Detection and localization of hidden targets in urban environment

| Référence : PHY-DEMR-2020-08 (à rappeler dans toute correspondance) |
| Début de la thèse : 10/2020 | Date limite de candidature : 07/2020 |

**Mots clés**  
Radar, Signal Processing, Propagation, urban environment

**Profil et compétences recherchées**

**Présentation du projet doctoral, contexte et objectif**
For most classic radar applications, the target is in Line-Of-Sight (LOS) of the radar. On the contrary, for radar applications in urban environment, the wave propagation is much more complex due to the buildings surrounding the scene. Indeed, these buildings create on one hand shadow areas where the target is not in LOS, and on the other hand multiple paths produced by any possible reflections and diffractions of the wave on the surrounding surfaces. Fortunately, these multipaths may be exploited by the radar in order to detect and locate targets in these shadow areas (NLOS: Non-Line-Of-sight). It may then become possible to detect target behind wall corners thanks to a simple portable radar: this is the so-called “around-the-corner” radar [1].

The results of a previous thesis [2] have shown the presence of strong ambiguities regarding the detection of localization of the target. The reduction of these ambiguities remains a challenge. By a more complex propagation model, for example taking into account some scattering mechanisms that may help in the reduction of ambiguities. Also, during the previous thesis many promising ideas to reduce these ambiguities have been proposed on the side of signal processing, such as the use of sparsity, target dynamics (human, UAV) information in particle filtering and Doppler information.

The student will participate in the setup of the one or many campaign measurements in real conditions using the different available radars of the laboratory SONDRA (X and K band). These new data will help validate the algorithms proposed in the thesis.

Proposition of calendar’s thesis:
1st year: Bibliography on classical signal processing, propagation models in urban environment and scattering mechanisms of targets (human, UAV …) in the around-the-corner configuration. Propose new methods of detection/localization of a target in NLOS. Proposition of a measurement setup.

2nd year: development of techniques of detection/localization of targets in NLOS allowing the reduction/elimination of ambiguities related to the scene, as well as the study of scattering mechanisms present in the scene. First measurement(s) and application of proposed algorithms on real data.


The student will be in the ONERA unit MATS (Méthodes Avancées en Traitement du Signal) of département Electromagnétisme et Radar, ONERA, Palaiseau, and SONDRA laboratory, CentraleSupélec, Gif-sur-Yvette.


Collaborations envisagées
Co-financement SONDRA (Encadrant : Israel Hinostroza)

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