Technische Universität Braunschweig

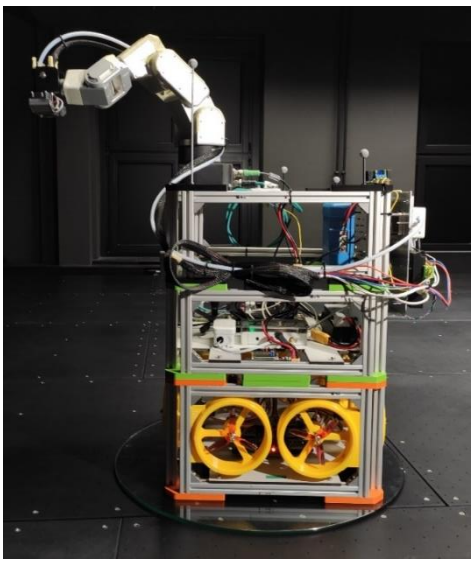
Institut für Raumfahrtsysteme

Study Thesis or Master Thesis

(German or English)

Development of Methods for In-Space Additive Manufacturing Using Two Satellites

The junior research group „In-Space Manufacturing" conducts research at the Institute of space systems in the field of large-scale additive manufacturing of functional structures in space utilizing CubeSats. For this, a satellite mockup is equipped with a commercial six degrees of freedom robotic arm and a fused filament fabrication (FFF) end effector. The experimental lab ELISSA is a 5 x 7 m large active air-bearing table that allows the test of control algorithms of satellite mockups. Combining the movement of the free-floating satellite mockup and the robotic arm, it is possible to print large truss structures onto a stationary substrate.



The scope of this thesis aims at the development of methods that elevate the current printing approach from a stationary to a moving substrate in form of a second satellite. This includes the development of control algorithms to counteract external disturbances using the robotic arm as well as techniques to dock the two free-floating satellites, e.g. using Gecko materials. The goal is the development of methods that allow the accurate and repeatable additive manufacture of truss structures.

The following tasks have to be performed:

1. Getting acquainted with the ELISSA system setup
2. Assembly of a second satellite mockup based on an existing design
3. Development of control algorithms for coordinated movements between two satellites with and without docking
4. Experimental validation of the developed algorithms with the manufacture of 3D-printed sample structures

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