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A DESIGN OF A RECONFIGURABLE LUNAR PRODUCTION CHAIN USING IN-SITU RESOURCES AND OPTIMIZED WITH EVOLUTIONARY ALGORITHMS

Abstract

Following the multiplication of future projects to explore our solar system, new solutions must be found to increase the number of missions. This limitation first comes from payloads restrictions. Launching from the Earth is very constraining due to the gravity forces, which reduces the payload mass sent to space. The only solution on Earth would be to improve the current launchers, which at some point will not be enough anymore, because of the limits of propulsion systems. Many studies suggested to use the Moon as a secondary base, and some studies go even further proposing to use the Moon to settle habitats for colonies. In both cases, using in-situ resources should be mandatory. Whether to supply resources to Lunar colonies or to build spacecrafts on the Moon, production means would have to be deployed. Thus, a design of a reconfigurable Lunar production chain using in-situ resources and optimized with evolutionary algorithms is proposed. This paper describes a comparison between Earth and Lunar production means, and the system performances using agent-based models. From the available resources to all the needed and manufacturable products on the Moon, this study covers the possibilities, performances and limitations of such a facility. The aspects of reconfigurable manufacturing systems are also studied and applied to design a system as versatile and thrifty as possible. Finally, the paper describes a simulation of the system implemented to demonstrate the feasibility of the design.