PhD offer

At Institut d'Electronique et des Technologies du numéRique (IETR, UMR CNRS 6164), France

WIDEBAND ARRAYS AT SUB-MILLIMETER BANDS

Project context

A more efficient use of available spectrum does not suffice to ***reach the ultra-large bandwidths (BWs) required by wireless systems beyond 5G***, and the use of frequencies in the Terahertz (THz) gap is the key to enable ultra-large BW wireless. The ***frequency range between 275 and 350 GHz*** is particularly convenient, owing to the following advantages: a) it has been selected for an IEEE standard; b) it presents atmospheric attenuation windows, which enable mid-range links and small cell deployment; c) the short wavelengths favor the design of on-chip antennas, integration and packaging; and d) THz links are less susceptible than optical wireless to air turbulence and humidity, fog, smoke, and rain.

One of the challenges in THz wireless communications consists in ***designing low-profile high-gain arrays efficiently coupled to continuous-wave THz sources at room temperature***, to compensate for the propagation loss. Moreover, ***appropriate radiation patterns must be tailored for the antennas in each THz wireless system***. For instance, directive pencil beams will suffice for point-to-point links, whereas small cells will demand a multi-beam system with broader angular coverage.

Objectives of the PhD offer

This project will explore the combination of ***two different antenna architectures*** to address the crucial need of future wireless systems for low-profile and high-gain antennas. The first architecture consists in ***modulated metasurface (MTS) antennas***, which can provide high gains owing to the interaction between an impedance boundary condition (IBC) and a surface wave (SW). The IBC is implement by sub-wavelength elements, while the SW is launched by a simple feeder. The design problem lines in finding and implementing an appropriate IBC and choosing an efficient feeding scheme.

The second solution consists of ***antenna arrays***. In this case, appropriate array elements must be chosen by assessing their active reflection coefficient and scanning capabilities, so one can establish the suitability of the design arrays for the next generation of wireless communications.

Both architectures offer key advantages: MTS antennas lead to ultra-thin structures, but with a limited bandwidth, whereas arrays provide broader bandwidths at the expense of using more complex corporate feeding networks.

The tasks will include a thorough literature review, the design of the MTS/array unit cells, the analysis and design of the modulated MTS, and of the finite array. Last but not least, special attention must will be paid to finding the most appropriate materials and fabrication techniques. By the end of the project, at least one prototype will be fabricated and measured at IETR´s World-class testing facilities.

Candidate

Required education level: Master or equivalent degree in electrical engineering or physics.
Duration: 36 months.
Required background: antenna theory, microwave engineering, numerical modeling, periodic structures. Knowledge of French is not required.

Deadline to apply: as soon as possible, with firm deadline on May 14, 2021.

Contact persons

To apply please send your motivation letter, CV, and recommendation letters (optional) to:

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All the candidatures are evaluated. However, due to the large number of applications we receive, we will contact only the short-listed candidates.