Offer #2024-07928

Development of Numerical Methods for dispersive free surface flows in an applicative framework

Contract type : Fixed-term contract

Level of qualifications required : Graduate degree or equivalent

Fonction : Temporary scientific engineer

Level of experience : From 3 to 5 years

About the research centre or Inria department

The Inria center at the University of Bordeaux is one of the nine Inria centers in France and has about twenty research teams.. The Inria centre is a major and recognized player in the field of digital sciences. It is at the heart of a rich R&D and innovation ecosystem: highly innovative SMEs, large industrial groups, competitiveness clusters, research and higher education players, laboratories of excellence, technological research institute...

Context

This project is a part of the ANR project LAGOON and the regional PSGAR project CORALI. The selected candidate will have to implement numerical strategies to deal with dispersive free surface models, in the Uhaina software. The Uhaina software, based on the Aerosol library (C++, parallelized, Discontinuous Galerkin Runge Kutta (DG-RK) scheme), aims at constructing a platform for the simulation of near shore hydrodynamics.

Assignment

Two improvements of the current scheme will be implemented. First we will focus on an Explicit-Implicit (ImEx) scheme do deal with low-Froude regime [4]. At low-Froude regime, the classical scheme becomes very diffusive and the CFL condition is very restrictive. ImEx schemes are ideal for this purpose. Secondly, we will implement dispersive source terms in the software. Dispersive models are an improvement on the well-known hyperbolic model for shallow waters, to give a better estimate of wave propagation speeds. Several numerical strategies are currently described in the literature: pseudo-compressible [1], elliptic source term [2], prediction-correction [3]. We will focus on a prediction-correction method based on projection of a linear subspace. First-order and second-order schemes will be implemented.

References

[1] N. Favrie and S. Gavrilyuk. A rapid numerical method for solving Serre–Green–Naghdi equations describing long free surface gravity waves. Nonlinearity, 30(7):2718, 2017.

[2] M. Kazolea, A. G. Filippini, and M. Ricchiuto. Low dispersion finite volume/element discretization of the enhanced Green–Naghdi equations for wave propagation, breaking and runup on unstructured meshes. Ocean Modelling, 182:102157, Apr. 2023.

[3] M. Parisot. Entropy-satisfying scheme for a hierarchy of dispersive reduced models of free surface flow. International Journal for Numerical Methods in Fluids, 91(10):509–531, 2019.

[4] M. Parisot and J.-P. Vila. Centered-potential regularization for the advection upstream splitting method. SIAM Journal on Numerical Analysis, 54(5):3083–3104, 2016

Main activities

· Implementation of updated numerical schemes of ImEx numerical scheme for shallow water model in a real-life context.

· Implementation of updated numerical schemes for Boussinesq-type models in a real-life context

· Design and run characteristic test cases for continuous integration.

· Write scientific reports

Skills

· Solid knowledge on C++ language, software version control with Git and software design.

· Solid knowledge in classical numerical scheme (for hyperbolic and/or elliptic equations).

· Basic knowledge in classical PDE.

· Taste for environmental problems, mathematical formalism and numerical simulations.

· Language: English (Speaking, writing and reading).

Benefits package

- Restauration subventionnée
- Transports publics remboursés partiellement
- Congés: 7 semaines de congés annuels + 10 jours de RTT (base temps plein) + possibilité d'autorisations d'absence exceptionnelle (ex : enfants malades, déménagement)
- Possibilité de télétravail partiel et aménagement du temps de travail
- Équipements professionnels à disposition (visioconférence, prêts de matériels informatiques, etc.)
- Prestations sociales, culturelles et sportives (Association de gestion des œuvres sociales d'Inria

Remuneration

Contrat à durée déterminée

Rémunération brute selon diplômes et expériences : de 2692 euros à 3084 euros

General Information

- **Theme/Domain :** Numerical schemes and simulations
  Scientific computing (BAP E)
- **Town/city :** Talence
- **Inria Center :** Centre Inria de l'université de Bordeaux
- **Starting date :** 2024-10-01
- **Duration of contract :** 2 years, 3 months
- **Deadline to apply :** 2024-08-31

Contacts

- **Inria Team :** CARDAMOM
- **Recruiter :**
  Parisot Martin / Martin.Parisot@inria.fr

About Inria

Inria is the French national research institute dedicated to digital science and technology. It employs 2,600 people. Its 200 agile project teams, generally run jointly with academic partners, include more than 3,500 scientists and engineers working to meet the challenges of digital technology, often at the interface with other disciplines. The Institute also employs numerous talents in over forty different professions. 900 research support staff contribute to the preparation and development of scientific and entrepreneurial projects that have a worldwide impact.

Warning : you must enter your e-mail address in order to save your application to Inria. Applications must be submitted online on the Inria website. Processing of applications sent from other channels is not guaranteed.

Instruction to apply

Les candidatures doivent être déposées sur le site jobs.inria.fr avec les documents suivants :

- CV détaillé
- lettre de motivation
- lettre(s) de recommandation si vous en avez.

Defence Security :
This position is likely to be situated in a restricted area (ZRR), as defined in Decree No. 2011-1425 relating to the protection of national scientific and technical potential (PPST).Authorisation to enter an area is granted by the director of the unit, following a favourable Ministerial decision, as defined in the decree of 3 July 2012 relating to the PPST. An unfavourable Ministerial decision in respect of a position situated in a ZRR would result in the cancellation of the appointment.

Recruitment Policy :
As part of its diversity policy, all Inria positions are accessible to people with disabilities.