Institut d'Electronique et des Technologies du numéRique
UMR CNRS 6164

15-months postdoctoral position (M/F): Wave control through walls using reconfigurable surfaces

Laboratory: Institut d'Electronique et des Technologies du numéRique (IETR), UMR CNRS 6164, Université de Rennes, Rennes – France.

Objectives: The control of waves in complex media is a long-standing interdisciplinary axis. A wave impinging on a complex structure is partially reflected as a result of both an impedance mismatch at the interface of two materials and/or scattering from inhomogeneities within the bulk of a material. An outstanding challenge lies in our ability to suppress the reflection through complex obstacles with the ultimate goal of completely transmitting or absorbing the incident energy.

The ambitious aim of this post-doctorate is to design reconfigurable structures able to increase the transmission through complex walls in the microwave regime. Like intelligent surfaces, these panels will adapt to the internal structure of each wall to obtain total transmission of an incident wave and greatly increase the focused intensity. The idea of placing reconfigurable intelligent surfaces (RIS) on walls as part of networks beyond 5G is currently attracting a lot of interest to make wireless environments programmable and significantly reduce power consumption in non-line-of-sight environments. However, RIS overcome neither reflection nor scattering in walls in their current form to increase transmission through these obstacles. By placing RIS within open cavities, we expect to show that the transmission through a wall can be increased by an order of magnitude compared with conventional antennas. The relationship between these systems and open transmission eigenchannels through disordered scattering media will be established.

Activities: The postdoc will perform numerical simulations and microwave experiments. A theoretical model will also be developed to predict the transmission enhancement through disordered walls.

Work context: The post-doc is funded by CREACH LABS, a cybersecurity research cluster, and the French defence agency. Electromagnetic cybersecurity is an emerging field that concerns attacks aimed at compromising information. We are interested here in attacks that are carried out in adjacent rooms, i.e. without direct targeting. The main limitation of these attacks is the power received at the detector level for eavesdropping, or at the level of the electronic component under attack for denial of service. The attenuation of waves in walls makes such attacks difficult or even impossible when the available power is insufficient. Our aim is to improve the range of listening signals radiated into an adjacent room using methods based on wave control.

Start date: October/November 2024

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