

PhD Position in Fluid mechanics (VAC-2021-33)

Title of the PhD project: hp-stabilized finite element methods for the convection-diffusion-type problems: a priori and a posteriori estimates and mesh adaptivity

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 Fluid mechanics.

The functions assigned to the candidate will be:

- Complete a PhD on Civil Engineering at 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:

Most of the work on stabilized finite element approximation of convection-diffusion problems has been restricted to h-refinement. The objective of this research would be to analyze hp-refinement strategies and to analyze their combination with high order time integration schemes. The theoretical framework would be the Variational Multiscale (VMS) concept. This should serve to motivate a posteriori error estimates based on the sub-grid scales, and from these estimates designing adaptive strategies. This work is intended to be fundamental in nature, filling theoretical gaps of the current knowledge, although there are numerous applications. In particular, the transport of contaminants with buoyancy effects is intended to be the target application.

References

For preliminary results on hp estimates:

- On hp convergence of stabilized finite element approximations of the convection-diffusion equation, Ramon Codina, SeMA Journal, Vol. 75 (2018), 591-606.

For a posteriori estimates based on the VMS concept:

- A posteriori error estimates in a finite element VMS-based reduced order model for the incompressible Navier-Stokes equations, Ramon Codina, Ricardo Reyes and Joan Baiges, Mechanics Research Communications, in press.

REQUIREMENTS

1. Candidates should have an excellent background in numerical methods, mathematical analysis, partial differential equations and continuum mechanics.
2. Good programming skills are also required.
3. A good command of English.

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**:

- 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 23rd April, 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.