Offer #2024-07134

Post-Doctorant F/H Modèles équivalents et méthode d'ordre réduit

Contract type : Fixed-term contract

Level of qualifications required : PhD or equivalent

Fonction : Post-Doctoral Research Visit

Level of experience : Recently graduated

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

The post-doc will be based in the Concace team, a joint venture between Cerfacs, Inria and Airbus, working on the use of modern programming techniques in HPC to produce composable software bricks. The team is at the crossroads of academic research, industrial research and end-user applications, aiming to transfer the developments made to end-users, whether Airbus or Cerfacs shareholders (Météo France, Total Energies, CNES, etc.).

Assignment

In industry in general, and at Airbus in particular, numerical simulation is widely used to model the sometimes complex behavior of certain physical phenomena.To speed up calculation, we try to use the coarsest possible mesh. In some cases, however, we are obliged to mesh locally very finely to obtain a correct result (e.g. in electromagnetism around slots, wires, small structural details, etc.).

The aim of this work is to replace these meshed areas with a few "equivalent" elements, so as to find a solution to the system that is close to the reference solution. This idea, which is quite old, is known as equivalent models; these models were obtained by simplifying the initial equation under particular conditions. For example, in electromagnetic cable modeling, if the radius of the cable is very small compared to the wavelength, Maxwell's equations can be simplified to an equation that can be solved numerically with far fewer unknowns.

The idea of this work is to find these equivalent models, not by simplifying the equation but by learning the equivalent behavior from reference simulation results. Initial results in 2D suggest that this technique can be extended to 3D and for more complex models. We propose to look at models in electromagnetism (the case of closely spaced cable assemblies for which no equivalent asymptotic models are available) and acoustics (the case of acoustic radiation through a complex fluid). In both cases, simulation codes exist, and research is carried out at the algebraic level. Knowledge of solved equations or underlying physics is not a prerequisite.

This work can be approached in successive increments, starting from a particular situation and extending the generalization step by step. For example, in electromagnetism, we'll probably go through the following stages:

1. the case of an insulated cable, where we focus on the interaction of one cable segment with another. This can be compared with an existing equivalent model.
2. the case of 2 distant cables, where the focus will be on the interaction of one cable on another.
3. the case of a set of closely spaced cables; the question here is whether to learn a model grouping all the cables together, or whether to make the individual models interact.
4. and finally, the case protected by a raceway.

Main activities

Main activities:

- Bibliography and understanding of existing algorithms;
- Programming, testing and validating new methods;
- Carrying out industrial tests;
- Writing documentation, scientific reports and research articles;
- Presentations as part of the CONCACE project and at scientific conferences.

Additional activities if desired: teaching, internship supervision.

Skills

Technical skills and level required: 5 years or more of higher education or equivalent, master's degree or engineering diploma + doctorate in applied mathematics or scientific computing.

Languages: the working language will be French or English, but English will be used frequently (with non-French-speaking team members/collaborators and written communication).

Interpersonal skills: enjoy working and interacting in a collaborative research environment, demonstrate curiosity and creativity.

Additional skills: writing scientific articles and public presentation of results.

Benefits package

- Subsidized meals
- Partial reimbursement of public transport costs
- Leave: 7 weeks of annual leave + 10 extra days off due to RTT (statutory reduction in working hours) + possibility of exceptional leave (sick children, moving home, etc.)
- Possibility of partial teleworking and flexible organization of working hours
- Professional equipment available (videoconferencing, loan of computer equipment, etc.)
- Social, cultural and sports events and activities
- Access to vocational training
- Social security coverage

Remuneration

gross monthly salary : 2788€ (before social security charges and income tax deduction)

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 :** 2024-04-01
- **Duration of contract :** 2 years
- **Deadline to apply :** 2024-06-30

Contacts

- **Inria Team :** CONCACE
- **Recruiter :**
  Benjamin Pierre / pierre.benjamin@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.

The keys to success

Candidates should be interested in digital sciences, numerical analysis, linear algebra and machine learning techniques. Working in a team, both locally and remotely, will be part of the daily routine of this job.

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

PLease send the following documents :
- CV
- Cover letter
- Support letters

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.