4th Workshop on Avionics Systems and Software Engineering (AvioSE'22)

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Abstract: Software and systems engineering in aerospace is subject to special challenges. The AvioSE'22 workshop connects academia and industry with selected scientific presentations, motivating keynote talks, and an interactive panel discussion.

Keywords: avionics; systems engineering; software engineering; formal methods; model-based; requirements; qualification; certification; simulation; process; tool; platform; architecture; AI

1   Scope and History

Considerable advances for aerospace applications are expected with the introduction of new technologies. However, the requirements do not allow the application of these straight away due to regulations and certification. Technologies and methods need to be amended or extended for meeting aerospace requirements. These challenges are to be addressed in the AvioSE workshop. The previous workshops AvioSE'19[4] dealt with general challenges[5] and AvioSE'20[6] addressed development tools. AvioSE'21[7] tackled the application and issues of AI in avionics[8].

The main topic of AvioSE'22 is *Safe and secure avionics architectures (e.g. IMA, platforms, multi-core, networks, clouds, middleware)*. Generic avionics platforms seem to be the obvious choice for air vehicles developed today. A low number of standardized avionics hardware shares its resources with several other system functions. While benefits in size, weight, power, and cost are agreed, generic platforms bring along challenges caused by a concurrent development process, distributed safety analysis, generic security vulnerabilities, configuration engineering, and software segregation.

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[4] Annighoefer et al., 1st Workshop on Avionics Systems and Software Engineering (AvioSE'19), 2019.

[5] Annighoefer et al., Challenges and Ways Forward for Avionics Platforms and their Development in 2019, in IEEE/AIAA 38th Digital Avionics Systems Conference (DASC), 2019.

[6] Annighoefer et al., 2nd Workshop on Avionics Systems and Software Engineering (AvioSE'20).

[7] Annighoefer et al., 3rd Workshop on Avionics Systems and Software Engineering (AvioSE'21).

[8] Schweiger et al., Classification for Avionics Capabilities Enabled by Artificial Intelligence, IEEE/AIAA 40th Digital Avionics Systems Conference (DASC), 2021.

2   Workshop Objectives

The main objective of the workshop is to accelerate the bidirectional transfer of knowledge between academia and industry. This workshop provides the enabling platform for the stakeholders to discuss technical, but also process, and educational topics. The objectives of AvioSE'22 are three-fold: **(1)** It provides a forum for researchers from both academia and industry to present new methods, tools, and technologies from avionics systems and software engineering, e.g. model-based development, requirements engineering, formal methods, model-based methods, and virtual methods. These contributions are presented in a scientific format, but the small character of the workshop allows detailed discussions. **(2)** AvioSE'22 shall motivate researchers by keynote talks from three invited speakers. The keynotes each highlight a dedicated topic from the avionics context, summarize its state-of-the-art, and emphasize urgent challenges. **(3)** The main topic is addressed interactively by inviting all participants to discuss aspects and needs of modern avionics architectures. We are connecting academics and professionals in a panel discussion with invited experts from academia, industry, and authorities. The expected outcome is the identification of the current and future challenges and needs for avionics platforms as well as ideas how to address these challenges. The panel members' statements can be challenged at any time by the audience. Major conclusions of the panel discussion are made available on a virtual platform.

3   Workshop Contributions

After the review with at least two reviewers for each submitted paper we could select six of them to be accepted for the workshop. They cover the following topics (in alphabetic order of the title): **(1)** A Multi-Platform Small Scale Drone Demonstrator for Technology Maturation of Next Generation Avionic Functions **(2)** An Anthropomorphic Approach to establish an Additional Layer of Trustworthiness of an AI Pilot **(3)** Build Your Own Training Data – Synthetic Data for Object Detection in Aerial Images **(4)** Comparison of Aviation and Automotive Standards and Methods in Terms of Safety and Cyber-security **(5)** Extending Behaviour-Driven Development of Avionic Systems to Flight Simulators **(6)** Static Analysis Methodologies for WCET Calculating with Asynchronous IO.

We observe a focus on autonomy and artificial intelligence, while the dependency between safety and cyber-security is also an issue. Due to the growing complexity of avionics systems and also of the corresponding flight simulation training devices there is the need to improve the software quality through new testing approaches. Because of the rising demands for computing power, additional hardware components have to be used for accelerating computations. Thus, these have to be considered in a WCET analysis, as well, which is investigated in one of the papers. In summary, the workshop covers up-to-date issues relevant for the future development of avionics systems.