to understand the operational feasibility of humanoid robots in space. The conclusion of the study is that a humanoid robot can greatly reduce the work of astronauts by carrying out tasks unsupervised, including high-risk jobs. Autonomy driven by artificial intelligence combined with remote operation has proved to be an effective method of job performance. On the other hand, the challenges of power efficiency, stress and fatigue on the robot's material, real-time adaptability, and radiation resistance, limit the application of the robots. The development of better artificial intelligence algorithms, the introduction of more efficient battery technologies, and the use of better material composites might enable the robots to stay in the space for more extended periods.