SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering - Methods, Processes and Tools (2) (6)

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A MULTI-DISCIPLINARY ANALYSIS, SIMULATION AND OPTIMIZATION TOOL TO SUPPORT SYSTEM ENGINEERING PROCESSES

Abstract

A focal point of successful system engineering is the analysis and implementation of user requirements into an overall system design, as well as the permanent validation of the system concept. Amongst others, operations, costs and performance are key system aspects of the project a system engineer has to deal with throughout the whole life cycle. The system engineer has to interact with subsystem teams and specialists in order to iterate the design. For this purpose the system engineer needs analysis and simulation tools that cover a wide field of system aspects. The subsystem level of detail might be less than provided by the subsystem development teams' expert tools. On the other hand system engineering tools must allow the incorporation of results and design parameters obtained by specialist tools up to a certain extend.

This paper presents the new capabilities of the ASTOS mission analysis, simulation and optimization software with respect to the needs of system engineers. It highlights the envisaged work flow and presents dedicated capabilities for system engineering applications.

The paper describes how the analysis capabilities from multiple disciplines can be combined in ASTOS in order to get an overview of the foreseen design for concept validation and how ASTOS can be used as a multi-disciplinary system design optimization tool. It is illustrated how the user - starting from very simple models - can increase independently the level of detail of the applied models as soon as the design becomes more detailed and how data from specialist tools can be integrated.

The paper shows how the AOCS system can be simulated using the ASTOS-Simulink interface. It describes how an R/F sensor can be modelled from very simple to complex and for specific applications like GNSS, telemetry or as payload and how a link budget or navigation accuracy analysis can be realized based on the user-defined sensor parameters. Emphasis is put on the interaction between the domains, e.g. how the sensor mode influences the power consumption, how navigation data can be used by the AOCS or how the sensor's waste heat and sun radiation are considered in the thermal model.

In order to address the latest trends in active debris removal and in-orbit servicing the paper also demonstrates how flexible multi-body dynamics can be accounted for using the ASTOS/DCAP module and how the flexibility of the structure may influence AOCS, sensor pointing and structural loads.