IAF SPACE SYSTEMS SYMPOSIUM (D1)
Innovative and Visionary Space Systems (1)

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TOOLBOX DESIGN TO DEMONSTRATE APPLICATION-SPECIFIC CONFIGURABLE SPACE ROBOTS USING MODULAR COMPONENTS

Abstract

Both in-orbit operations and planetary exploration have one thing in common: They can be accomplished with robotic systems. Instead of building separate highly specialized systems, the idea is to elaborate specialized and standardized modules that can be (re-)combined to setup a robot for specific tasks; if necessary, this robot can also be reconfigured during runtime to adapt to different objectives. Such a modular building block system is being developed In the MODKOM (Modular Components as Building Blocks for Application-specific Configurable Space Robots) project, which unifies both, specially developed components according to a standardized building block systematic as well as industrial third-party COTS components.

Besides developing mechatronic and software modules, designed for various applications, a software toolkit is implemented to support non-expert users composing those modular functional units to robotic

systems. By the application of AI-methods, both the development of robot behaviors during creation as well as autonomous reactions to unforeseen events during the mission will be supported. The building block systematic distinguishes between two different layers of modules: modules for system configuration (offline) and modules for system reconfiguration (online). For interconnecting the modules of the toolkit, a distinction is made between two primary types of interfaces. First, a so-called workshop-interface is defined, allowing to enable the interconnection of different modules for configuring and assembling the system. Second, a standard interconnect, which ensure mechanical connection as well as power and data transfer, is used for system reconfiguration.

The performance of this technology developed, will be demonstrated by the realization of a complex composite system. Not only the functionality of the selected modules shall be demonstrated, but also their smooth interaction including various modules of the toolkit as well as third-party systems. The planned performance demonstration is intended to show that certain use cases can be covered by the toolkit. Therefore, a manipulator will be integrated based on standardized modules of the toolkit and be equipped with standard interconnects, to allow system reconfiguration. The manipulator will interact with a stationary modular platform as well as a mobile roving platform. It will be used to reconfigure the included systems with additional function blocks as well as the implementation of new systems, based on modular payload items from the toolkit.

By defining modules and standards, the results from MODKOM will help in the future, to provide flexibly configurable solutions that can be adapted to new or changing requirements with minimal effort.