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

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DESIGN OF SPACE MISSIONS THROUGH THE EFFECTIVE COOPERATION OF SYSTEMS ENGINEERING TOOLS

Abstract

Space missions and systems complexity have strongly increased in the last years highlighting the importance of dening tools improving the design, verication and validation process: eectiveness and costs reduction without loss of condence in the nal product are the objectives that have to be pursued. System Engineering (SE) shall ensure that any kind of requirement is satised avoiding that some aspects prevail on other. However, critical issues are the interaction and integration of the design and verication phases due to the lack of tools able to cover the entire product-life cycle. This often generates discontinuities into the project usually due to the loss of information and misunderstanding between consecutive phases. Model Based System Engineering (MBSE) seems a promising strategy that can reduce the wasted resources within the modern SE context. The paper proposes an eective tools chain that puts together the main elements of MBSE and the Model and Simulation based approach that simplies the verication. First, well-known SE instruments drive the requirements denition. Taking into account the stakeholders' needs, regulations and constraints, Functional analysis, Concept of Operations evaluation and architecture denition are the main activities that shall be completed. The adoption of dedicated software improves this process by producing a set of data to be shared among dierent platforms. Notably, DOORS generates, hosts and manages the requirements list, providing a main reference hub for the specication; Rhapsody provides the model based system architecture in terms of attributes and blocks that can be translated to standard formats and made available for specic verication tools. Moreover, being synchronized with the DOORS database, it supports requirements traceability and mapping features aimed at creating matrices and tables views for coverage, impact analysis and verication. Matlab/Simulink and dedicated environments take the Rhapsody outputs and perform dierent types of verication campaigns. Indeed, Matlab/Simulink allows simulation during the conceptual, preliminary and detailed design phases while an in-house developed platform, called STARSIM, perform "in the loop" verications useful during the production, qualication and acceptance phases. The outputs of the verication campaigns are directly referred to requirements (managed by DOORS), analysing autonomously if and how they are satised and, potentially, negotiating them. The paper presents the results obtained thanks to the rst release of the tools-chain. Its capabilities and the integration among all the parts are shown highlighting the advantages with respect to the traditional approaches.