PhD Position in Innovative Algorithms for Fast Accurate Computing Group (VAC-2021-18)

Title of the PhD project: Scientific Machine Learning for UAVs Path Planning

INTRODUCTION:

The International Centre for Numerical Methods in Engineering (CIMNE, www.cimne.com) is a research centre, created in 1987 by consortium between the Catalan Government and the Universitat Politècnica de Catalunya (UPC-BarcelonaTech), devoted to the development and application of numerical methods to a wide range of areas in engineering. CIMNE has been selected as a Severo Ochoa Centre of Excellence for the period 2019-2023, the highest level of recognition of excellence and leadership awarded to a research centre in Spain.

POSITION DETAILS

Number of vacancies: 1
Category: PhD (PHD2)
Location: Barcelona
Yearly salary (gross): 17.563,14 EUR
Working hours: Full time
Duration: 3 years
Starting date: No later than Sept 2021

FUNCTIONS TO BE DEVELOPED BY THE APPLICANT

CIMNE is looking for a **PhD Researcher** to be part of the Research and Technical Development (RTD) Group on *Innovative Algorithms for Fast Accurate Computing*.

The functions assigned to the candidate will be:

- Complete a PhD in the Applied Mathematics or Civil Engineering programs at the Universitat Politècnica de Catalunya – Barcelona Tech. The candidate is expected to complete the PhD thesis in a maximum of three years.

- Collaborate with various research groups within CIMNE and worldwide.

- To publish a minimum of two papers in JCR journals during the PhD period, author and co-author articles in high-impact international journals.

- Carry out quality research, training and management.

- Participate on the dissemination and outreach activities associated with the project.

- Participate in international conferences presenting her/his work.

DESCRIPTION OF THE PHD PROJECT:

Unmanned aerial vehicles (UAVs) and micro aerial vehicles are gaining increasing attention in urban environments. Several challenges arise in identifying optimal paths. Note that the conditions in which these devices operate are characterized by a large variability of the external aerodynamic forces induced by the changes in wind intensity and direction. The resulting problem thus features a large number of uncertain conditions leading to a high-dimensional parametric space to be explored with optimization routines.

This project aims to develop robust methods for the simulation of external aerodynamics of UAVs in an urban context, accounting for an uncertain and evolving environment. More precisely, the project will bridge physics-based modeling of computational fluid dynamics with machine learning and artificial intelligence solutions for the development of reliable predictions and real-time decision control and optimization.

References

Aggarwal, S., and Kumar, N., "Path planning techniques for unmanned aerial vehicles: A review, solutions, and challenges," Computer Communications, Vol. 149, pp. 270-299 (2020)

Giacomini, M., Sevilla, R. and Huerta, A. "HDGlab: An open-source implementation of the hybridisable discontinuous Galerkin method in MATLAB". To appear in Archives of Computational Methods in Engineering (2020) https://doi.org/10.1007/s11831-020-09502-5

Giacomini, M.; Borchini, L.; Sevilla, R. and Huerta, A. "Separated response surfaces for flows in parametrised domains: comparison of a priori and a posteriori PGD algorithms". To appear in Finite Elements in Analysis and Design (2020).

REQUIREMENTS

1. Strong undergraduate and MS degree (or equivalent) record in computational science and engineering, mechanics, applied mathematics or related discipline.
2. Good written and oral communication skills in English.
3. Good knowledge of numerical methods for the approximation of partial differential equations (in particular, the finite element method).
4. Knowledge of machine learning, reduced order models, computational fluid dynamics is not compulsory but will be considered an advantage.
5. Advanced programming skills (Matlab and/or Fortran).
6. Hard-working and enthusiastic attitude towards research and innovation.

EVALUATION OF CANDIDATES

The requirements and merits will be evaluated with a maximum mark of 100 points. Such maximum mark will be obtained by adding up the points obtained in the following items:

- Academic record (60%)
- Previous research and academic experience in the field of the position (20%)
- Programming skills (10%)
- Language skills (10%)

HOW TO APPLY

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the following documents **in English**:

cimne@cimne.upc.edu
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Barcelona, Spain

A Consortium of

Generalitat de Catalunya

UNIVERSITAT POLITÈCNICA DE CATALUNYA
BARCELONATECH

In cooperation with:

- Curriculum vitae
- A motivation letter
- Academic transcripts from all Undergraduate and MSc degrees
- Name and institutional contact information of two possible referees

The deadline for registration to the offer ends on 12th May, 2021 at 12 noon.

The shortlisted candidates may be called for an interview. They may also be required to provide further supporting documentation.

CIMNE is an equal opportunity employer committed to diversity and inclusion. We are pleased to consider all qualified applicants for employment without regard to race, colour, religion, sex, sexual orientation, gender identity, national origin, age, disability or any other basis protected by applicable state or local law. CIMNE has been awarded the HRS4R label.