



PhD position in digital communications

Title

Distributed MIMO systems for next generation cellular networks and application to public transport.

Keywords

Multiple Input Multiple Output (MIMO), cooperative relay network, virtual MIMO, Turbo principle, transport applications.

Location

The Ph.D. position will be located at Telecom Bretagne (former ENST Bretagne), Brest, France. Created in 1977, TELECOM Bretagne is a member of Institut TELECOM with TELECOM ParisTech and TELECOM SudParis. TELECOM Bretagne trains future engineers for careers in industry, services and research.

The student will join the Turbo Algorithms and Circuits (TAC) group of the Electronics Department. TAC is an internationally recognized research group in the field of iterative processing for channel coding and of iterative receivers (turbo-communications) since the invention of Turbo Codes in 1993 by its leader, Prof. Claude Berrou. Claude Berrou has been awarded prestigious prizes, such as the Marconi prize in 2005.

Description

In wireless networks, signal fading strongly degrades the performance of the system, which generally leads to a reduction of the coverage. The diversity techniques allow to benefit from the time and frequency variations of the propagation channel, and thus of fading, to improve performance. Moreover, when several antennas are implemented on the transmission side and/or the reception side, space diversity can also be exploited. This type of diversity is particularly attractive since the improvements brought by its exploitation are added to those of the other types of diversity. Such systems utilizing multiple antennas at the transmitter and at the receiver are known as MIMO (Multiple Input Multiple Output).

The fast emergence of MIMO systems in up-to-date communications standards is gained thanks to the following performance enhancements, compared to a SISO (Single Input Single Output)

- higher spectral efficiency (spatial multiplexing gain)
- higher quality of the transmission (diversity gain)
- And finally higher coverage (array gain)

The extension of the MIMO point to point transmission to the context of a wireless network with several nodes has opened a huge field of research. In this work, we will consider a cellular wireless network that involves an infrastructure with several access points. To benefit from the MIMO principle, each node of the network must have several antennas. Unfortunately, in case of mobile and /or portable terminals, the network nodes may not be able to support multiple antennas because of size, cost or power limitations. However, the inherent space diversity of the network can still be exploited if a different strategy is adopted: the so-called cooperative MIMO relaying or

“virtual” MIMO strategy. In such a scenario, the communication between transmitter and receiver is done in two (or more) hops through a group of other nodes (the relays) which cooperate to improve transmission reliability or to increase throughput. This group of terminals can then be viewed as a “virtual” antenna array. Therefore, the network may benefit from the MIMO enhancements without requiring multiple antennas devices. Since the antennas are not located at the same network node this strategy is also known as **distributed MIMO system**.

The thesis will focus on the algorithms of the physical layer of such distributed MIMO systems. In particular, the student will address the following problems

- Construction of full rate full diversity space-time code based on linear precoding
- Potentiality of iterative receiver in this context
- Opportunity of the joint design of multiple access and cooperative multiple antennas system
- Connections with network coding over relay channels

The Thesis will be partially funded by a national grant attributed to a collaborative research project dedicated to the application of the MIMO concept to wireless systems in public transportation. The partners are INRETS (Institut National de Recherche sur les Transports et leur Sécurité), Alstom, Gigacomm and Université de Poitiers.

Requirements

Applicants must hold a Master of Science degree (or equivalent diploma) in telecommunications, electrical engineering, or computer science.

Qualified applications are invited to submit official academic records for their master education, a 1-page statement of research interest and CV, together with 2 names of professional referees (and/or reference letters), electronically to Charlotte Langlais at your **earliest convenience**. Please indicate your source of information about this position (TELECOM Bretagne web site, Google search, etc).

For further information contact:

Charlotte Langlais, charlotte.langlais AT telecom-bretagne.eu

Phone: +33 229001534

Web site

http://departements.telecom-bretagne.eu/elec/proposition_de_stage_master/