"Leaky-Wave Antennas for Direction-of-Arrival estimation for future mmWave and (sub-)THz Communications"

Keywords: Electromagnetics, antennas, periodic analysis

Offer description

A 3-year PhD position is available in the framework of the BeSensiCom project, funded by the French national research agency (ANR).

The doctoral candidate will conduct original research in leaky-wave antenna design to develop sensing units for 6G communications.

The research project will be carried out at Sorbonne University (SU) in Paris (Pierre & Marie Curie campus) and the candidate will be enrolled in a PhD programme at SU.

The candidate will develop original designs of leaky-wave antennas (LWA) for channel sensing. She/he will study appropriate modeling techniques to optimize a new class of LWAs to estimate Directions of Arrival (DoA) in real time at base stations. She/he will explore the fundamental performance of the DoA estimation in different propagation channels, and eventually the impact of the proposed antenna systems on wireless communications in various use cases. She/he will also be in charge of the fabrication (additive manufacturing, CNC, PCB, etc.) and measurement of the designed prototypes.

About BeSensiCom project

The next decade is going to witness a profound transformation in the mobile communication infrastructure. The aim of interconnecting everything everywhere unleashes new visions such as autonomous vehicles, factory of the future, and augmented reality. To meet the requirement associated with these new use cases, one key technology is the millimeter-wave (mmWave) and sub-Terahertz (sub-THz) spectrums. However, operating at such high frequencies remains challenging, especially in mobile scenarios. Indeed, mmWave operation includes a beam training process to align the directional beams radiated by the antennas at the base station and the user equipment. This procedure introduces large overhead signaling as well as latency, especially during initial access, which could jeopardize mmWave effectiveness. So far, beam training relies on the sequential scanning of the beam space, which represents a bottleneck for efficient mobile communications. To address the latency and overhead issues in this beam management, BeSensiCom conducts a radically different approach by envisioning a sensing unit that feedbacks the angular spectrum to the base station in real time. To achieve such a technological breakthrough, BeSensiCom leverages the intrinsic frequency beam scanning behavior of multibeam leaky-wave antennas to perform angle-of-arrival estimation using dedicated algorithms. BeSensiCom goes beyond the state-of-the-art by conducting a transdisciplinary approach combining applied electromagnetics and signal processing. With BeSensiCom's vision, the cognitive approach of frequency spectrum sensing is

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extended to the angular spectrum to enable managing the beam space not as a separate resource, but as an extra dimension in the resource grid. This brings the unique opportunity to represent channel resources, not as a 2D grid, but as a time-frequency-beam 3D grid.

About the environment

Sorbonne University is in the center of Paris and offers an attractive working environment for students from all over the world.

Regular interactions and visits to Nantes Université, partner of the BeSensiCom project, will be planned. Yearly meetings are organized with Thales and Orange companies, both being members of BeSensiCom steering committee. In addition, research results will be regularly presented within the European network INTERACT COST action as well as among main national and international conferences in the field of antennas and propagation.

Qualification and requirements:

The candidate should be highly motivated, autonomous, and have a good knowledge of English (both written and oral). She/he should be enrolled in a master program in Engineering or Physics or an equivalent degree with a strong mathematical and electromagnetics background.

Duration: 3 years. **Starting date:** October 2023

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