**Internship description**

6 months internship, starting date: 01/02/2018  
Tutors: Dr Marion Berbineau (Ifsttar), Michel Saideh, PhD student, Iyad Dayoub (UVHC)

**Context and Objectives**

In the context of the North Europe Region Smarties project from ELSAT 2020 program some research works are focusing on the development of adaptable wireless communications resilient to technology evolutions and to interferences able to answer the railway needs. In this context, in order to evaluate the new wireless system performance, we need to evaluate new channel estimation techniques in the context of 5G.

5G communication systems are still under research and they are expected to answer different needs in the high speed railway sector. Many 5G waveform candidates have been proposed recently to replace the 4G OFDM waveform due to its well-known disadvantages. The different structures of these newly proposed waveforms have urged the need to study and analyze new transceiver design techniques (e.g., Precoding, Channel Estimation (CE), Equalization...). Since having a good channel estimate is critical to the performance of the overall communication system, too many researches have focalized upon the channel estimation techniques. However, in the high speed railway environment, the Doppler spread induce inter carrier interference which becomes challenging. A Time Domain LMMSE channel estimation technique has been recently proposed by adopting a comb pilot pattern. It has shown a very good performance with the 4G OFDM technique in handling the high speed challenges and it has been analyzed for some 5G waveforms.

It has been shown how the performance of this CE technique is highly depending upon the pilot sequence. Hence, we are interested in analyzing the effect of the pilot signal on the performance of the TD-LMMSE in order to propose and conduct a pilot optimization study.

The missions will be to first understand the work principle of some 5G waveform candidates (e.g., FBMC, GFDM...). Then the student will study and analyse the TD-LMMSE technique in a multipath time varying channel scenario. It will be then necessary to optimize the pilot signal to have the optimal TD-LMMSE performance for the studied 5G waveform candidates. The work will be performed with Matlab simulations.


**Profile and Competences**

**Master 2 student or Engineer in the domain of wireless communications and Signal processing**

**Main skills:** Wireless communications, signal processing, informatics, mathematics, Matlab, very good level of English, writing, knowledge of Railway domain will be a plus

**Kow-how:** Autonomy, sense of initiative, excellent relationship, rigor, taste for experiments

**Contacts**

Candidatures (cover letter + CV) should be send by email to:  
marion.berbineau@ifsttar.fr, michel.saideh@ifsttar.fr; iyad.dayoub@univ-valenciennes.fr