1st Workshop on Avionics Systems and Software Engineering (AVIOSE'19)

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Abstract: Companies are struggling with the complexity of digital avionics systems. Millions of man months are required for the development of digital airborne systems. Moreover, the complexity of functions, the number of vehicles, and systems continuously rises. There is a high demand for more efficient methods and tools of systems and software engineering. The AVIOSE workshop establishes a new forum for the exchange for the people working on simplifying, shortening, and maturing the creation of avionics systems.

Keywords: avionics; systems engineering; software engineering; formal methods; model-based; requirements; qualification; certification; simulation; processes

1   Introduction

Software development in the aerospace domain is driven by increasing complexity, new application potentials, and rising certification effort. Future applications demand for new software development methodologies, e.g. autonomous air transport and commercial UAVs and further enhancement of existing functionality. At the same time, there are issues in communication and navigation in airspace, multi-core processors or artificial intelligence. Many projects struggle with continuously rising effort required for the implementation, development, configuration, integration, and qualification of digital airborne systems, i. e. avionics.

Progress is made in various disciplines, as formal methods, process automation, simulation and regulations, but results often stay in their (academic) community. For instance, formal methods like CSP, FOCUS, π-Calculus, Hoare-Calculus, or Isabelle are around already for several years or even decades. However, they are still not widely adopted in industry.

Therefore, it is about time to create a central point of exchange for the engineers, computer scientists, and industry and all other involved parties with a holistic meeting on "Avionics Systems and Software Engineering". Invited are key players from the industrial and academic community to take part in a one-day workshop held in the context of the "Combined Conference Software Engineering & Management" in February 2019 in Stuttgart (SE'2019).

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2 Workshop Goals

The core objectives of the workshop are: (1) Providing a forum for novel and innovative approaches and tools of systems and/or software engineering methods within the avionics domain. (2) Bring together all involved disciplines, e.g. computer scientists theories, engineering methods, and industrial processes. (3) Derive a common consensus on the most important challenges within the avionics sector within the next decade. (4) Discuss between participants on what way to proceed in order to solve the problems of the future. With these in mind, the topics of interest for the workshop are defined to be: *(A) Development technologies:* Requirements engineering, modeling languages and tools, transfer of modeling techniques to industrial application, verification via testing and formal methods, security & safety; *(B) Development methods:* Certification, agile development, interaction with other domains (e. g. physics, psychology); *(C) Product technologies:* Applications of artificial intelligence (including verification), autonomous systems; *(D) Additional challenges:* Reference architectures for hard- and software and interfaces between sub-systems, sensors and sensor fusion, Integrated Modular Avionics (IMA), obsolescence (management).

3 Talks and Contributions

The workshop is organized as one-day conference with contributions from researchers as specialists of their specific domain. Each author has the forum to present and discuss his results, such that important and novel ideas from the AVIOSE domain are shared in detail. On the high-level a motivation and general challenges are provided by invited long-term experts from the academic and industrial world as keynote speakers. In addition, it is envisaged to collect common topics, cross-relations, and lessons learned during the workshop; to evaluate and discuss those within a moderated podium discussion in order to find and define common results of the workshop.

In total six papers with topics from formal verification and testing, early validation as well as requirements process automation have been chosen for a presentation. Despite the SE being a German institution, the AVIOSE attracted authors of various nationalities. Most of them situated in Germany, but it got high European interest and includes a European contribution. The accepted publications are entitled: "MODCAP: A Platform for Cooperative Search and Rescue Missions", "Model-Based Engineering for Avionics: Will Specification and Formal Verification e.g. based on Broy's Streams become feasible?", "Test Sequence Generation From Formally Verified SysML Models", "Towards Computer-Aided Software Requirements Process", "Tool Chain for Avionics Design, Development, Integration and Test", "Using Runtime Monitoring to Enhance Offline Analysis".

In addition, two keynotes by Prof. Dr.-Ing. Reinhard Reichel from the University of Stuttgart and by Franz Münz from Airbus Defence and Space are given.

4 Conclusion

Throughout the workshop, current industrial and academic challenges are gathered. All participants contribute to the identification of worthwhile problems and their ratings. Solutions, approaches, and methods are debated in plenary and panel discussion. The combination of industrial and academic participants increases awareness and information level on both sides.

Throughout the submissions we recognize the particular efforts and the resulting promising trends in model-based and model-driven development. Nevertheless, still a major of contributions focuses on adjustments, adaptations, extensions, and customization of the models to use cases in our domain and the development processes.

Though advertised in the call for papers, no contribution concerning new technologies such as AI has been received. Therefore, discussions are directed in this area during the workshop. The same holds true for certification endeavors. Exchanging experience and clarity in both fields are strongly recommended by the program committee and thus make up significant open topics for discussions during the workshop.