
PhD position (M/F) – Thesis offer (M/F)
(Reference: CS_FK_PhD_MASS-START_042017)

Research topics 5G Massive MIMO Systems

Department Communication Systems

Parution date 24/04/2017

Start date ASAP

Duration Duration of the thesis

Description Ongoing 5G standardization efforts are targeting an evolution of the current LTE-advanced system that is deployed globally. This evolution includes spectrum expansion below 6 GHz and at the same time exploitation of very high-frequencies (e.g. 28 GHz), air-interface innovation (5G NR or New Radio) and radio system evolution (5G Core). Collectively, these will allow for

- Increased data volume: 1000X increase over current levels
- Lower latency: 5X reduction in transit time
- Faster data transfer speed: 10 to 100X higher speeds
- More devices: 10 to 100X devices
- Longer battery life to aid massive machine communication: 10X more life

One of the key techniques used in 5G NR will be massive MIMO. Massive MIMO takes multi-user MIMO to the next level by scaling up the number of antennas at the base station by an order of magnitude, providing additional degrees of freedom in the channel. These additional degrees of freedom can be used to design more simple and scalable signal processing algorithms and help focusing energy into small regions of space and thus reducing interference.

OpenAirInterface (OAI) is an open source initiative that provides Rel-8/Rel-10 3GPP compliant reference implementation of eNodeB, UE, RRH and EPC that runs on general purpose computing platform (Intel/ARM). Today OAI supports massive MIMO using so called transmission mode 7, which allows beamforming to a single user. Eurecom has also build a hardware platform based on its ExpressMIMO2 cards that can drive up to 64 antenna elements.

Together with its partners, Eurecom is currently extending its established OpenAirInterface platform to support 5G NR, both from a software and a hardware point of view. This PhD project will be embedded in this framework and will both benefit and contribute to this development.

Challenges and expected results: The goal of this PhD thesis is to advance the state of the art in massive MIMO systems with a strong focus on practical feasibility of such systems. To this end, the successful applicant is expected to build a 5G-NR massive MIMO system based on OpenAirInterface and use it to as a tool for experimentation and innovation.



In particular some of the initial tasks of the thesis will be:

- Build a simulator for 5G NR
- Explore design options for both eNB (beamforming algorithms) and UE (feedback and receiver algorithms) especially for hybrid digital-analog antenna systems
- Design efficient reciprocity calibration methods for (hybrid) massive MIMO systems
- Propose innovative ideas on how to get the most out of the current 5G-NR or how it could be improved.

Requirements We are looking for a highly motivated person with a master degree in electrical engineering or applied mathematics (signal processing or communications engineering) with strong mathematical and communication skills, keen to operate in a multidisciplinary team. The candidate should further have good programming skills in C and should have basic knowledge in communications systems such as LTE. The candidate should be fluent in English.

Application The application must include (I, II and III):

- I-Curriculum Vitae
- II-Motivation letter of two pages also presenting the perspectives of research and education
- III-Names and addresses of three references

Applications should be submitted by e-mail to secretariat@eurecom.fr with the reference: CS_FK_PhD_MASS-START_042017

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EURECOM is a French graduate school and a research center in digital sciences based in the international science park of Sophia Antipolis, which brings together renowned universities such as Télécom ParisTech, Aalto University (Helsinki), Politecnico di Torino, Technische Universität München (TUM), Norwegian University of Science and Technology (NTNU), Chalmers University (Sweden) and Czech Technical University in Prague (CTU). The Principality of Monaco is a new institutional member. The Institut Mines-Télécom is EURECOM's founding member.

EURECOM benefits from a strong interaction with the industry through its specific administrative structure: Economic Interest Group (kind of consortium), which brings together international companies such as: Orange, ST Microelectronics, BMW Group Research & Technology, Symantec, Monaco Telecom, SAP, IABG.

EURECOM deploys its expertise around three major fields: Digital Security, Data Science and Communication Systems. EURECOM is particularly active in research in its areas of excellence while also training a large number of doctoral candidates. Its contractual research is recognized across Europe and contributes largely to its budget.

Thanks to its strong ties set up with the industry, EURECOM was awarded the "Institut Carnot" label jointly with the Institut Telecom right from 2006. The Carnot Label was designed to develop and professionalize cooperative research. It encourages the realization of research projects in public research centers that work together with socioeconomic actors, especially companies.