Paper ID: 59403
oral
student

IAF SPACE EDUCATION AND OUTREACH SYMPOSIUM (E1)
New Worlds - Non-Traditional Space Education and Outreach (7)

Author: Mr. Alexander Kharlan
Skolkovo Institute of Science and Technology, Russian Federation

Mr. Nikita Veliev
Skoltech Space Center, Russian Federation
Mr. Petr Mukhachev
Skolkovo Institute of Science and Technology, Russian Federation
Dr. Anton Ivanov
Skolkovo Institute of Science and Technology, Russian Federation

IMPLEMENTING MODEL-BASED SYSTEMS ENGINEERING APPROACH IN A STUDENT SPACE MISSION DESIGN ENVIRONMENT

Abstract

In the recent decades, the educational process in STEM disciplines has not changed a lot, especially in the former Soviet bloc countries. In engineering studies, traditional lectures, tutorial classes, and examinations are typically all that one has to offer for the students to familiarize them with the contents of the course. However, in the recent years, as certain methods, tools, and hardware even in aerospace engineering became significantly cheaper, do not require excessive professional training, and are widely available for students, there is a trend towards implementing a more project-oriented approach to teaching in STEM-courses. At the same time, many specialists in the industry are often used to the same traditional approach to system design. In more innovative educational environments, an attempt is observed to build certain educational programs around projects that might go through all stages of the product lifecycle. In terms of the constructive alignment principle that is nowadays followed in many institutions worldwide, this would mean that the learning outcomes tend to become more about acquiring specific skills than about possessing theoretical knowledge. In this work, an Educational program is discussed that is based on implementing the Model-Based Systems Engineering (MBSE) approach to project-based education. Designed for a master-level course, the program is also applicable and used by Skoltech for professional training. The core of implementing the MBSE approach to education is collaboration and software enabling efficient concurrent work. In Skoltech Space Center, engineers responsible for domains are using different software, including 3D modelling software (CATIA, SolidWorks), software for scripting and APIs (Matlab, Excel VBA, Python), domain-specific software (STK, GMAT). Corresponding to the main advantage of the concurrent engineering approach based on the data exchange, the connection was established for most of the software using collaboration tools, such as CDP4 or Valispace. Additionally, the Skoltech CDF Lab allowed to run visualizations and ease the communication process. The intended learning outcomes partly cover the teamwork-oriented side of concurrent design, which is suitable for vocational training of industry specialists, while other outcomes specifically target various individual skills that the students develop during the concurrent studies. The paper discusses the learning model implemented in the course, and how the specified software tools are integrated in order to facilitate the concurrent design studies. Finally, the paper describes specific cases of implementing the program, and some evaluation metrics following the feedback gathered from the participants of the program.