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AUTOMATING DETAILED-DESIGN-LEVEL SATELLITE ADCS PERFORMANCE SIMULATION
AND ANALYSIS FOR CONCEPTUAL DESIGN STAGE DECISIONS**Abstract**

High fidelity satellite ADCS simulation models generally require data inputs from various domains of expertise such as mechanical and electrical design, payload and orbit parameters, supply chain, other component performance data etc. Earlier, these inputs were typically provided in informal textual formats coming from various sources, which required their translation into more meaningful configurations appropriate for the simulation tool and involved manual intervention by ADCS experts. This not only increased preparation time, but also made the process prone to human error. Thus, with the expansion of limited-schedule, low-budget and commercial NewSpace spaceflight missions, model-based tools have proved to provide a promising representation of cutting-edge technology. These tools capture relevant engineering data of the entire satellite mission in a central, consistent and formal way. Domain-specific analyses access this central design data to compute results that are then fed back into the data model to enrich the satellite mission model.

The presented work introduces simulation fidelity classically only available during the detailed design phase already at the conceptual design stage of the mission life cycle. This enables engineers to take design decisions based on more precise analysis results and allows thus for a more efficient technical design. This paper defines, implements and validates an automated process in which a heritage satellite simulator (SATSIM) performs accurate ADCS (among others) simulation in all relevant mission scenarios, where all the inputs are prepared and structured within a standard model-based satellite design and modeling tool called IDM-CIC (developed by CNES). The scope of this paper also includes definition of various use-cases and constraints in terms of mission types, satellite design requirements and types of ADCS performance simulations. Furthermore, validation of the implemented solution and comparative analysis of test cases simulation results are also covered.