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A MODULAR TILE FOR MODULAR NANOSATELLITES

Abstract

The AraMiS architecture being developed at Politecnico di Torino is an enhanced capability bus alternative to CubeSats for more demanding missions. Although keeping the low-cost and COTS approach of CubeSats, it extends the modularity concept as it also targets different satellite shapes and sizes. The AraMiS architecture is scalable since it's based on smart *tiles* (or *panel bodies*) which can be connected together at different angles to fit specific missions requirements (90° for cubic structures, 180° for flat panels, 120° for hexagonal tubes, etc.), making it an extremely modular system.

But modularity moves beyond the mechanical structure: the AraMiS tiles have, at the same time, thermo-mechanical, harness, and signal processing functionalities. Each tile incorporates solar panels on the external side and basic power routing, data routing and processing capabilities on the internal side. Multiple tiles interface through a proprietary self-configuring, dual-redundant, distributed power and data distribution bus.

Further modularizing the system, every tile can also host a variable number of small sensors, actuators or payloads (up to 16 for each tile), connected using a plug-and-play approach. Every sub-system is housed in small daughter board and is supplied, by the main tile, with power and data distribution functions, power and data harness, mechanical support, and is attached and interconnected with space-grade spring-loaded connectors. Connections are electrically and mechanically modular, so they can handle from simple systems with a single analog channel up to larger systems with 8 analog channels, 16 digital I/Os and CPUs with standard serial communication. Each sensor, including analog ones, hosts a serial memory for storing its own calibration and configuration data which is read automatically by the CPU to provide calibrated housekeeping.

Being each tile a system made of pluggable sub-systems, they can be tailored to mission-specific requirements without re-design needs.

The tile software is also modular and allows a quick adaptation to the specific subsystem. The basic software for the CPU is properly hardened (through both hardware and software means) to guarantee a high level of radiation tolerance at a very low cost.

The AraMiS tile comes in the end as a fully functioning system scalable to a wide range of small satellite structures. But it still manages to provide the highest possible degree of adaptability, both from the hardware and software points of view, to properly fit any mission's requirements.