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# STATIC SIMULATION SCHEDULING FOR THE VALIDATION OF SPACE SYSTEM REQUIREMENT DECOMPOSITION

**Abstract**

The first step to develop a space system is to define its requirements. However, it is not always obvious how to implement such systems. A promising approach is to subdivide the system requirements into sub-requirements which can be assigned to the system's sub-components. Simulation is an appropriate way to validate that the system decomposition still fulfils all requirements. The main challenge in space missions is that sub-systems are tightly coupled and requirements fluctuate throughout its lifetime. On the other hand, definitions like data types of interfaces among sub-systems, transition processes of their relationships, and internal processes should be clearly defined in advance to implement system simulation. These are the reasons why it is so difficult to implement the validation task in space engineering.

To validate whether a system requirement is fulfilled by sub-systems and whether a sub-system meets all of its requirements, a static simulation scheduling approach is proposed in this paper. This scheduling approach is based on a hierarchical state model of a space mission. The state model is constructed following the principles of Model-Based Systems Engineering (MBSE). It maps all original system requirements to state variables and defines states as well as relations along three red lines of a space mission: space mission lifecycle, internal (sub)systems, and inter-(sub)systems. Therefore, in the scheduling approach, all of the state variables are treated uniformly, which means that interface data types among sub-systems, transition processes of their relationships, and internal processes are not considered at all. Thus, static simulation is just driven by states of state variables and their relations and is processed along the three red lines mentioned above. But, their execution sequences depend on the current state of the processed variable. A detailed description of the scheduling approach is illustrated and demonstrated in this paper.

The scheduling approach facilitates a preliminary system analysis that would otherwise either be impossible or cost intensive. Furthermore, after each sub-system refinement, non-technical stakeholders can immediately validate that their requirements are still fulfilled. Once requirements change, the analysis can be carried out again quickly. We are using the "Virtual Satellite" developed by German Aerospace Center (DLR). This framework already handles the definition of system specifications and offers a variety of views to analyse the results. Thus, we have to concentrate just on the implementation of static simulation.