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DEVELOPMENT (D3)

## Space Technology and System Management Practices and Tools (3)

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## CONCURRENT MODEL-BASED APPROACH FOR CUBESAT MISSION DESIGN

**Abstract**

The SPACE4YOU (SPace Activities and CompEtences for industrY bOost in bUusiness) project aims at enhancing existing skills, and realities, but also at creating novel ideas and stimulating technological transfer between the Academia, large system integrators, and small-medium enterprises. This project promotes collaboration and open knowledge sharing to accelerate the development of forthcoming space technologies and applications, providing a common environment and shared tools and methods for designing, simulating, developing, and testing new space systems. One of the research contributions resulted in a Concurrent Model-Based approach based on digital tools for designing and developing missions and services of micro and nanosatellites.

This paper presents an innovative approach that combines the concurrent engineering paradigm with standardized calculation sheets linked to a CubeSat Technologies Database, facilitating the preliminary design process and enabling component selection based on applicable specifications and performance data of available technology. This combined concurrent design approach offers faster, more flexible, and transparent design management compared to traditional methods, simplifying the system design flow and the decision-making process in the early phases of a space mission project. This approach has been implemented and tested during several CubeSats projects, among them an in-orbit servicing cis-lunar mission and a CubeSat constellation around Bennu asteroid, emphasizing collaborative learning through concurrent design sessions, and encouraging both communication and resource sharing across different technical fields. The research team worked simultaneously tackling the various aspects of space mission design, from conceptual design up to subsystem sizing, supported by both standardized calculation sheets and CubeSat Technologies Database. The effectiveness of the new Concurrent Model-Based approach in achieving accurate and efficient results has been determined by assessing the design outcomes against appropriate figures of merit.

Therefore, this work contributes to the development of best practices and tools in space technology and system management, exploiting the results and outcomes of an innovative approach to small satellite design for space exploration, and promoting lessons learned within the space engineering community. This work is part of NODES - Nord-Ovest Digitale E Sostenibile project, financed by the MUR - Ministero dell'Università e della Ricerca (PNRR, D.D. n.1054 of 23/06/2022), involving the North-Western Italian regions of Piemonte, Valle d'Aosta and the bordering provinces of Lombardia. NODES aims to support

and create scientific and industrial research chains in different areas, including Industry 4.0 For Sustainable Mobility and Aerospace coordinated by the Politecnico di Torino.