

Modelica for large scale aircraft electrical network V&V

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The model based design approach is a key factor for more efficient aircraft design with its growing demand to optimize the complex physical systems containing mechanical, electrical, hydraulic, thermal, control, electric power or process-oriented sub components. Especially the more electric aircraft concept relies on incorporating high quality system models in the complete aircraft design process. The process itself briefly can be divided into 4 major phases: concept phase, system specification phase, system development phase and system verification phase. The model types and level of detail change for every phase. The aircraft electrical network validation and verification process strongly relies on software for detailed and numerical complex modeling, simulation and analysis of network components and systems. Substantial efforts were made to reach platform independence and link simulation tools each with special strengths and dedicated for specific domains. Especially the FMI standard was a major step forward and was verified to improve an aircraft systems design process. Nevertheless, for the sake of performance and transparency, industrial processes often rely on a single common tool.

The software used in an aircraft project for the systems integration validation and verification (V&V) process is defined by the airframer for all model suppliers and contributors. While Modelica has found attraction in the automotive sector, it is not the standard for detailed simulation in aeronautic industry yet. Inspired by the success in the prior design phases, a study was performed in the context of the CleanSky project to evaluate the potential and performance of Modelica and the commercial tool Dymola for electrical V&V. In this paper we give an overview of the necessities of the infrastructure which had to be developed. We demonstrate the modeling and the simulation results of component stand-alone tests as well as the tests of an integrated aircraft power network. Necessary tools are addressed and lessons learned from the study are documented. It is the aim of this paper to rise awareness of the needs to conduct V&V studies.

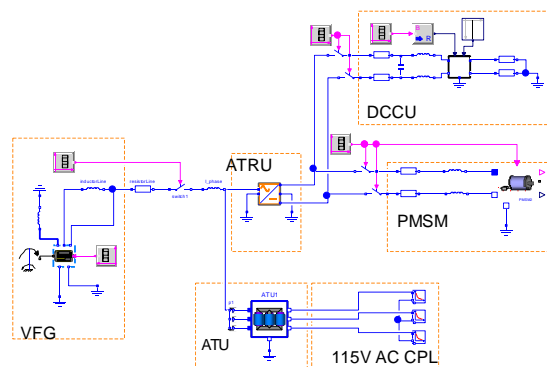


Figure 1: An integrated electric power network for MEA