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

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. 616

Research Area : Aeronautics

Research Topic: **Integration of the nested hp-multigrid method into the next-generation CFD software by ONERA, DLR, Airbus (CODA)**

DLR Institute: Institute for Aerodynamics and Flow Technology, DLR Braunschweig

Position: Postdoctoral Fellow

Openings: 1

Job Specification: Numerical simulation is a crucial key technology for the complete digital description and design of aircraft. The availability of multi-disciplinary simulation tools is therefore a key point on the way to the virtual product. Computational Fluid Dynamics (CFD) plays a central role in this context from an aerodynamics perspective. Since high-precision methods in CFD lead to a particularly high computational effort, the efficiency of these methods is of crucial importance.

Higher-order Discontinuous Galerkin (DG) methods are now being considered for industrial applications due to their potential of superior performance – compared to its equivalent 2nd order methods – in a certain class of aeronautical problems, such as aero-acoustics or highly detached flows. In order to exploit this potential for use in industrial or industry-relevant problems, efficient numerical methods for the non-linear solution process are needed. Methods to accelerate and stabilize an iterative solution process are non-linear multigrid methods. The acceleration due to multigrid methods basically results from solving the given problem for coarsened discretizations. The coarsened solutions are then used during the iterative process to smooth the solutions of the finer level problems. Two different types of coarsening strategies can be applied in the DG case. Based on either lower-order discretizations or agglomerated coarse grids, the resulting algorithms can be characterized as either p- or h-multigrid, respectively. The strategies can be combined to a nested hp-

multigrid method, for which the one multigrid method is used on the coarsened levels of the other.

The CFD software by ONERA, DLR, Airbus (CODA) is being developed as part of a collaboration between the French Aerospace Lab ONERA, the German Aerospace Center (DLR), Airbus, and their European research partners. CODA provides several higher-order DG discretizations. A prototype of a nested hp-multigrid method for DG based on a modal basis of orthonormal functions has been implemented in the environment of CODA and has shown the potential of the method to increase robustness and efficiency of the iterative solution process for basic verification test-cases.

The focus of the offered position is on assessing the hp-multigrid prototype of CODA for industry-relevant problems, identifying and developing potential improvements, and integrating the nested hp-multigrid method into CODA based on the existing prototype.

The duration of the fellowship is max. 12 month.

Required Qualification: DLR looks for a person with experience in developing and applying CFD software for aerodynamic problems (i.e. higher-order discretization methods; robust, efficient and scalable non-linear solver algorithms), e.g. obtained during the PhD or dedicated project work. A substantial working knowledge in C++ is essential.

Advantageous Skills: Experience in software development in a team and in C++ template metaprogramming is preferred.

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

Earliest Start Date: 01.01.2024

Application Deadline: Until position filled

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