Job Reference

573_23_CASE_LSCFD_R1

Position

Machine-learning based non-equilibrium LES wall models (R1)

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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, was a founding and hosting member of the former European HPC infrastructure PRACE (Partnership for Advanced Computing in Europe), and is now hosting entity for EuroHPC JU, the Joint Undertaking that leads large-scale investments and HPC provision in Europe. 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 900 staff from 55 countries.

Look at the BSC experience:
BSC-CNS YouTube Channel
Let's stay connected with BSC Folks!

We are particularly interested for this role in the strengths and lived experiences of women and underrepresented groups to help us avoid perpetuating biases and oversights in science and IT research.

Context And Mission

The PhD projects aims to develop non-equilibrium wall models for complex geometries based on data driven technologies. In particular, the PhD student will work on the development of novel machine learning algorithms that can be applied to improve wall modeling on non-equilibrium situations. During the PhD, three-stages are envisioned: i) to develop reduced order models wall shear stress models based on convolutional neural networks (CNN) and recurrent neural networks (RNN); ii) to develop an in-situ post-processing and machine learning strategy for the detection of specific vorticity structures on turbulent flows.
Machine learning algorithms will be used to carry out the classification; and iii) to couple ML-ROM and feature detection algorithms with Deep Reinforcing Learning control algorithms to find novel wall models based on interactive tune near wall velocity field to obtain the desired wall shear stress instead of fixing the boundary wall shear stress like in traditional wall models.

The present PhD student will be integrated into the activities of the Large-scale Computational Fluid Dynamics group at BSC. The backbone of the Large-scale Computational Fluid Dynamics (LS/CFD) team is centred on the fact that today, the capabilities of leading-edge emerging HPC architectures are not fully exploited by industrial simulation tools. Current state-of-the-art industrial solvers do not take sufficient advantage of the immense capabilities of new hardware architectures, such as streaming processors or many-core platforms. A combined research effort focusing on novel numerical methods, more accurate physical models, algorithms and HPC application is the only way to make it possible to develop and advance simulation tools to meet the needs of the European industry. The LS/CFD team will focus on developing numerical tools, turbulence models, multi-physics algorithms, data-driven methodologies and large-scale industrial simulations.

Key Duties

- To develop ML base wall models
- To validate the developed WMLES in relevant aeronautical test cases
- To participate in the rest of the CFD activities of the LS/CFD team in CASE.

Requirements

- Education
  - MSc in computational fluid dynamics

- Essential Knowledge and Professional Experience
  - Experience in CFD development (at least 3 years)
  - Knowledge in large eddy simulation models (at least 3 years)
  - Experience in large-scale simulation at high speed (wall models for LES, complex mesh generation, industrial simulations, etc.) (at least 3 years)
  - Understanding of HPC clusters at a user level and experience programming MPI (at least 3 years)
  - Good programming level (python, C, Fortran, C++, etc.) (at least 4 years)

- Additional Knowledge and Professional Experience
  - Good writing and oral skills (English is a must)

- Competences
  - CFD development knowledge
  - Experience in large-scale CFD computations (meshing, running in HPC systems and post-processing large data sets)
  - Turbulence modelling (LES and RANS modelling, including wall modelling)
  - Experience in European projects
Conditions

- The position will be located at BSC within the CASE Department
- We offer a full-time contract (37.5h/week), a good working environment, a highly stimulating environment with state-of-the-art infrastructure, flexible working hours, extensive training plan, restaurant tickets, private health insurance, support to the relocation procedures
- Duration: Open-ended contract due to technical and scientific activities linked to the project and budget duration
- Holidays: 23 paid vacation days plus 24th and 31st of December per our collective agreement
- 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 2024

Applications procedure and process

All applications must be made through BSC website and contain:

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

In accordance with the OTM-R principles, a gender-balanced recruitment panel is formed for every vacancy at the beginning of the process. After reviewing the content of the applications, the panel will start the interviews, with at least one technical and one administrative interview. A profile questionnaire as well as a technical exercise may be required during the process. The panel will make a final decision and all candidates who had contacts with them will receive a feedback with details on the acceptance or rejection of their profile.

At BSC we are seeking continuous improvement in our recruitment processes, for any suggestions or feedback/complaints about our Recruitment Processes, please contact recruitment [at] bsc [dot] es.

For more information follow this link

Deadline

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

OTM-R principles for selection processes

BSC-CNS is committed to the principles of the Code of Conduct for the Recruitment of Researchers of the European Commission and the Open, Transparent and Merit-based Recruitment principles (OTM-R). This is applied for any potential candidate in all our processes, for example by creating gender-balanced recruitment panels and recognizing career breaks etc.

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.

For more information follow this link