Université Gustave Eiffel

Laboratoire ESYCOM

Internship: Antenna Gain Radiation Pattern Estimation from Radar Cross Section Measurement Within Reverberation Chamber

Supervisors: Elodie Richalot (Full Prof.), François SARRAZIN (Ass. Prof.)
Laboratory ESYCOM / ED MSTIC

Starting Date and Duration
This offer is for a 4-month internship that could start anytime between February and April 2021.

Context
Due to emerging applications like the Internet of things, antenna structures suffer from strong constraints regarding their size and integration. However, antenna miniaturization leads to a strong decrease of their radiation performances and their near-environment strongly modifies their radiation pattern. The characterization of radiation properties is barely possible with conventional methods in the case of miniature antennas. Indeed, it is necessary to connect the antenna under test (AUT) to an analyzer and the presence of the cables in the antenna reactive near-field zone disturbs the radiation and impedance properties. In that context, innovative methods that are contactless [1] and within reverberation chamber (RC) [2] are under research at the ESYCOM lab.

Internship Topic
Antenna radar cross section (RCS) measurement can be used in order to avoid cables connected to the AUT. Initially performed in anechoic chamber, RCS measurements have been recently conducted in RC [2], [3]. In [2], the measurement setup takes benefit from the diffuse field that occurs within an RC to retrieve the ballistic wave among the multiple reflections. This internship's objective is to establish the proof of concept of a contactless antenna gain measurement method within RC. Based on RCS measurement, the load variation approach [4] will be performed in order to retrieve the antenna gain.

Work plan
The intern will set up a measurement bench to perform antenna RCS measurement within RC. The method will first be validated on electrically large and directive antennas such as horns, before being extended to the measurement of miniature antennas. In addition to the experimental aspects, post-processing using Matlab will be conducted in order to retrieve the antenna properties.

Applicant Profile
The targeted student profile is the following:

- Last year of Master degree, engineer school degree or equivalent;
- Background in electromagnetics and antennas (essential);
- Knowledges in signal processing (preferable);
- Interest for high frequency measurement;
- Autonomous and highly motivated.

Contacts
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The application file should include CV, statement of purpose, recommendation letters and all academic transcripts and may be addressed by email to both contacts. **Application deadline: April 15th 2021.**

The ESYCOM laboratory is within the field of communication systems, sensors and microsystems for the city, the environment and the person. The topics of interest are more specifically:

- antennas and propagation in complex media, photonic-microwaves components;
- microsystems for environmental analysis and pollution control, for health and the interface with living organisms;
- micro-devices for ambient mechanical, thermal or electromagnetic energy harvesting

References

[1] A. Reis, F. Sarrazin, E. Richalot and P. Pouliguen, *Mode-Stirring Impact in Radar Cross Section Evaluation in Reverberation Chamber*, 2018 International Symposium on Electromagnetic Compatibility (EMC EUROPE), pp 875-878, Aug. 2018.

[2] W. Krouka, F. Sarrazin and E. Richalot, "*Influence of the reverberation chamber on antenna characterization performances*," Int. Symp. and Workshops Electromagn. Compat. (EMC Europe), Amsterdam, 2018.

[3] A. Soltane, G. Andrieu, E. Perrin, C. Decroze, A. Reineix, *"Antenna Radiation Pattern Measurement in a Reverberating Enclosure Using the Time-Gating Technique,"* IEEE Antennas and Wireless Propagation Letters, vol. 19, no. 1, pp 183-187, 2020.

[4] W. Wiebeck and E. Heidrich, "Wide-Band Multiport Antenna Characterization by Polarimetric RCS Measurements", IEEE Trans. Antennas. Propag., 2014.