

ANNOUNCEMENT FOR THE PROVISION OF THE WORKPLACE

VAC-2020-01 - PhD Pos.-ProTechTion- Multiscale reduced order models for viscous flow simulations (ESR#10)

Number of positions: 1

Professional Category: PhD Student

Place of Work: CIMNE Barcelona and Swansea University

Annual Gross Salary: According to MSCA-ITN Call

Working schedule: 40 hours/week

Contract type: Pre-doctoral contract

Expected duration: 36 months

Scope and functions

Computational fluid dynamics (CFD) techniques are employed on a daily basis to simulate flow problems in several industrial environments. Realistic flows in automotive and aeronautic industry imply high Reynolds numbers simulations. Therefore, turbulence modelling is in general necessary under these conditions. Efficient and robust flow solvers allowing overnight computations under realistic and industrial meaningful problems are still a challenge for today's simulation-based engineering sciences. Existing implementations experience lengthy, time-consuming and cumbersome procedures in many phases of the simulation loop. Two bottlenecks have been enduringly identified: mesh generation and solvers. The former requires a time-consuming preprocess step to generate meshes with specific properties making them suitable for computation. Typical restrictions are quasi-structured meshes, problem dependent de-featuring, curved elements, etc. This mesh generation procedures have a high cost in terms of man-hour of specialised technicians. This is especially critical when dealing with complex geometries, possibly affected by uncertainties. The latter, the flow solver, requires robustness, accuracy and efficiency. Note that, some restrictions on the discretisation are directly linked to the formulation implemented in the solver. Low-order approaches are systematically and persistently used in industry because of their robustness but lack in many occasions of the desired accuracy. In particular, in transient problems with multiscale features. High-order techniques, which allow to obtain low diffusion and low dispersion approximations, suffer from important computational overheads. In fact, turbulent industrial flows in complex geometries are a challenge for academia.

The aim of this Ph.D. thesis is to develop a novel strategy combining low and high-order approaches for turbulent flows in order to produce a competitive tool for the simulation of turbulent flows. Special attention will be devoted to the efficient implementation of the turbulence at boundary layers both for low-order (finite volumes) and high-order approximations. Applications of industrial interest will be tackled throughout the entire project.

Centre Internacional de Mètodes Numèrics a l'Enginyeria (CIMNE)

Edifici C1, Campus Nord UPC, Gran Capità s/n, 08034, Barcelona – Telèfon 93 401 74 95 – cimne@cimne.upc.edu

Obligations of ESRs

- Completion of the PhD programme.
- Be highly committed with quality research, training and management. The successful candidate is expected to become a future leader on the development and application of advanced computational methods for industry.
- Take part of the mobility programme both in academia and industry.
- Participate on the dissemination and outreach activities associated to the project.
- Attend international conferences and present the research undertaken.
- Contribute to the writing of articles in high impact international journals.

Required skills:

Prerequisites

- To have a strong undergraduate and MSc degree (or equivalent) in Engineering, Mathematics, Physics or a related field and a good level of English.
- To have an enthusiastic attitude to conduct research, being hard-worker and critic.
- To demonstrate knowledge of some programming languages such as Matlab and/or Fortran and/or C/C++.
- To have some experience with numerical (finite element/finite volume) methods.

Eligibility

- Applicants shall, at the time of recruitment by CIMNE, be in the first four years (full-time equivalent research experience) of their research careers and have not been awarded a doctoral degree. Full-Time Equivalent Research Experience is measured from the date when a researcher obtained the degree, which would formally entitle him/her to embark on a doctorate, irrespective of whether or not a doctorate is or was ever envisaged.
- At the time of recruitment by the host organisation, researchers must not have resided or carried out their main activity (work, studies, etc.) in SPAIN for more than 12 months in the 3 years immediately prior to the reference date.

Selection Procedure

1- Shortlisting of the candidates. The first phase of the selection procedure is a shortlisting of the candidates to be interviewed. This process is based on the information and documentation provided by candidates and done by the coordinator. At least two members of the Supervisory Board are involved in the ranking of the candidates using following criteria:

Data	Range
DC Degree classification (marks)	Normalized. 0
DI Degree. Recognition of awarding	0 to 1
MC Master classification (marks)	Normalized 0 to
MI Master. Recognition of awarding	0-1
MR Relevance of master	0, 0.5, 0.95, 1
CV Curriculum Vitae	0, 0.5, 1
L Motivation Letter	0, 0.5, 1
R Recommendation Letter	0, 0.5, 1

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The ranking is build based on the following formula:

$$\text{Ranking} = \text{DC} \cdot \text{DI} \cdot 20 + \text{MC} \cdot \text{MI} \cdot \text{MR} \cdot 35 + \text{CV} \cdot 20 + \text{L} \cdot 10 + \text{R} \cdot 15$$

The evaluation of each one of these fields is as follows:

- **Degree and Master marks** are taken from application form and checked against transcripts
- **Institutions recognition** are provided by Swansea.
- **Relevance of the Master** is marked as follows:
 - Value 1: Computational Mechanics or most courses related to CM
 - Value 0.95: Mechanical/Civil/Aeronautical/Applied Math
 - Value 0.5: Any other STEM¹ not listed above
 - Value 0: not STEM.
- **Curriculum Vitae** are marked as follows: default value is 0.5. Value is increased or decreased based on any positive/negative aspects. Take into account
 - Relevance of the followed master courses
 - Adequacy of candidate profile for the programme
 - Work experience
 - Academic experience
 - Activities since master award
- **Motivation Letter.** Default 1. Value is decreased for negative aspects: not mentioning any relevant topic, using a generic letter, etc.
- **Recommendation Letter.** Default 0. If know professor in the field 1.

Second round of interviews. Second round of interviews could be needed.

Closing date:

The deadline for registration to the offer ends on February 8, 2020 at 12 noon.

How to apply:

Candidates must complete the "Application Form" form on our website, indicating the reference of the vacancy and attaching the required documents.

¹ Science, Technology, Engineering, Mathematics