# Offer #2025-08967

# Post-Doctoral Research Visit F/M Job Opportunity: Engineer / Postdoctoral Researcher / Master's Graduate in Applied Mathematics and Biomedical Engineering

**Contract type :** Fixed-term contract

**Level of qualifications required :** Graduate degree or equivalent

**Fonction :** Post-Doctoral Research Visit

**Level of experience :** From 3 to 5 years

## 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).

# Assignment

**Assignments :**

With the help of the multidisciplinary research team at DEFROST/INRIA team, the recruited person will be taken to develop and validate a digital twin for the surgical insertion of an active cochlear implant, optimizing its design and enabling automated insertion techniques.

**For a better knowledge of the proposed research subject :**

For a better knowledge of the proposed research subject: A state of the art, bibliography, and scientific references are available at the following URL: https://www.defrost.inria.fr/research/research-axes/, do not hesitate to explore our team's work on biomechanical modeling, soft robotics, and digital twin development for cochlear implant insertion. Additional resources, including relevant publications and project documentation, can be accessed here : https://www.defrost.inria.fr/research/publications/.

**Collaboration :**
You will collaborate with a multidisciplinary team of researchers, biomedical engineers, and clinicians specializing in cochlear implant technology and surgical robotics. This role offers a unique opportunity to contribute to cutting-edge research with direct medical impact, including the potential to develop an operational prototype for preclinical testing. You will also have access to state-of-the-art facilities for simulation and experimental validation.

**Responsibilities :**

1. Code Integration with Simulation Platform:
- Adapt and integrate existing biomechanical modeling code into the SOFA master platform (or equivalent) for real-time simulation of cochlear implant insertion.
- Ensure compatibility with multiphysics simulation frameworks for fluid-structure and electromechanical interactions.

2. Modeling and Stabilization of Biomechanical Interactions:
- Develop and refine Cosserat-based models (or similar) to simulate the active deformation of the cochlear implant and its interactions with cochlear anatomy.
- Identify and resolve instabilities in the model, particularly during dynamic actuator control and contact with cochlear tissues.

3. Prototyping and Validation:
- Contribute to the design of a functional prototype of the active cochlear implant and its insertion system.
- Validate the digital twin through experimental tests in artificial cochlear models and cadaveric specimens, ensuring model accuracy and practical feasibility.

4. Optimization and Automation:
- Use the digital twin to optimize implant design (e.g., actuator placement, material properties) and insertion strategies.
- Develop control algorithms for real-time actuator adjustment, paving the way for automated insertion techniques.

## Main activities

Main activities :

1. Develop and refine biomechanical models (e.g., Cosserat-based) to simulate the active deformation of a cochlear implant and its interaction with cochlear anatomy.
2. Integrate and optimize simulation code into the SOFA platform for real-time modeling of implant insertion dynamics.
3. Identify and resolve algorithmic instabilities in the digital twin during actuator-driven deformations and tissue interactions.
4. Validate models and simulations through experimental tests using artificial cochlear models and cadaveric specimens.
5. Design and test control algorithms to optimize actuator performance and explore automated insertion techniques.

## Skills

**Additional Requirements for Postdoctoral Candidates:**

- **Scientific Communication:** Proven ability to read, write, and present scientific papers in international journals and conferences.
- **Bridging Theory and Practice:** Skill in translating theoretical models into practical, clinically relevant solutions.
- **Interdisciplinary Problem Solving:** Ability to integrate knowledge from applied mathematics, biomechanics, and medical engineering.

## 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

2788 € monthly gross salary

## General Information

- **Theme/Domain :** Robotics and Smart environments
  Scientific computing (BAP E)
- **Town/city :** Villeneuve d'Ascq
- **Inria Center :** Centre Inria de l'Université de Lille
- **Starting date :** 2026-01-01
- **Duration of contract :** 12 months
- **Deadline to apply :** 2025-07-16

## Contacts

- **Inria Team :** DEFROST
- **Recruiter :**
  Adagolodjo Yinoussa / yinoussa.adagolodjo@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

**Required Skills:**

- Strong expertise in applied mathematics, particularly in modeling complex systems (e.g., Cosserat models, finite element methods, or multiphysics

simulations).

- Advanced programming skills in C++ and/or Python, with experience in simulation frameworks (e.g., SOFA, COMSOL, ANSYS).
- Knowledge of biomechanical systems and medical applications, particularly in otology or soft robotics, is highly desirable.
- Problem-solving skills with the ability to propose innovative solutions to challenges in implant design and insertion.
- Familiarity with experimental validation techniques (e.g., force measurements, imaging-based verification).

**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 your CV and cover letter

**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.