2022-05513 - High performance computing for the study of nanoscale light-matter interactions

Contract type: Fixed-term contract
Renewable contract: Yes
Level of qualifications required: Graduate degree or equivalent
Other valued qualifications: Theses
Function: Temporary scientific engineer
Level of experience: Recently graduated

About the research centre or Inria department

The Inria Sophia Antipolis - Méditerranée center counts 37 research teams and 9 support departments. The center’s staff (about 600 people including 400 Inria employees) is composed of scientists of different nationalities (250 foreigners of 50 nationalities), engineers, technicians and administrators. 1/3 of the staff are civil servants, the others are contractual. The majority of the research teams at the center are located in Sophia Antipolis and Nice in the Alpes-Maritimes. Six teams are based in Montpellier and a team is hosted by the computer science department of the University of Bologna in Italy. The Center is a member of the University and Institution Community (ComUE) “Université Côte d’Azur (UCA)”.

Context

Atlantis is a joint project-team between Inria and the Jean-Alexandre Dieudonné Mathematics Laboratory at Université Côte d’Azur. The team gathers applied mathematicians and computational scientists who are collaboratively undertaking research activities aiming at the design, analysis, development and application of innovative numerical methods for systems of partial differential equations (PDEs) modelling nanoscale light-matter interaction problems. In this context, the team is developing the DIOGENeS [https://diogenes.inria.fr/] software suite, which implements several Discontinuous Galerkin (DG) type methods tailored to the systems of time- and frequency-domain Maxwell equations possibly coupled to differential equations modeling the behaviour of propagation media at optical frequencies. DIOGENeS is a unique numerical framework leveraging the capabilities of DG techniques for the simulation of multiscale problems relevant to nanophotonics and nanoplasmics.

Assignment

The main objective in this assignment is to further enhance the high performance computing capabilities of the numerical tools developed in the DIOGENeS software suite.

The recruited engineer will also actively participate in the studies conducted by the Atlantis team members for demonstrating the benefits of these numerical tools through the simulation of realistic and challenging use cases pertaining to various applications of nanoscale light-matter interactions. In particular, the team is now actively collaborating with potential end-users of the DIOGENeS software suite who are raising various modeling issues that need to be addressed prior to simulating such realistic use cases.

Main activities

Concretely, this will concern two components of DIOGENeS:

- On one hand, the DG-type high order finite element solvers for solving the differential models of nanophotonics. Here, the goal will be to develop GPU and multi-GPU-enabled versions of the compute intensive numerical kernels of these solvers;
- On the other hand, the inverse design workflows for mastering and enhancing the properties of nanophotonic structures and devices. Here, the goal will be to develop and implement parallelization strategies for a statistical learning-based global optimization method, which is coupled to the above-mentioned DG-type high order finite element solvers.

Skills

Candidates will hold a Master degree or a PhD degree in applied mathematics/scientific computing or computational wave physics or computational photonics.

Required skills:
- Sound knowledge of numerical analysis and development of finite element type methods for computational physics;
- A concrete experience in numerical modeling for computational electromagnetics will be an asset;
- Strong programming skills and exposure to high performance computing models (MPI, OpenMP/OpenACC, CUDA);
- Knowledge and experience of Fortran 95/2000x and Python programming languages;
- Fluent spoken and written English.

Benefits package
• Subsidised catering service
• Partially-reimbursed public transport
• Social security
• Paid leave
• Flexible working hours
• Sports facilities

Remuneration
From 2652 euros gross monthly (according to degree and experience)