



**Offer #2024-08162**

## **Post-Doctoral Research Visit F/M Adaptive finite element computations for time-dependent wave propagation problems with dynamic meshes**

**Contract type** : Fixed-term contract

**Level of qualifications required** : PhD or equivalent

**Other valued qualifications** : none

**Fonction** : Post-Doctoral Research Visit

### **About the research centre or Inria department**

The Inria University of Lille centre, created in 2008, employs 360 people including 305 scientists in 15 research teams. Recognised for its strong involvement in the socio-economic development of the Hauts-De-France region, the Inria University of Lille centre pursues a close relationship with large companies and SMEs. By promoting synergies between researchers and industrialists, Inria participates in the transfer of skills and expertise in digital technologies and provides access to the best European and international research for the benefit of innovation and companies, particularly in the region.

For more than 10 years, the Inria University of Lille centre has been located at the heart of Lille's university and scientific ecosystem, as well as at the heart of Frenchtech, with a technology showroom based on Avenue de Bretagne in Lille, on the EuraTechnologies site of economic excellence dedicated to information and communication technologies (ICT).

### **Context**

Accurate simulations of wave propagation phenomena are of central interest in many areas of physics and engineering. Finite element and discontinuous Galerkin methods have become very popular to perform such simulations, due to their ability to handle complex propagation media.

The goal of this postdoctoral fellowship is to improve the reliability and efficiency of these discretization methods through the use of a posteriori error estimators and adaptive mesh refinements.

The postdoctoral fellowship takes place in the context of the APOWA project, funded by the French national research agency ANR. The APOWA project is concerned with the design of error estimators and adaptive schemes for time-dependent wave propagation problems. The postdoctoral fellow will be tasked with one research axis of the project: the design of a posteriori error estimators for semi-discrete schemes with dynamic meshes.

### **Assignment**

A posteriori error estimation for wave propagation is very involved. A novel approach to a posteriori error estimation of finite element discretizations of time-dependent wave propagation problems has been recently introduced and will be the main line of investigation of the postdoctoral research program.

Currently, this approach is limited to static meshes, which can be adapted in space but are fixed in time. However, to deliver optimal performance, adaptive schemes require dynamic meshes that are allowed to change as the wave propagates through the computational domain. The goal of the postdoctoral project is therefore to develop a posteriori error estimators that are able to handle dynamic meshes.

### **Main activities**

1. The first objective of postdoctoral project is to extend the analysis currently limited to static meshes to the case of dynamic meshes, and illustrate the theoretical results with a one-dimensional implementation.
2. The postdoctoral fellow will then be asked to implement the error estimator and simple adaptive schemes in a two-dimensional setting.
3. As a third goal, the theoretical analysis of adaptive schemes for dynamic meshes will be targeted. Libraries including basic routines for the management of meshes and finite element basis functions will be provided for the implementation tasks.

### **Skills**

- A strong background in analysis of finite element methods is mandatory.
- A priori knowledge in wave propagation problems and a posteriori error estimation is desired.

## 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 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

2 788€ gross per month

## General Information

- **Theme/Domain** : Numerical schemes and simulations  
Scientific computing (BAP E)
- **Town/city** : Villeneuve d'Ascq
- **Inria Center** : [Centre Inria de l'Université de Lille](#)
- **Starting date** : 2025-01-01
- **Duration of contract** : 1 year, 6 months
- **Deadline to apply** : 2024-10-31

## Contacts

- **Inria Team** : [RAPSODI](#)
- **Recruiter** :  
Chaumont-frelet Theophile / [Theophile.Chaumont@inria.fr](mailto:Theophile.Chaumont@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

### 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.