Paper ID: 59866
student

IAF SPACE SYSTEMS SYMPOSIUM (D1)
Cooperative and Robotic Space Systems (6)

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IN SITU 3D PRINTING FOR MODULAR ROBOT MISSION ADAPTATION

Abstract

The modular robotic architecture or bucket-of-bits approach allows the in-situ assembly of multiple robot configurations from a core set of modules. The imminent availability of in-situ resource utilisation (ISRU) and 3D printing on celestial bodies combined with this bucket-of-bits approach allows robots to be designed and assembled as needed. The proposed work leverages 3D printing to create bespoke robot bodies for different mission requirements.

The modules proposed are the NeWheels a self-contained 2 DOF mobility unit. Each NeWheel is capable of independent operation, equipped with sensors, computation, communication and battery. Further to this, the NeWheels are capable of collaborative work in a constrained swarm of varying numbers defined by the task.

On arrival, modules implemented in predefined ways achieve pre-planned objectives and missions. As the mission progresses, parts designed before liftoff printed on-site enables the completion of secondary tasks. As the mission evolves with an updated better understanding of the challenges, new bodies can be designed and printed. This adaptation allows the completion of tasks unknown at liftoff. Over time as the modules, age and begin to fail, bespoke printed bodies enable better use of the remaining modules.

Modular robots, in conjunction with ISRU and 3D printing capabilities, offer the ability for robots to evolve to meet mission requirements as they develop.