

MUNICH AEROSPACE – NEW HORIZONS IN AVIATION AND SPACE

In 2010, through Munich Aerospace and its pooling of research, graduate programs and teaching an alliance has been formed between the **Technical University Munich (TUM)**, the **Bundeswehr University Munich (UniBwM)**, the **German Aerospace Center (DLR)**, as well as **Bauhaus Luftfahrt (BHL)**.

To promote excellent, scientific young academics, Munich Aerospace awards a PhD scholarship on

Certifiable Control Allocation for eVTOL

The research group “**Intelligent Control of Highly Over-Actuated Flight Systems**” is led by Dr. Gertjan Looye from the Institute of System Dynamics and Control at DLR and involves the Institute of Flight System Dynamics at TUM (Prof. Florian Holzapfel) and the Chair of Aircraft Dynamics and Flight Guidance at UniBwM (Prof. Axel Schulte). The research aims at developing new key technologies pushing forward fully autonomous flight, with a focus on the design, validation and certification of intelligent flight guidance and control (G&C) systems. The group explicitly addresses challenges arising in modern flight systems such as air taxis or next generation transport aircraft which feature a large number of control inputs due to, e.g., distributed control surfaces or propulsion systems. Relying on a long-lasting and strong collaboration on several research topics, the researchers from DLR, TUM and UniBwM will bring together their expertise and tightly co-operate within this activity.

Your tasks

Electrical vertical-take-off-landing (eVTOL) aircrafts receives increasing attention in the aerospace industry over the years. The vision is to develop eVTOLs as complete digitalized and autonomous systems operating in urban areas. The goal of this PhD addresses design, analysis, and implementation of a certifiable control allocation framework for eVTOLs to manage the redundancy and control power. For a certifiable application, the focus is to guarantee feasible, reproducible, and deterministic behavior, assure WCET on target platforms, suppress dangerous phenomenon such as input jitter and noise amplification, and incorporate failure information from fault tolerant schemes. The outcome of the study should include the delivery of air-worthy flight-tested certifiable software as well as a dissertation which covers algorithm development, implementation details as well as verification and validation workflow.

To accomplish the challenges, your tasks are:

- Extensive study of control allocation methods in literature and develop algorithm baselines.
- Implement the algorithms under certifiable code-compliant guidelines.
- Develop acceptable means of compliance and V&V metrics and methods.
- Test and verify the methods and implementation in flight tests with real systems.

Your profile

- M.Sc. in Aerospace Engineering, Mechanical Engineering, or a related field.
- Good knowledge about flight dynamics, simulation, control, and concepts of control allocation.
- Good knowledge about matrix theory, optimization, and numerical analysis.
- Very good skills in MATLAB/Simulink. Experience with C/C++ is a plus.
- Experience with version control such as GIT is a plus.
- Background of model-based development and certification guidelines (e.g., DO-178C/DO-331) is a plus.
- Strong motivation to contribute and lead in development of future air mobility industry.
- Self-dependent, autonomous, and target-driven workstyle with the ability to work in a team is required.
- A strong mindset of analytical problem solving.
- Fluent English skills including both speaking and technical writing is essential.

The Institute of Flight System Dynamics at Technical University of Munich

The Institute of Flight System Dynamics (TUM-FSD) in Technische Universität München's Department of Aerospace and Geodesy is devoted to analyzing and modifying the dynamic characteristics of aerial platforms. Our passionate team is committed to mature cutting-edge technologies that are required to incept the flight system behavior of tomorrow. The Institute's research areas are guidance and control of manned and unmanned aircraft; simulation, parameter identification and flight safety; trajectory optimization; sensors, navigation, and data fusion; and avionics and safety critical systems. Our goal is to develop and apply highly sophisticated approaches tailored to real world applications and products, as well as to the demanding challenges of tomorrow.

The Scholarship

The Munich Aerospace scholarship is awarded for a period of three years. The monthly scholarship according to the Munich Aerospace scholarship directives is € 1,575 per month (tax free upon § 3 no. 44 EStG). Munich Aerospace scholarship holders are entitled to attend the Munich Aerospace Graduate School, formed by the TUM Graduate School and the DLR_Graduate_Program, and have access to special events and trainings. An additional grant of up to € 6,100 per year will be available to cover expenses that are directly related to the PhD project (e.g. textbooks, laptop, travels for national/international conferences, public transport, housing subsidy, research stays abroad, etc.). Furthermore, the scholarship holder is part of a Munich Aerospace research group and receives additional technical support from the research group head. The PhD takes place at TUM and the completion of the university degree should not be more than three years prior to the application for the scholarship.

Interested?

Please send us your application including relevant documents (cover letter, CV, diplomas, transcript of records) in PDF format to application@fsd.lrg.tum.de with subject "Application Munich Aerospace Control Allocation". The application deadline is April 14, 2021.

We are looking forward to your application!