

Jury Member Report – Doctor of Philosophy thesis.

Name of Candidate: Dominik Johannes Knoll

PhD Program: Engineering Systems

Title of Thesis: Model-based Processes and Tools for Concurrent Conceptual Design of Space Systems

Supervisor: Associate Professor Alessandro Golkar

Date of Thesis Defense: 31 January 2019

Name of the Reviewer: Paolo Gaudenzi

I confirm the absence of any conflict of interest (Alternatively, Reviewer can formulate a possible conflict)	Signature: Paolo Gaudenzi Date: 30-12-2019
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The purpose of this report is to obtain an independent review from the members of PhD defense Jury before the thesis defense. The members of PhD defense Jury are asked to submit signed copy of the report at least 30 days prior the thesis defense. The Reviewers are asked to bring a copy of the completed report to the thesis defense and to discuss the contents of each report with each other before the thesis defense.

If the reviewers have any queries about the thesis which they wish to raise in advance, please contact the Chair of the Jury.

Reviewer's Report

Reviewers report should contain the following items:

- Brief evaluation of the thesis quality and overall structure of the dissertation.
- The relevance of the topic of dissertation work to its actual content
- The relevance of the methods used in the dissertation
- The scientific significance of the results obtained and their compliance with the international level and current state of the art
- The relevance of the obtained results to applications (if applicable)
- The quality of publications

The summary of issues to be addressed before/during the thesis defense

The doctoral thesis by Dominik Knoll addresses a very interesting topic that has received more and more attention in the last few years. In fact the concurrent engineering (CE) approaches have been increasingly used in the space field both in the research environment and by space agencies and space companies. Model based system engineering (MBSE) processes have been developed for a better analysis, design and operation of complex systems in space systems.

Concurrent design and model based design represent a fundamental tool for the development of new space systems and services based on even more complex technical solutions like the ones based on satellite constellations and aimed to disruptive services such as almost real time Earth observation from space.

The thesis has three main ambitious aims: a) a better understanding of the processes and methods of concurrent engineering as used in the main facilities in operation around the world; b) the development of an advanced concurrent engineering tool based on an optimal set of models and processes, conceived as the synthesis of the already existing ones, namely for the modelling of design processes; c) the use of model based system engineering for technology development.

The author was able to set up a very extensive and comprehensive analysis of the state of the art. In fact the analysis of the state of the art CE is conceived by the author not just as the starting point of his research effort but as the first objective of his work. In fact there is no recognized standard in existing CE approaches and it is very important to understand if some common ground of methods and tools can be established at least for space activities. The analysis of the experiences conducted in operating CE facilities was obtained thanks to a series of expert interviews the result of which was presented in the first part of the thesis. The second part of the thesis then proceeds towards the realization of a design collaborative tool: the CEDESK software. The development of this software was a major outcome of the thesis and for sure required a lot of work. The author demonstrated the efficiency and effectiveness of this tool by illustrating several case studies performed thanks to CEDESK. These studies demonstrate also the application of the methods and processes developed in the frame of the thesis in the real engineering practice. In conclusion the thesis deals with the use of model based processes for technology development. This is maybe the most innovative idea contained in the study, but would profit by further studies maybe in some prosecution of activities after the completion of the thesis.

The research work developed in the thesis was also reported in several good quality papers by the author.

In conclusion the thesis represents an interesting development of methods and tools for design of space systems based on CE and model based system engineering. A collaborative design tool was developed and used for conceptual studies of future space systems. The work contains novel approaches and ideas especially for the application of MBSE to technology development, a topic that the author could develop with success in the next future.

Provisional Recommendation

I recommend that the candidate should defend the thesis by means of a formal thesis defense