PhD Position in Flumen Institute and Kratos Research Group (VAC-2021-19)

Title of the PhD project: Accelerated Tools for 2D and 3D Numerical Modelling of Sediment Transport and Morphology Evolution in Rivers and Reservoirs. Case Study of Lower Ebro River.

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) at **Flumen Institute** and **Kratos Research Group**.

The functions assigned to the candidate will be:

- Complete a PhD in the PhD Programme un 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, namely with other groups in University of Padova, with the team of Virginia Ruiz-Villanueva in the School of Geosciences and the Environment of the University of Lausanne, and with the team of Guillaume Piton in INRAE, University of Grenoble Alps.

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A Consortium of

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In cooperation with:

- 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:

Numerical methods are useful tools for the prediction and analysis the evolution of rivers morphology, and their capacity to transport bedload and suspended sediment. A 2D approach is suitable for rivers, while for the transit of sediments through reservoirs 3D models are required because of the hydrodynamic patterns in this water bodies, especially in Mediterranean areas where stratification and mixing processes alternate every year. In altered rivers which are in no equilibrium, sediment transport processes and the effect of upstream alterations, as can be the case of Ebro River downstream of Riba-roja Reservoir, need years or decades to make their effects visible. This, in long river reaches, like the one mentioned above, means a high computational cost which makes it difficult for existing tools to deal with such problems. Additionally, there exist very few 3D models capable of simulating sediment transport through reservoirs, and because of the three dimensionality of the phenomenon, all them under a very high computational cost.

The objectives of the thesis will be: 1) acceleration by means of HPC GPU based computing of existing 2D codes for sediment transport in rivers (based on Iber model), 2) construction of accelerated codes for 3D modelling of sediment transport in reservoirs (based on Kratos), 3) application of the above tools to first analyse management alternatives for enhancing sediment transport through Ebro River reservoirs and 4) characterize the sediment dynamics (bedload and suspended) of lower Ebro River.

The thesis will benefit from the extensive data of the dynamics of the reservoirs and Ebro river already available in Flumen Institute, and data being acquired at present under our supervision.

References

Bladé Castellet, E., Sánchez-Juny, M., Arbat Bofill, M., and Dolz Ripollés, J. (2019). Computational Modeling of Fine Sediment Relocation Within a Dam Reservoir by Means of Artificial Flood Generation in a Reservoir Cascade." Water Resources Research, 55(4), 3156–3170.

Iaconeta, I., Larese, A., Rossi, R., and Guo, Z. (2017). "Comparison of a Material Point Method and a Galerkin Meshfree Method for the Simulation of Cohesive-Frictional Materials." Materials, 10(10), 1150.

Liro, M., Ruiz-Villanueva, V., Mikuś, P., Wyżga, B., and Bladé Castellet, E. (2020). "Changes in the hydrodynamics of a mountain river induced by dam reservoir backwater." Science of the Total Environment, Elsevier B.V, 744, 140555.

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REQUIREMENTS

1. Masters in Civil Engineering or Mathematical Engineering or Computational Mechanics or Computational Engineering.
2. Experience in developing code for numerical methods will be a plus.
3. Good written and oral communication skills in 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 31st 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.

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