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DLR – DAAD Fellowships

Fellowship No. 669

Research Area : Aeronautics

Research Topic: **Non-Intrusive Measurement Techniques for Hypersonic Flow Characterization**

DLR Institute: German Aerospace Center,
Institute of Aerodynamics and Flow Technology, Spacecraft Department
Göttingen

Location: Germany

Position: Postdoctoral Fellow

Openings: 1

Job Specification: The High Enthalpy Shock Tunnel Göttingen (HEG) is a free piston driven shock tunnel commissioned for use in 1991. It is extensively used in a large number of national and international space and hypersonic flight activities and thus is one of the major hypersonic laboratories in Europe. The research activities at HEG are strongly linked to computational fluid dynamics as well as the development of measurement techniques. The scope of the studies covers for instance generic aerodynamic configurations, fundamental aspects of high enthalpy flows, complex hypersonic flight configurations, integrated scramjet configurations and hypersonic boundary layer transition and transition control strategies.

The technique of Focused Laser Differential Interferometry (FLDI) was successfully applied to hypersonic flows in order to investigate high frequency boundary layer instabilities as well as shock boundary layer interactions in fully turbulent hypersonic flows in HEG. FLDI is an optical technique for the detection of density fluctuations in transparent media. It has gained attention in the hypersonic research community in the recent years, due to its remarkably high bandwidth and its ability to reject high-frequency noise away from the foci. It is therefore a powerful tool to probe the smallest scales of flow field structures, relevant to boundary layer

transition and turbulence investigations. The FLDI setup currently operational at HEG is composed of six independent probes, realized by means of a custom-made diffractive optical element. The successful applicant will mechanically and optically advance the existing setup to allow tests in different hypersonic wind tunnels studying the spectral distribution and evolution of free-stream disturbances in a wide range of Mach and Reynolds numbers. The work will result in a unique free-stream disturbance map.

A second focus of the postdoctoral research activity is the Design and realization of a Tunable Diode Laser Absorption Spectroscopy (TDLAS) setup for flow diagnostics in HEG. The activity primarily supports the calibration of the free-stream conditions in HEG by providing additional, independent information on the flow field. TDLAS is an optical measurement technique suitable for use in harsh test environments such as impulse facilities. The technique uses a narrow-line width monochromatic diode laser as light source which is tuned over the characteristic absorption lines of the target species. Apart from species concentration the technique can be used to determine gas temperature, pressure and velocity.

Required Qualification: PhD in Aerospace Engineering, Physics or related fields

Advantageous Skills: background in experimental hypersonic testing, experience in applied optics

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

Earliest Start Date: 15th of January 2025

Application Deadline: **31st of October 2024**

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

More information may be obtained by contacting:

Dr. Alexander Wagner (Alexander.Wagner@dlr.de)

Thank you for your attention!
We look forward to receiving your application!