

## IAF MATERIALS AND STRUCTURES SYMPOSIUM (C2)

Space Structures III Design, Development and Verification (Orbital infrastructure for in orbit service & manufacturing, Robotic and Mechatronic systems, including their Mechanical/Thermal/ Fluidic Systems)  
(3)

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## 3D-PRINTING MECHATRONICS COMPONENTS FOR RECONFIGURABLE ROBOTICS

**Abstract**

Modularized reconfigurable robotics, using 3D-printed mechatronics components, allows for in-space manufacturing with the potential to transform spacecraft design. This paper focuses on 3D-printing a complete mechatronic system including DC motor, sensors, and electronic control circuitry to act as an individual module for reconfigurable robotics. These modules can be reconfigured to allow for more complex robotic systems with varying degrees of freedom. This is advantageous in space environments where the individual modules can be reused to provide a different functionality which reduces payload requirements. This can be expanded upon further by using lunar materials to 3D-print these modules in space. The paper models the various mechatronics components and initially prints them using copper due to its electrical characteristics. Several topologies were evaluated for the DC motor system to determine the most efficient structure. The electrical control circuitry mainly comprises of a simple P-controller and minimizes the need for external through-hole components. A simple rotary potentiometer was used as a sensor to close the feedback loop of the control system. The individual module was tested and modified so multiple modules can be connected to create more complex robotic systems. This paper discusses some of the complex systems that the individual modules were able to create. The work described in this paper can also be expanded upon for self-replicating machines in a robotic factory.