SPACE SYSTEMS SYMPOSIUM (D1)
System Engineering Tools, Processes and Training (1) (3)

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THE CONCEPTUAL ARCHITECTURE OF A GENERALIZED DSML BASED SIMULATION FRAMEWORK FOR ON-BOARD SYSTEMS

Abstract

In space system development the interface level simulation of on-board equipments has a special importance due to two main nature of the field. On one hand the space system developments are done parallel by a number of different – often geographically separated – development teams. While on the other hand the application of special hardware elements and the lack of maintainability of these systems drives the necessity to ensure the reliability of the system components as well as the whole system.

In the MTA-Wigner FK (earlier KFKI-RMKI) and the SGF ltd. we have spent decades developing – along many other on-board systems – Electrical Ground Support Equipments (EGSEs) simulating on-board electrical interfaces for different space missions. For the European Space Agency's (ESA) Rosetta mission we have implemented the simulator of the Philae lander's on-board system (called Lander Software Simulator - LSS). This simulator uses a dedicated modelling framework and a special hardware module to perform signal level simulation of the on-board equipments.

Based on the gained knowledge and the LSS we have decided to elaborate the conceptual architecture of a more generalized simulation framework which provides the possibility of performing on-board system modelling and simulation in mission and platform independent way. The basis of our simulator is a special so called domain specific modelling language (DSML) by which the behavior of the on-board equipments can be described. Furthermore our simulation framework provides solution for parallel and distributed simulation of the subsystems and to dynamically substitute the simulated equipment by the real hardware element for testing purposes. For supporting the fault tolerance and reliability verification of the spacecraft modules the elaborated modelling language and simulation framework provide fault injection and evaluation services.

This paper presents the conceptual architecture of a generalized simulation framework for spacecraft on-board equipments along with the concepts of the underlying modelling language.