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ENHANCING ANTENNA CONSTRUCTION WITH AMOCSIS ON-ORBIT MANUFACTURING

Abstract

The Automated Manufacturing of Composite Structures in Space (AMoCSiS) approach, developed by the German Aerospace Center (DLR), presents an innovative method for constructing large and structurally efficient frameworks in space. Unlike conventional deployable or rigidly manufactured structures, AMoCSiS integrates carbon fiber-reinforced plastic (CFRP) tubes with additively manufactured nodes, allowing for the in-situ fabrication of truss structures. This method not only enhances material efficiency but also enables scalable and adaptable structures, reducing the limitations imposed by launch vehicle constraints.

Antennas are a critical component of many space missions, supporting applications such as satellite communication, Earth observation, and deep-space exploration. The demand for large, lightweight, and structurally robust antennas makes them an ideal candidate for AMoCSiS. By leveraging in-orbit manufacturing, AMoCSiS can overcome traditional design constraints, enabling the creation of expansive antenna surfaces that would be challenging to deploy using conventional means.

This paper focuses on the evaluation of an antenna structure constructed using AMoCSiS. This chosen design is analyzed in detail, considering factors such as material efficiency, structural integrity and truss topology. This antenna will then be compared to an antenna deployed by conventional means with regards to relevant factors.

Another aspect of this analysis lies in discussing the implications AMoCSiS has for alternative antenna configurations such as parabolic antennas. A key aspect of the analysis lies in assessing the adaptability of the AMoCSiS approach. Unlike rigid or deployable antennas, which are preassembled and constrained by launch conditions, AMoCSiS allows for in-orbit modifications and expansions. This capability introduces new possibilities for mission planning, enabling more flexible and mission-specific adaptations post-launch.

This study highlights the transformative potential of AMoCSiS in the field of spaceborne constructions and for future large-scale antenna systems. Further research will focus on refining the manufacturing process and integrating performance enhancements to establish AMoCSiS as a viable alternative to conventional space structure fabrication techniques.