

IAF SPACE SYSTEMS SYMPOSIUM (D1)  
Space Systems Engineering - Methods, Processes and Tools (1) (4A)

Author: Mr. Jan-Peter Ceglarek  
TU Darmstadt, Germany, jan-peter.ceglarek@posteo.de

Dr. Redouane Boumghar  
Germany, red@parametry.ai

AI4CE - LATEST DEVELOPMENTS ON THE AI-BASED SYSTEM GENERATION PLATFORM

**Abstract**

A growing market of space components magnified the design space of every spacecraft design. To cope with the growing market, while increasing the design efficiency, the need for AI-supported system design became apparent. The AI for Concurrent Engineering (AI4CE) research project, conducted at the Technical University Darmstadt together with Parametry.ai, investigates the feasibility of AI-based system generation to support CE teams in their design studies. Following a mainly bottom-up approach, no historical mission data is needed for the system generation process. Instead, the AI agent is capable of providing valuable design knowledge just by the use of system requirements and textbook established calculations, like they are used by the domain experts during the CE studies together with a database of components and engineer feedback.

Main focus of AI4CE is the development of a platform to design, train, test and validate different system generation methods. To reduce the overall system complexity for the system generation, the CubeSat platform was chosen, to validate the overall feasibility of this approach. The platform includes a dedicated CubeSat system architecture designer, an AI builder to create the desired AI agent and a validation tool to benchmark the system generation. Using the system architecture designer, the concurrent engineering team can introduce the desired system components and characteristics to the system generator. With the help of the AI builder tool, the required algorithm can be selected and customised to fit specialised need of the spacecraft design or test case. Lastly, to validate the outcome of the system generation regarding the overall model quality, the benchmarking tool can be used to compare the selected AI method across different generation methods, like combinatorics, static optimisation algorithm or AI methods like (Deep) Reinforcement Learning or generative models.

This paper will focus on the current status of project including the improvements to both the general research methodology and technical advancements.