



Offer #2023-06146

PhD Position F/M Massively 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

Wireless connected devices such as smartphones, computers and TVs, autonomous cars, watches, sensors, lightbulbs and numerous sensors proliferate as our lifestyle becomes increasingly intertwined with digital services. From the point of view of communications networks, these devices give rise to a new class of data traffic, more sporadic, and for some applications requiring more stringent reliability guarantees than what classical mobile broadband can offer. In particular, the mechanisms and protocols classically used to mitigate transmission collision between randomly activated transmitters are not efficient in the new regime of many users and small payloads. A significant breakthrough was made with the introduction of the unsourced random access paradigm [P17]; one of the proposed approaches is based on the use of multi-linear spreading as a modulation, which allows convenient user separation at the receiver using tensor algebraic considerations [DLG21]. The object of the proposed study is to develop modulations and waveforms for massive multi-user wireless communications that can be applied to a wide class of propagation channels, including multipath and time-varying channels, and support asynchronous or quasi-synchronous operation.

[P17] Y. Polyanskiy, "A perspective on massive random-access," 2017 IEEE International Symposium on Information Theory (ISIT), Aachen, Germany, 2017, pp. 2523-2527

[DLG21] A. Decurninge, I. Land, M. Guillaud, "Tensor-Based Modulation for Unsourced Massive Random Access," IEEE Wireless Communications Letters, Vol. 10, No. 3, March 2021

Assignment

The successful candidate will join the MARACAS research team of Inria (<https://team.inria.fr/maracas/>), hosted by CITI Lab (<https://www.citi-lab.fr/>) in Lyon, France. MARACAS is a research group consisting of approximately 15 people within Inria and INSA Lyon. The focus of MARACAS lies in the theoretical, algorithmic and experimental aspects of communication systems, developing and applying methods in information theory, statistical signal processing and machine learning.

The offered contract is for a fixed-term 3 year position, funded by a collaborative research project, during which the candidate will work towards obtaining a Ph.D. degree. The candidate will have the opportunity to interact and collaborate with our high-profile partners from various European universities involved in the collaborative project funding the work. The candidate will be supervised by Dr. Maxime Guillaud and Prof. Jean-Marie Gorce.

Main activities

The successful candidate will perform research on the design of waveforms and channel codes suitable for massive-scale over-the-air contention between radio devices, while ensuring reliable communication. The objective of the proposed work is to design waveforms and receiver algorithms suitable for reliable, massive multi-user communications under realistic channel conditions, provide a theoretical analysis of their performance, and develop algorithmic proof-of-concept implementations. Possible fields of applications cover radio access networks (e.g. 6G), non-terrestrial (satellite and/or UAV) networks, internet-of-things applications, self-organizing ad-hoc networks, and more. The considered

aspects will range from theoretical code and modulation design, to efficient message-passing decoder implementation.

Skills

Candidate must hold a Master's degree or equivalent in any of the following field: Computer Science, Informatics, Electronics, Mathematics, Statistics.

Required skills:

- fluent spoken and written technical english
- a strong background in digital communications, statistical signal processing and information theory

Desired skills:

- familiarity with Matlab and/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
- Social security coverage under conditions

Remuneration

1st and 2nd year: 2 051 euros gross salary /month

3rd year: 2 158 euros gross salary / month

General Information

- **Theme/Domain** : Networks and Telecommunications
- **Town/city** : Villeurbanne
- **Inria Center** : [Centre Inria de Lyon](#)
- **Starting date** : 2023-02-01
- **Duration of contract** : 3 years
- **Deadline to apply** : 2023-12-31

Contacts

- **Inria Team** : [MARACAS](#)
- **PhD Supervisor** :
Guillaud Maxime / 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

Processing of applications sent by other channels is not guaranteed.

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.