PhD proposal :

Reconfigurable antennas for enhanced GNSS CRPA applications in jammed or spoofed environment

Laboratories :

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Background :

Satellite navigation (GPS and GNSS) is a key element for a multitude of applications (UAV, loitering amunition, guided projectiles, flying- road- or floating vehicles) ; the GNSS positioning and the timing are also absolutely required for a wide range of systems (as for Starlink for example. On the battlefield, the (sometimes intensive) usages of GNSS jammers and spoofers prevent, by their number, opposing systems to use the GNSS services. Beyond conflict zones, protection through low-cost systems of civilian vehicles or infrastructure seems to be today mandatory in a turbulent geopolitical context. The performance enhancement of interference mitigation system constitutes a major research topic.

Objectives :

In the field of GNSS radionavigation, this study aims to investigate and design antennas with radiation characteristic reconfigurability (typ. by analog function, with a limited number of states) to be associated with a signal processing unit and to constitute hybrid CRPA (analog/digital) with enhanced mitigation performances. The objectives are to reach higher rejection levels and to enable gain reduction in angular directions where the signal processing unit by itself can not address, because of a lack of sufficient acquisition channels.

Proposed work program :

Relying on the previous works and the know-how of ISL and IETR, the main objective of this PhD subject is the design of a reconfigurable antennas (diversity of radiation patterns, polarization, orientation, etc) wideband and multi-band for CRPA applications. This complete work can be divested as follow:

- Investigation of potential antenna architectures with reduced gain in various angular sectors, then design of fixed radiation patterns antennas over a monoband and over multiple bands
- Integration into arrays of the designed antennas and radiation performance assessment as well as rejection capabilities
- Investigation of reconfiguration technologies: applications for monoband and multiband antennas.

Prototypes will be manufactured and characterized. Then they will be associated to spatial filtering signal processing units in order to characterize the whole system in anechoic chamber but also in outdoor measurement campaigns.

As far as possible, communications in international conferences and in peer-review journals will be encouraged.

Conditions to apply :

The applicant must satisfy the following requirements to apply for a DGA funding:

- Holder of an engineering degree or a Master 2 Research (or equivalence), or be enrolled the year of application
- A solid background in microwaves, antennas, radar and electromagnetism is appreciated. Good English language skills are desired.

Keywords :

Electromagnetism, antennas and antenna arras, anti-jamming, GNSS, GPS, prototypes and experimental results.