Position: Post-doctoral Position, starting between November and February 2019.

Duration: 18 months

Title: Cross-correlation of diffuse electromagnetic field in reverberation chambers.

Laboratory: Institut d'Electronique et des Télécommunications de Rennes (IETR), UMR CNRS 6164, Université de Rennes 1, Rennes, France.

Context: The purpose of the post-doctoral position is to exploit the cross-correlation of the diffuse field generated by sources in a chaotic reverberation chamber to passively retrieve the impulse response between receiving antennas. Mode-stirred reverberation chambers are now used as an alternative solution to anechoic rooms to measure antenna performance such as the efficiency, the sensitivity or the diversity gain for multiple antennas. Instead of mimicking free-space propagation, the field generated within such a cavity is naturally diffuse so that receiving antennas are illuminated by random plane waves. We will apply the ambient noise Green's function retrieval technique to retrieve the impulse response between two receiving antennas. Even though it has led to spectacular results in seismology, the method still remains largely unexplored in electromagnetism. The principle of the technique is shown in the following figure.

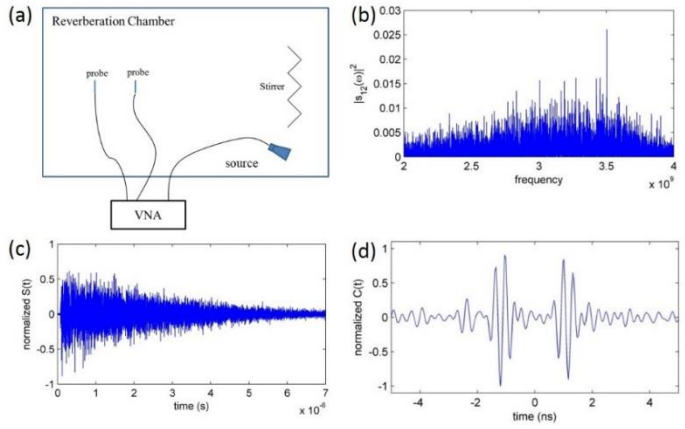

Fig : (a) Setup used for Green's function retrieval. Two non-invasive probes record the field transmitted by a source antenna located in the RC. (b) Spectrum between 2 and 4 GHz of the transmission coefficient between the source antenna and the first receiving antenna. (c) Impulse response which is the inverse Fourier transform of $s_{13}(\omega)$. (d) Cross-correlation $C(t)$ of the field probed at two positions. The cross-correlation converges towards the coherent response between the antennas.

We aim to use the cross-correlation technique to pave the way for a new technique to characterize electromagnetic antennas and scattering objects in reverberation chambers. More specifically, we aim to i) Overcome current limitations of coupling measurements between two receiving antennas which do not have the possibility to be turned into their emitting modes; ii) Provide a great simplification of the setup to measure the mutual coupling matrix of an antenna array. This is crucial since this matrix controls the performance of MIMO communication and radar imaging systems; and iii) Extract the radiation pattern of objects.

This post-doctoral position is part of the DICOREV Project (DIffuse field cross-COrrelation in REVerberation chambers), which is funded by the ANR Astrid (2018-2021). In addition to IETR, the consortium gathers 3 research labs with leading experts in the fields of noise correlation, wave chaos and reverberation chambers, in INPHYNI (Nice), ESYCOM (Marne-La-Vallée), and Institut Langevin, (Paris).

Job description: Measurements of the correlation function will be carried out in the reverberation chambers of IETR (Rennes) and ESYCOM (Marne-La-Vallée) in the *centimeter*- and *millimeter*-wave ranges. During the post-doc period, the candidate will spend several weeks at ESYCOM.

The extraction of the coupling between antennas will be investigated and demonstrated using different kinds of noise sources ranging from ambient thermal radiations to perfectly controlled sources. To achieve this ambitious project, an interdisciplinary approach combining methods from wave physics, signal processing and applied mathematics is required.

Requirements: Candidates must have a Ph.D. preferably in electromagnetism and especially dealing with the propagation of waves in complex and reverberating environments.

Contact: To apply, please send an application including:

- A detailed CV with a list of publications
- A cover letter
- A list of scientific personalities able to comment on the application
- A reference letter mandatory

To both addresses:

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References:

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