
PhD position (M/F) – Thesis offer (M/F) in Wireless Communications
(Reference: SC_DS_PhD_DUPLEX_122017)

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| Research topics | Self Interference Cancellation and Transceiver Techniques for Multi-Antenna Full Duplex Radio Systems |
| Department | Communication Systems |
| Parution date | December 2017 |
| Start date | ASAP |
| Duration | Duration of the thesis |
| Description | <p>This PhD thesis will contribute to the French ANR project DUPLEX, "Full-Duplex MIMO Techniques for the Future Wireless Networks" http://www.eurecom.fr/cm/duplex</p> <p>Full-duplex consists in transmitting and receiving simultaneously in the same frequency band, which in theory allows to double the capacity of communication. The DUPLEX project objectives are:</p> <ul style="list-style-type: none">- to study the theoretical limits (throughput) of full-duplex communication equipment, and in particular in the case of a Multiple Input Multiple Output (MIMO) equipment- to develop antenna techniques, analog and digital processing for the cancellation of the transmitted signal at the receiver- to develop a MIMO full-duplex communication equipment (prototype) for the next generation of communications. <p>The project addresses two scenarios:</p> <ul style="list-style-type: none">- full-duplex communication between two communication nodes. In this case, the signal cancellation device uses the knowledge of signal, assumed to be known- full-duplex relaying, in which the relay processes, amplifies and retransmits the received signal in the same band. In this scenario, several cases will be considered depending on the information to be relayed (i.e. decodable or not). <p>The project is divided into 5 tasks:</p> <ul style="list-style-type: none">• The first task will consider the overall system aspects of the DUPLEX project. The refinement of the target scenario and the system requirements specification, taking into account real use cases and constraints, will be the starting point for the project implementation. Led by industrial partners, this task will ensure a consistent project development under common scope, requirements and working assumptions. The target system definition will indeed impose important constraints like for example the radio environment, the radio access technologies characteristics, the amount of available spectrum, the power available for transmissions, the required sensitivity and dynamics of the equipment, the number of antennas and any other relevant parameters• Task 2 (digital cancellation) aims to go beyond the state of the art in terms of digital techniques for self-interference cancellation.• Task 3 (analogue techniques) is devoted to the development of analogue techniques, including the design and implementation of antennas and circuits.• Task 4 (prototyping) is dedicated to the integration of all the hardware and software parts developed (in Tasks 2 and 3) in the hardware MIMO platform OpenAirInterface (www.openairinterface.org), which is an existing Software Defined Radio platform developed by EURECOM. Furthermore, this task also aims to test and validate the system in laboratory conditions. |

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- Finally, task 5 (dissemination, communications) aims to promote the scientific results of the project and to disseminate the reusable results for future industrialization.

Research Topics of this PhD thesis

This thesis will focus both on self-interference cancellation and on multi-antenna transceiver techniques for wireless systems containing full duplex radio units.

Self-interference cancellation topics:

- We will in particular focus on pushing the limits of digital cancellation techniques, by modeling of non-linearities. Compressed sensing techniques will be used for the model determination.
- For the adaptation of digital filters, some attention will go to the relaying scenario, which represents a case of strong correlation between filter input and filter error.
- Extension to hybrid architectures: digital solutions cannot work alone

Multi-antenna transceiver techniques:

- FD MIMO Self backhauling in 5G
- (MIMO) relaying for interference reduction:

Design and analysis of multi-user multi-cell interference networks with MIMO relays, with mixed half and full duplex nodes.

- Two-way spatial filter training (exploiting reciprocity):

Bidirectional training schemes that use transmission over the channel to do fast filter computations, allowing superfast in-network transceiver adaptation with simultaneous transmission.

Requirements

We are looking for a highly motivated person with a master degree in electrical engineering with a strong background in applied mathematics and signal processing as well as excellent programming skills (Matlab). Previous experience in the area of statistical signal processing, possibly applied to wireless radio communications will also constitute a significant advantage. English language and general communication skills also constitute a plus.

Application

The application must include:

- CV,
- 2-3 letters of reference (especially by the Master's thesis/project/internship supervisor),
- Master's degree grades and any evidence of good academic performance (e.g. rank),
- a one page statement of research interests and motivations.

Applications should be submitted by e-mail to secretariat@eurecom.fr and dirk.slock@eurecom.fr with the reference: SC_DS_PhD_DUPLEX_122017

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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),

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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: Security, Data Science and Mobile Communications. 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.