Available post-doctoral position

Array **Ge**ometry and Mutual **C**ouplings study for Seek**e**rs antenna **O**ptimization ***Gecko***

Sept 2020-sept 2021

Keywords:	2D AESA, Sparse array antennas, ESPAR, Antenna design,
Partners:	Lateral, Lab-STICC (University of Brest), Thalès Lom
To apply:	Send CV + cover letter + publication list to Thierry Le Gouguec : thierry.legouguec@univ-brest.fr
Duration:	1 year (from September 2020 to august 2021)
Gross salary:	2450 €/month
Location:	Brest (Lab-STICC).
Management:	Thierry Le Gouguec (Lateral/Lab-STICC), Cédric Quendo (Lateral/Lab-STICC), Aude Leuliet (Lateral/Thales), Thomas Merlet (Lateral/Thales)

Context of the study:

Using 2D AESA technologies for various applications (such as radars, 5G antennas…), presents many advantages such as robustness or multiple beamforming. However it also presents the challenge of integrating dense RF circuits on meshes as small as the operational frequency gets high.

Many new applications will have to include new sensors for passive detection or communications, increasing the number of components to integrate in the antenna front end.

To meet this challenge, the miniaturization of the RF components is intensively studied. Another complementary approach is to decrease the number of channels to feed, decreasing automatically the number of components to integrate. This solution presents the advantage to address the integration as well as to decrease the cost and weight. However, in classical array geometries, increasing mesh size goes with side-lobe levels increase and scan blindness.

The aim of this post-doctoral proposal is to develop new array designs surpassing this limitation by mutual coupling optimization. Two main architectures will be compared minimizing or maximizing intentionally mutual couplings.

Sparse arrays have shown to enable wide-angle scanning performance and low side-lobe levels while maintaining low array elements density [ref1].

ESPAR concepts exploit mutual couplings to feed “parasitic elements” and to optimize the number of array elements supplied [ref2].

These architectures will be evaluated considering the Direction Of Arrival (DOA) estimation as main issue as well as the reduction of powered complexity.

Aims of works.

For the both architectures previously presented, mutual couplings play a key role as they impact the beam steering as well as the antenna calibration, load pull and DOA estimation.

In this project we propose to study these couplings and to evaluate different approaches to take them into account while designing antennas. A first approach is to minimize their impact, while quantifying it, in aperiodic arrays. It has indeed been shown that mutual couplings in sparse arrays impact the DOA estimation. A second approach is to exploit the mutual couplings to feed parasitic elements in ESPAR concepts.

We will base our designs of Ku antennas on the work done at lower frequency. The different architectures will be evaluated while taking into account technical specifications but also the available TR module components, their power handling and their volume. A compromise will be searched between antenna array performance and sustainable RF circuit density and performance.

Within the scope of the project the couplings will be calculated for different array element types. The element array type plays an important role in antenna bandwidth and in scanning angle that will be taken into account. In addition, we will identifying the impact of the mesh geometry and size, of the substrate material and of the

array element type on the nature of the coupling (coupling taking place in the air or in the substrate of the antenna).
These results will be exploited to choose the right array element type and/or substrate material for each proposed concept.

Candidate profile
The post-doctoral candidate must have a PhD in electronic and RF field, he must have good skills in antennas and array antenna design, he have to know electromagnetic simulators (as CST or HFSS) and good knowledge in optimization process.

Work conditions
The post-doctoral will take place at the joint-lab “lateral” between "Thalès" and the "Lab-Sticc". All the capabilities and technical equipment available at "Lab-STICC" in the premise of the University of Brest (France) will can be used for this study.

Gross Salary 2450 €/month

Contact: thierry.legouguec@univ-brest.fr
cédric.quendo@univ-brest.fr