Deutsches Zentrum
für Luft- und Raumfahrt
German Aerospace Center

Linder Höhe
D-51147 Köln
Telephone: +49 (0)2203 601-0
Internet: https://www.dlr.de

DAAD
Deutscher Akademischer Austauschdienst
German Academic Exchange Service

Kennedyallee 50
D-53175 Bonn
Telephone: +49 (0)228 882-0
E-mail: dlr-daad-program@daad.de
Internet: https://www.daad.de/dlr

# DLR – DAAD Fellowships

## Fellowship No. 564

**Research Area :** Aeronautics

**Research Topic:** **Modelling and system identification of icing on (small) fixed-wing UAV with certain regard to indirect ice detection**

**DLR Institute:** Institute of Flight Systems (FT), DLR Braunschweig

**Position:** Postdoctoral Fellow

**Openings:** 1

**Job Specification:** For a comprehensive view on the icing effects of small fixed wing UAV source of detailed information is required. With a high-quality real-time simulation model, a detailed analysis and evaluation can be made revealing the specific characteristics of icing impact on such flight vehicles. The best way for the simulation model development is the system identification from flight test data. For optimal flight test conduction, a specific test program with suitable optimized manoeuvres is required, focusing on the unique characteristics of small aerial vehicles with restricted operational capabilities and limited available flight instrumentation. Moreover, for flight through natural icing conditions, there are additional limitation and requirements to prevent a vehicle loss-of-control during flight test, obtain the required data sets during ice encounter and keep the flight test time short: UAV icing can lead to a rapidly increasing degradation of the vehicle characteristics for what it is necessary to perform manoeuvres during flight test in a minimal time to have a snapshot of the effects related to the current ice accretion. There are many differences in icing effects related to small aerial vehicle compared to large transport aircraft. Therefore, the dynamic simulation model structures must be adapted to these specific effects, like change of aerodynamics or weight increase including a change of moments of inertia.

With the gained knowledge about UAV icing, the definition of a new indirect ice detection methodology, based on the change of vehicle characteristics during icing encounter, can be made including not only the

detection and icing alert but also the determination of the limited aircraft enveloped for further save flight operations.

There are several scientific questions to be answered:

- Which icing impacts have to be considered for a save operation of small fixed-wing UAVs in icing conditions?
- How must the flight test design be adapted to meet the requirements for flying small fixed-wing UAVs in clean air and icing conditions in order to obtain the required data for system identification with the given constrains of vehicle operation requirements and limited instrumentation?
- Which icing effects on small aerial vehicle characteristics can be reliably used for ice detections?

The postdoctoral fellowship includes the following tasks:

1) flight test definition for fixed-wing UAV, flight test conduction, flight data analysis and data compatibility check;
2) simulation model development for clean and iced aircraft using system identification;
3) aircraft performance and flight dynamics analysis with regards to the definition of an indirect detection algorithm tailored to small UAV.

The duration of the fellowship is max. 24 month.

**Required Qualification:** PhD in Mechanical / Aerospace Engineering with specific experience in airplane flight physics, modelling, simulation, flight testing, flight data handling, system identification, flight control and fixed-wing UAV operations

**Advantageous Skills:** Modelling and Simulation of dynamic systems, programming languages C, C++, MATLAB®, Simulink®

**English competence:** See requirements on www.daad.de/dlr

**Earliest Start Date:** March 2023

**Application Deadline:** December 31st, 2022

**Further Information:** http://www.dlr.de
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