Job Reference

337_19_CASE_PNM_R2

Position

Researcher to support the High-Fidelity LES/DNS Data for Innovative Turbulence Models H2020 project (R2)

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Divendres, 31 Gener, 2020
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About BSC

The Barcelona Supercomputing Center - Centro Nacional de Supercomputación (BSC-CNS) is the leading supercomputing center in Spain. It houses MareNostrum, one of the most powerful supercomputers in Europe, and is a hosting member of the PRACE European distributed supercomputing infrastructure. The mission of BSC is to research, develop and manage information technologies in order to facilitate scientific progress. BSC combines HPC service provision and R&D into both computer and computational science (life, earth and engineering sciences) under one roof, and currently has over 650 staff from 49 countries.

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Context And Mission

The present research effort is part of the H2020 project HiFiTurb. Hereafter a summary of the context of the project is given.

The unremitting, most significant challenge in all areas of applied fluid dynamics (covering aerospace, energy and propulsion, automotive, maritime industries, chemical process industries and many more) is posed by a lack of understanding and thus poor prediction of turbulence-dependent features and laminar-to-turbulent transition. Amongst a number of important adverse consequences of defects in representation of
turbulence is that the optimal design and analysis of industrial equipment cannot be relied upon to be accurate or even valid in challenging flow conditions, such as separation, swirling 3D flows, corner vortices. Improving the capabilities of models when predicting these complex fluid flows, offers the potential of reducing energy consumption of aircraft, cars, and ships, with consequent reduction in emissions and noise. The inevitable result is a major impact on environmental factors as well as on economy and industrial leadership in the highly competitive global markets. Hence, the ability to understand, model and predict turbulence and transition phenomena is the key requirement in the design of efficient and environmentally acceptable fluids-based energy transfer systems.

Against this background, the recent granted H2020 HiFiTurb sets out a highly ambitious and innovative programme of work designed to address influential deficiencies in advanced statistical models of turbulence. The removal of these deficiencies is an unconditional requirement for reducing the limitations of the use of Computational Fluid Dynamics (CFD) in aeronautics and extending significantly the range of conditions that can be predicted with confidence within an aircraft flight envelope. In a recent Airbus study listing about 30 different applications considered for CFD predictions, only around 30% are frequently treated by CFD simulations, indicating an acceptable level of confidence. The remaining applications, indicating poor, or at least minimal, industrial confidence in CFD with regard to current capabilities cover flow detachment (stall), separation in high-load conditions and behind shocks, shock-boundary layer interactions, buffet, and transient loads causing substantial structural deformations due to strong gusts, atmospheric turbulence and extreme aircraft manoeuvres. In addition, the utility and effectiveness of optimisation techniques, designed to evolve optimum fullaircraft configurations, critically depends on the accuracy of the flow predictions. These limitations are due to significant weaknesses of present turbulence and transition models, which are unable to predict separated and complex 3D flows with sufficient reliability.

The ambition of the HiFiTurb project is to evolve a new generation of reliable anisotropy-resolving turbulence models, able to predict accurately separated and vortical flows for the European aeronautics industry to be used in RANS and Hybrid RANS-LES methods – forming the CFD backbone in industry. With the innovative and ambitious objectives and goals of the HiFiTurb project, using for the first time large and highly-refined LES/DNS data bases in a systematic manner, including the innovative use of AI and big-data technologies for feature detections towards new/improved turbulence models, the present gaps of capabilities in modelling challenging conditions within the flight envelop will be largely removed. It must be noticed that the turbulence models will not be improved by re-setting or introducing new parameters (e.g. by using optimisation tools), but by investigating newly to be detected and well-resolved physics, avoiding any up- and downscaling of coefficients. The collection of new reliable interrelations of all the physical quantities that are relevant to anisotropy-resolving formulations will be saved permanently on the Open ERCOFTAC Knowledge Base, available worldwide for further investigations, beyond the duration of the HiFi-TURB project. Thus, the project will pave the way to a reliable use of RANS and wall-modelled LES approaches in a future automated industrial simulation environment.

The selected researcher will work around HiFi-Turb activities focusing in the development of novel non-equilibrium wall models for LES by means of ML.

Key Duties

- To develop ML algorithms in order to identify relevant correlations for RANS and wall modelling for LES inspecting DNS data.
- To develop new wall models using IA and DNS data.
- To validate WMLES by direct comparison with experimental data in industry relevant conditions.
- To interact with the different partners of the H2020 HiFi-Turb project and help on BSC activities.
Requirements

- **Education**
  - Bachelor/BSc Mechanical/Aerospace Engineering
  - Master/MSc on Data Analytics
  - PhD in Data Analytics/Aerospace Engineering (will be valued)

- **Essential Knowledge and Professional Experience**
  - CFD knowledge (turbulence modeling, numerical methods, experience using commercial/research packages...) at least 1 year
  - Programming in Python and Fortran at least 1 year
  - Knowledge ML algorithms and libraries at least 1 year

- **Competences**
  - English fluent
  - Knowledge ML algorithms and libraries
  - Programming in Python and Fortran
  - CFD knowledge (turbulence modelling, numerical methods, experience using commercial/research packages...)

Conditions

- The position will be located at BSC within the CASE Department
- We offer a full-time contract, a good working environment, a highly stimulating environment with state-of-the-art infrastructure, flexible working hours, extensive training plan, tickets restaurant, private health insurance, fully support to the relocation procedures
- Duration: Temporary - 29 Months renewable
- Salary: we offer a competitive salary commensurate with the qualifications and experience of the candidate and according to the cost of living in Barcelona
- Starting date: 1 January 2020

Applications Procedure

All applications must include:

- A Cover Letter with a statement of interest in English, including two contacts for further references - Applications without this document will not be considered
- A full CV in English including contact details

Deadline

The vacancy will remain open until suitable candidate has been hired. Applications will be regularly reviewed and potential candidates will be contacted.
Diversity and Equal Opportunity Employment

BSC-CNS is an equal opportunity employer committed to diversity and inclusion. We are pleased to consider all qualified applicants for employment without regard to race, color, religion, sex, sexual orientation, gender identity, national origin, age, disability or any other basis protected by applicable state or local law.

This position is reserved for candidates who meet the requirements and have the legal status of disabled persons with a degree of disability equal to or greater than 33%. In case there are no applicants with disabilities that meet the requirements, the rest of the candidates without declared disability will be evaluated.

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