



**Offer #2024-07593**

## **PhD Position F/M Uncoordinated Multi-User Wireless Communications**

**Contract type** : Fixed-term contract

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

**Fonction** : PhD Position

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

The Inria research centre in Lyon is the 9th Inria research centre, formally created in January 2022. It brings together approximately 300 people in 16 research teams and research support services.

Its staff are distributed at this stage on 2 campuses: in Villeurbanne La Doua (Centre / INSA Lyon / UCBL) on the one hand, and Lyon Gerland (ENS de Lyon) on the other.

The Lyon centre is active in the fields of software, distributed and high-performance computing, embedded systems, quantum computing and privacy in the digital world, but also in digital health and computational biology.

### **Context**

Inria is the French national research institute for digital science and technology. At Inria, more than 3900 researchers and engineers organized in 215 project-teams, most of which are shared with major research universities, explore new paths, often in an interdisciplinary manner and in collaboration with industrial partners to meet ambitious challenges. As a technological institute, Inria supports a diversity of innovation pathways, ranging from fundamental research to the creation of technological startups.

Inria's Models and Algorithms for Reliable Communication Systems (MARACAS, <https://team.inria.fr/maracas/fr/>) team combines communication theory and information theory with statistical signal processing, control theory, and game theory to develop methods, algorithms, and experimentation for reliable communication systems. MARACAS is hosted by the CITI Lab (<https://www.citi-lab.fr/>), at the heart of the INSA Lyon (<https://www.insa-lyon.fr/en/>) campus.

Funding for this 3-year PhD position is available within the "Future Networks" national stimulus funding plan (PEPR).

### **Assignment**

The offered position focuses on the design of waveforms and channel codes for uncoordinated wireless communications, with applications to future terrestrial (6G) and non-terrestrial (satellite, UAVs) networks. An emergent class of network traffic arises from connected devices (such as autonomous cars, environmental sensors, healthcare monitoring and delivery, smart watches, connected robots) with sporadic communication needs. The development on an unprecedented scale of such traffic — characterized by small packets, sent at unpredictable times, but with strong reliability requirements — pushes the limits of current designs since the mechanisms and protocols classically used to mitigate transmission collision between simultaneously active transmitters are not efficient in the regime of many users and small payloads. The successful candidate will contribute to the design of waveforms and forward-error correction codes for wireless systems with massive-scale over-the-air contention between uncoordinated radio devices.

### **Main activities**

The goal is to create efficient approaches (in terms of spectrum and energy use, as well as decoding computational complexity) while minimizing the protocol overhead. The design methodology will start with the design of a new theoretical framework relying on probability theory, tensor algebra, and information theory. In this framework, new joint code and modulation techniques will be introduced, and robust multi-user decoding algorithms leveraging message-passing will be developed.

The role will involve devising the mathematical representation of the involved waveforms, deriving analytical performance metrics, algorithmic development, as well as writing up scientific articles and presenting the results in academic conferences.

### **Skills**

Required skills:

- a strong background (MSc level) in applied mathematics (probabilities, statistical signal processing, information theory), digital communications, or equivalent
- a taste for theoretical results
- fluent spoken and written technical english
- familiarity with scientific programming (Matlab or Python)

## 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 (90 days / year) 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
- Complementary health insurance under conditions

## Remuneration

1st and 2nd year: 2 100 euros gross salary /month

3rd year: 2 190 euros gross salary / month

## General Information

- **Theme/Domain** : Networks and Telecommunications
- **Town/city** : Villeurbanne
- **Inria Center** : [Centre Inria de Lyon](#)
- **Starting date** : 2024-09-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2024-07-19

## Contacts

- **Inria Team** : [MARACAS](#)
- **PhD Supervisor** :  
Guillaud Maxime / [maxime.guillaud@inria.fr](mailto:maxime.guillaud@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 assigned to a restricted area (ZRR), as defined in decree no. 2011-1425 relating to the protection of the nation's scientific and technical potential (PPST).

Authorisation to access a zone is issued by the head of the establishment, following a favourable ministerial opinion, as defined in the decree of 03 July 2012 relating to the PPST. An unfavourable ministerial opinion for a post assigned to a ZRR would result in the recruitment being cancelled.

### **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.