4 month internship for M2

Efficient antenna modelling in complex environments

Context:

The recent growth of Internet of Things (IoT) has brought a variety of services and applications in our everyday life. The advent of 5G communications cellular systems with an increased data rate, a reduced end-to-end latency and an improved coverage is considered to be a major driver for the development of a truly global IoT. The various nature of the connected objects can be highlighted through different new areas of application. For example, IoT offers a wireless low-cost high-density distributed sensor-based tool for Structural Health Monitoring (SHM) which can replace a regular maintenance into a more cost-effective condition-based one. In a completely different context, Wearable Health Monitoring Systems (WHMS) deploy various types of miniature wearable or implantable sensors to improve the supervision of patients. Besides these specific applications, IoT can bring solutions to the recent public health problems by providing individuals with reliable information. For example, nowadays a public issue concerns the food quality and traceability.

Despite the diversity of the cited applications, some common aspects can be recognized regarding the conditions under which the communicating sensors or terminals operate:

- A partial or uncertain knowledge of the close environment
- Intrinsic variability of the sensor or terminal support (stretchable, flexible, conformable, crumpled)

In those cases, due to the complexity and the variability of the antenna environment, efficient modelling method must be developed rather than commercial softwares which are resource demanding and time consuming.

This internship aims to contribute to this research work using a simulation tool based on Method of Moments developed at TELE Laboratory in UCL [1]–[2].

Objectives of the internship:

This internship will be conducted at ESYCOM Laboratory.

The scientific work consists of two parts:

- During the first part of the internship, the candidate needs to learn to use the meshing tool named “Gmsh” which is used by the research group in UCL. Gmsh is an open-source three-dimensional finite element grid generator with a build-in CAD engine and post-processor. Its design goal is to provide a fast, light and user-friendly meshing tool with parametric input and advanced visualization capabilities [3]. At the end of this part, a few reference designs will be meshed such as a simple wired dipole antenna, a dipole antenna over a ground or a printed folded antenna.

- The second part includes the validation and the simulation of the meshed object. During this part, the supervising group and the candidate will work with the research group in UCL to validate the meshing step and to obtain the MoM's simulation results. These results can be cross-validated by a commercial 3D CAD such as HFSS at ESYCOM laboratory.

Candidate's profile:

- Autonomy in computer programming
- Interest for numerical modelling
- Solid knowledge in electromagnetics and applied mathematics
- Very high scientific rigour

Supervising group:

Benoit Poussot, Associate Professor, ESYCOM/UGE
Shermila Mostarshedi, Associate Professor, ESYCOM/UGE

Application procedure:

The application file should include CV, statement of purpose and all academic transcripts may be addressed by email to Benoit Poussot (benoit.poussot@univ-eiffel.fr) and to Shermila Mostarshedi (shermila.mostarshedi@univ-eiffel.fr).

References:

[1] Alkhalifeh, K., Hislop, G., Ozdemir, N. A., & Craeye, C. "Efficient MoM simulation of 3-D antennas in the vicinity of the ground," *IEEE Transactions on Antennas and Propagation*, 64(12), 5335-5344, 2016.

[2] Cavillot, J., Tihon, D., Mesa, F., Acedo, E. D. L., & Craeye, C. "Efficient Simulation of Large Irregular Arrays on a Finite Ground Plane," *IEEE Transactions on Antennas and Propagation*, 68(4), 2753-2764, 2019.

[3] Geuzaine, C. & Remacle, J. F. "Gmsh: A 3-D finite element mesh generator with built-in pre-and post-processing facilities," *International journal for numerical methods in engineering*, 79 (11), 1309-1331, 2009.