



**Offer #2025-08893**

## **Post-Doctoral Research Visit F/M Modern Grant-Free Access Techniques for Cellular Networks (Theory and Experimentation)**

**Contract type :** Fixed-term contract

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

**Fonction :** Post-Doctoral Research Visit

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

The Inria Saclay-Île-de-France Research Centre was established in 2008. It has developed as part of the Saclay site in partnership with **Paris-Saclay University** and with the **Institut Polytechnique de Paris** .

The centre has [40 project teams](#), 32 of which operate jointly with Paris-Saclay University and the Institut Polytechnique de Paris; Its activities occupy over 600 people, scientists and research and innovation support staff, including 44 different nationalities.

### **Context**

This post-doctoral position is part of the [PEPR Future Networks](#), and its [PERSEUS](#) project. PERSEUS focuses on the technologies, processing and optimization of next-generation cellular cell-free networks. This includes the development of robust physical and MAC layers and the proofs of concept for the practical assessment of the performance of selected algorithms.

The position will be based at Inria Saclay, with expected collaboration with other sites and partners. The start and end dates are flexible, subject to administrative

constraints, and the contract is for 12 months.

## Assignment

The proposed position will focus on the development of grant-free access techniques for IoT applications.

One common communication scenario in IoT applications is massive machine-type communications (mMTC), where a large number of devices transmit sporadic, small packets. In traditional cellular systems, each device is allocated orthogonal resources prior to uplink transmission via a grant mechanism. However, this allocation requires signaling on control channels, which can exceed the data payload size and lead to inefficient resource use. Consequently, grant-free methods [1] that eliminate or reduce control traffic are well suited for these scenarios. Removing coordination introduces non-orthogonality, resulting in the superposition of signals from some or all devices.

A recent family of random access protocols—sometimes called "modern random access"—aims to address and even exploit this phenomenon. The IRSA protocols (Irregular Repetition Slotted ALOHA) [2,3,4] use Successive Interference Cancellation (SIC) and represent one form of grant-free technique, but they can also operate with any packet transmission scheme. Adapting these methods for grant-free mMTC in cellular networks is therefore of prime interest and the main objective of this position.

## Main activities

The initial research direction in this post-doctoral position is to study variants of modern random access, incorporating realistic physical-layer features and methods (e.g., [5]), including cell-free systems.

Our main objectives are to enhance performance and practicality in cellular networks. IRSA-based protocols can operate with any modulation scheme, including existing transmission techniques, and do not necessarily require NOMA features such as advanced multi-user detection. However, they can benefit from NOMA methods that improve SIC.

We are particularly interested in improving the selection of transmission opportunities (e.g., using precomputed sequences), possibly constructed with machine learning techniques. We could also consider lightweight node synchronization to reduce signal superposition.

An important aspect is that we plan to do actual experiments on the [CortexLab](#) platform in INSA/Inria Lyon using available software.

[1] Muhammad Basit Shahab, Rana Abbas, Mahyar Shirvanimoghaddam, and Sarah J. Johnson. "Grant-free non-orthogonal multiple access for iot: A survey.IEEE

Communications Surveys & Tutorials", ,2020.

[2] Gianluigi Liva. "Graph-Based Analysis and Optimization of Contention Resolution Diversity Slotted ALOHA." IEEE Transactions on Communications, 59(2):477–487, 2011.

[3] Clazzer, Federico, Andrea Munari, Gianluigi Liva, Francisco Lazaro, Cedimir Stefanovic, and Petar Popovski. "From 5G to 6G: Has the time for modern random access come?." arXiv preprint arXiv:1903.03063 (2019).

[4] "Modern Random Access for Grant-Free Cellular Networks,"" C. Adjih, Tutorial, [https://indo-french-seminar-6g.github.io/slides/Modern\\_Random\\_Access\\_for\\_Grant-Free\\_Cellular\\_Networks--Cedric-Adjih.pdf](https://indo-french-seminar-6g.github.io/slides/Modern_Random_Access_for_Grant-Free_Cellular_Networks--Cedric-Adjih.pdf)

[5] Saeed Alsabbagh, Cédric Adjih, Amine Adouane, and Nadjib Aitsaadi. "Optimization of Irregular Repetition Slotted ALOHA with Imperfect SIC in 5G CIoT". IEEE International Conference on Communications (ICC) 2025.

## **Skills**

- Ph. D. in Computer Science, Telecommunications, Electrical Engineering, or a related field.
- Excellent programming skills (e.g., Python) and good knowledge of machine learning frameworks.
- Strong background in communication theory, random access, machine learning, or artificial intelligence.
- Experience in programming SDR (Software Defined Radio) is a plus.

## **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 (after 6 months of employment) 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€ gross/month

## General Information

- **Theme/Domain** : Networks and Telecommunications System & Networks (BAP E)
- **Town/city** : Palaiseau
- **Inria Center** : [Centre Inria de Saclay](#)
- **Starting date** : 2025-07-01
- **Duration of contract** : 1 year, 2 months
- **Deadline to apply** : 2025-06-30

## Contacts

- **Inria Team** : [TRIBE](#)
- **Recruiter** :  
Adjih Cédric / [Cedric.Adjih@inria.fr](mailto:Cedric.Adjih@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.