ÉCOLE DOCTORALE GALILÉE
Université Sorbonne Paris Nord

Contrat doctoral – ED Galilée

Titre du sujet : **Allocation de Ressources Radio pour les Réseaux d'Accès 6G**

Radio Resource Allocation for 6G RAN

Unité de recherche : Laboratoire de Traitement et Transport de l'Information (L2TI)

Discipline : Réseaux

Direction de thèse : Thi-Mai-Trang NGUYEN (L2TI)
Co-encadrants : Marwen ABDENNEBI (L2TI)
Yan Li (School of Physics and Electric Engineering, Nationalities University, Kumming, Yunnan, China)

Contact : thimaitrang.nguyen@univ-paris13.fr, marwen.abdennebi@univ-paris13.fr

Domaine de recherche : Réseaux Radio Mobiles

Mots clés : Allocation de ressources, Réseaux radio mobiles, Réseaux cellulaires, Modélisation de trafic, Modélisation de mobilité
Resources allocation, radio and cellular networks, traffic and mobility modelling

---

Descriptif du sujet

The 6th generation of mobile networks (6G) is currently under study and almost under the standardization process with the objective of being the successor of the 5G cellular network. Even if it is expected to be released by the ITU by 2030, many patents and research publications have given interesting proposals to improve performances along with key features and innovative technologies such as the application of Artificial Intelligence (AI) in wireless networks.

The most challenging research issues are related to the new frequency bands that could be defined up to the terahertz, Ultra-Massive Multiple-Input Multiple-Output (UM-MIMO) and the Extremely Large-scale Antenna Array (ELAA) which has a strong impact on electromagnetic wave propagation. With such antenna configuration, the transmission of high-frequency waves could take place in the near-field region (Fresnel zone) for many equipments depending on the position. In this configuration, the propagation in the area is through spherical wavefronts, with hence the possibility of beam focusing instead of simple beam steering. This can give challenging opportunities for completely new approaches to improve radio resource allocation which could be done in the 3D spatial area of the cell, to a specific user, and hence not limited to only single directional allocation with beam-steering (5G far-field communication). These challenges can be addressed for terrestrial 6G Radio Access Network (RAN) as well as for satellite RAN and the dynamical 6G radio resource allocation could take advantage of AI to address the dynamic needs of traffic demand of a node as well as its mobility. This allocation should be based on a realistic modelling of data traffic as well as mobility

for each user. It should also take into account the propagation channel environment for each node as well as the interference between them and cross-beam interferences.

The proposed radio resource algorithms and solutions should be implemented on simulation and/or emulation tools, such as OpenAirInterface plateforme and NS-3, in order to achieve validation and performance testing.

Requirements:

- Obtained or about to obtain a Master degree in a relevant discipline
- Network fundamental skills
- Knowledge on 3GPP radio cellular networks (4G, 5G)
- Programming skills such as Python, C/C++ and MATLAB
- Mathematical skills especially in traffic modelling
- Knowledge in Linux or Unix Operating System