Technische Universität Braunschweig
Institut für Strömungsmechanik | Exzellenzcluster SE²A
Hermann-Blenk-Str. 37 | 38108 Braunschweig

Announcement of the position of a

research assistant (m/f/d, full time)

on the topic

"Sensitivities of Laminar Suction Boundary Layers for Large Re"

(starting ASAP - temporary position, ends December 31st 2025)

Background

The Institute of Aerodynamics and Flow Technology (AS) at DLR in Braunschweig and the Institute of Fluid Mechanics (ISM) at TU Braunschweig are conducting joint research in the Cluster of Excellence SE²A on the stability of laminar suction boundary layers at large Reynolds numbers. In particular, it is of interest whether and how a boundary layer can be kept laminar over extremely long distances by means of successively arranged suction regions and how this can be done efficiently. For this purpose, the stability behaviour of the boundary layer with and without suction must be precisely understood, including the areas just at the beginning and just after the end of a suction panel. Furthermore, perturbations (especially steps in the surface) could play a major role and therefore the interaction of the boundary layer and the unstable modes with steps must also be understood.

Fig.1: Current setup of the flat plate in wind tunnel DNW-NWB

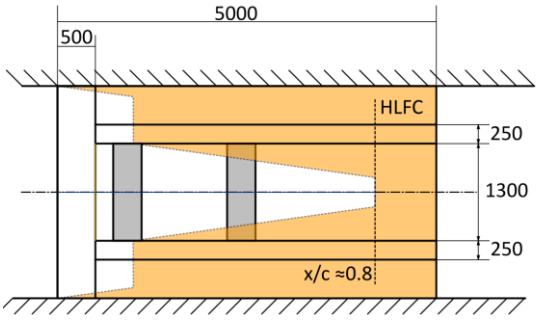

Fig.2: Planned setup with two suction panels (grey areas) in a tandem arrangement

For this purpose, two complementary methods will be used in subproject B1.5:

On the one hand, the Tollmien-Schlichting modes shall be investigated with two-dimensional direct numerical simulations (DNS) [1]. From the simulations, the stability behavior (amplification and damping rates) will be determined. Of particular interest are the areas where the boundary layer properties change in streamwise direction, i.e. the beginning and the end of the suction areas and in the surroundings of steps.

On the other hand, an experimental setup with a large flat plate, which is available for the DNW-NWB wind tunnel [2], shall be modified and used in several experimental entries. The configuration with the two successive suction panels ("tandem configuration") is to be designed, the construction of the hardware is to be coordinated, and the instrumentation, setup in the wind tunnel, and measurements are to be planned and executed.

In summary, the tasks are:

- Planning, setup and execution of measurement campaigns with a large flat plate in the wind tunnel DNW-NWB, including necessary preparations.
- Preparation of stability calculations with different tools, up to 2D DNS simulations.
- Evaluation and overall analysis of the data, comparison and interpretation of results
- Documentation and presentation of the data and results in internal symposia, at technical conferences and in peer-reviewed journal publications

TU Braunschweig and Cluster of Excellence SE²A

The project is part of the Cluster of Excellence SE²A, more specifically in ICA B "Flight Physics and Vehicle Systems", located at TU Braunschweig.

With 17,800 students and 3,800 employees, the Technische Universität Braunschweig is the academic centre of Braunschweig, the traditional "City of Science" in the middle of one of the most active research regions in Europe. We, the Institute of Fluid Mechanics, are part of the Aeronautics Research Centre Niedersachsen (NFL). The NFL is a leading research centre for aviation in Germany with excellent research and education. As part of the NFL, we have an internationally unique infrastructure with research aircraft, wind tunnels, simulators and test rigs with which our scientists and dedicated students conduct cutting-edge research. A major focus of current research at the NFL and TU Braunschweig is the mobility needs of society in the future and, in particular, the factors of environmental compatibility, safety and economic efficiency of air transport. This focus is also reflected in the goals of the Cluster of Excellence SE²A on Sustainable and Energy-Efficient Aviation, awarded to TU Braunschweig by the German Research Foundation (DFG) in 2019. The Cluster of Excellence SE²A is an interdisciplinary research centre with the purpose of investigating technologies for a sustainable and eco-friendly air transport system. Scientists from aerospace, electrical, energy and chemical engineering are working on the reduction of emissions and noise, as well as recycling and life-cycle concepts for airframes and improvements in air traffic management. Technische Universität Braunschweig, the German Aerospace Centre (DLR), Leibniz University Hannover (LUH), Braunschweig University of Art (HBK) and the National Metrology Institute of Germany (PTB) have joined forces in this extraordinary scientific undertaking.

Requirements

We seek candidates that have:

- received an above-average completed university degree (master or equivalent) in mechanical engineering, aerospace engineering, applied physics or a related field
- profound knowledge in aerodynamics
- experience with aerodynamic methods, such as experimental methods and/or CFD simulations.

Furthermore, we expect:

- self-initiative and result-oriented working approach
- creative approach for developing innovative methods and solutions
- good command of written and spoken English
- willingness to travel, including short stays abroad
- willingness to work closely with the scientific and technical staff of the involved institutes and project partners

Boundary conditions

The project is a cooperation of the Institute of Aerodynamics and Flow Technology (AS) of DLR with the Institute of Fluid Mechanics (ISM) at TU Braunschweig. The work shall be carried out variably in both institutes. Employment will be through TU Braunschweig.

The work can start as soon as possible. The position is limited to December 31st 2025. A subsequent employment for completing the PhD studies is possible. Depending on the assignment of tasks and fulfilment of personal requirements, the salary can be up to salary group 13 TV L collective agreement. The position is generally suitable for part-time work, but we favour a 100% involvement.

The TU Braunschweig strives in all areas and positions to reduce under-representation in the sense of the NGG. Therefore, applications from women are particularly welcome. Applications from people of all nationalities are welcome. Severely handicapped persons are preferred in case of equal suitability. Proof of eligibility must be submitted.

Application costs cannot be reimbursed. Please understand that applications that are not considered can only be returned against a self-addressed and sufficiently stamped envelope. Personal data will be stored for the purposes of the application process.

Application documents

Please include a cover letter (including your motivation), CV and academic performance record (grades during Bachelor and Master studies including grading scale details). Additional documents, such as a

copy of your Master's thesis, scientific publications, references from former employees and/or proof of English language proficiency may be added to support your background.

Documents may be in english or in german language

Please send your application ***by December 23rd 2022*** via email or post to:

Dr.-Ing. Peter Scholz
TU Braunschweig, Institute of Fluid Mechanics
Hermann-Blenk-Str. 37, 38108 Braunschweig, Germany
p.scholz@tu-braunschweig.de

If you have any further questions, please feel free to contact us via the above email address.

References

[1] Lüdeke, H., v.Soldenhoff, R., Direct numerical simulation of TS-waves over suction panel steps from manufacturing tolerances, CEAS Aeronautical Journal, Vol. 12, pp. 261-271, 2021, doi: 10.1007/s13272-021-00496-9

[2] Lüdeke, H., Breitenstein, Chr., Experimental investigation of hybrid laminar flow control by a modular flat plate model in the DNW-NWB, CEAS Aeronautical Journal, Vol. 13, pp 267-280, 2022, doi: 10.1007/s13272-021-00564-0

[3] Corelli Grappadelli, M., Sattler, S., Scholz, P., Radespiel, R., Badrya, C., Experimental investigations of boundary layer transition on a flat plate with suction, AIAA-Paper 2021-1452, AIAA SciTech 2021 Forum, Virtual Event, 19.-21.Jan. 2021, doi: 10.2514/6.2021-1452

Mission statement

As part of the Aeronautics Research Centre Niedersachsen (NFL) our work is based on the following mission statement:

We are a leading aerospace research centre in Germany, providing top level research and education. We create leading innovations in aerospace.

Scientific excellence and professionalism guide us in all that we do. Our research helps satisfy society’s need for mobility – both today and in the future. We focus on environmental sustainability, safety, and efficiency.

We direct the results of our research toward industry, science, and society. Our education is aimed at highly qualified engineers who are enthusiastic about aerospace.

Joining together the broad areas of expertise from the TU Braunschweig and the German Aerospace Centre gives us a particular appeal, along with international visibility.

Together we have all the skills needed to create technical innovations for aircraft and air transportation. These we develop with a holistic view toward of the system.

We offer the complete spectrum, from basic research to application-based technical development and testing. The results keep our education and training on the cutting edge.

The Campus Research Airport is building on an 80-year tradition of aeronautical research and flight testing in Braunschweig. We have an infrastructure that is unique internationally, with research aircraft, wind tunnels, simulators, and test facilities. Award-winning scientists and motivated students ensure top-level research.