Open Post Doctoral Position

on

"Channel Modeling for mmW-M-MIMO"

General Context

This offer holds in the framework of the upcoming CominLabs project **M^{5}HESTIA** on the topic of mmW Multi-user Massive MIMO Hybrid Equipments for Sounding, Transmissions and HW ImplementAtion.

mmW is an extremely attractive enabler for next-generation (5G) mobile communications. Operation in these high frequency bands offers very large bandwidths is one of the simplest ways to increase system capacity, but also leads to device miniaturisation thanks to the small related wavelength. In this context, M-MIMO systems, with up to hundreds of radiating elements at the radio Access Point (AP), are intended to achieve very high data rates for multiple users sharing the same spectrum at the same time, with low power consumption thanks to the use of specific analogue/digital precoding techniques.

The M^{5}HESTIA project has two main objectives :

The first one consists **in providing a precise and realistic model for the M-MIMO channel in the 60-GHz band**. Indeed, most of already-available theoretical results are based on very simple or theoretical models that do not take into account channel propagation and electronics specificities of very high frequencies such as, for example, electromagnetic coupling, power issues and other impairments.

The second main objective is the hardware (HW) implementation of a M-MIMO system deployed at the base station (or AP) in a multi-user context based on SDMA (spatial division multiple access) technique. Indeed, the larger the number of transmit antennas on infrastructure side, the larger the number of users who can be simultaneously served in the same "channel". For this purpose, analogue and/or digital beamforming techniques (implemented to improve link budgets at 60 GHz, one of the most important critical points at these frequencies) and digital precoding techniques (SVD

decomposition, ZF, MMSE, time reversal, conjugate beamforming, etc.) will be studied and combined (leading to a hybrid analogue and digital system).

In particular, **M^{5}HESTIA** project will optimise these different analogue and digital processing techniques by using **the proposed channel model** and by taking into account real antennas characteristics that will be also developed in the project.

Description of the research project:

The current offer is for working on the channel modeling task of the M^{5}HESTIA project. The main task will be to propose and implement a mmW M-MIMO channel model based on extensive channel measurements campaign realized during the project. The approach will be based on deterministic and/or quasi deterministic approaches aiming to produce test vector for PHY layer simulation. The effect of the environment on the channel angular structure and its coherence over time will be investigated. The impact of the diffused energy will also be investigated from the measurement data and depolarization estimation.

The model should be able to take as much as possible the effect of the base-band/RF architecture. The proposed channel model (or simulator) should allow addressing a wide range antenna specifications and architectures in order to figure out which is the best overall architecture for mmW. In particular this includes the antenna coupling effect and specification of the separation of baseband and RF functions number of baseband fluxes number of antennas, and switching or phasing network.
The effect of the environment on the channel angular structure (in particular elevation spread) and its coherence over time will be investigated. The model should be scalable toward larger problems (typically more antennas) while being validated over a smaller set of antennas from the measurement campaign performed during the project.
The deterministic or quasi-deterministic simulator will implement, jointly with channel simulations, the vehicular and human mobility in order to assess the effect on the overall system performance. The effects of flashing rays caused by the blockage from subject and object mobility will be investigated.

Expected candidate Profile : Ph.D in propagation modeling or digital communications with a good proficiency in mathematics and statistics and computational implementation of channel models. Python language proficiency is very welcome.

Location : IETR - UMR 6164 - Campus de Beaulieu Bâtiment 11D - Rennes - France

Expected start date : October / November 2016

Duration : 18 months

Salary : 2000 Euros net/month

Application : Send a CV, a motivation letter and a recommendation letter

Contact : Bernard UGUEN - bernard.uguen@univ-rennes1.fr, @BernardUguen