

Internship proposal (6 months)

Evaluation of sensing capabilities of 6G waveforms

(reference CCI062022)

Internship supervisor

Mitsubishi Electric R&D Centre Europe:

Cristina Ciochina, Senior Researcher (c.ciochina@fr.mercedes-mee.com)

Overall context

Set up in the middle of the scientific campus of Rennes, the capital of Brittany, the French branch of Mitsubishi Electric R&D Centre Europe provides advanced R&D support to the Japanese R&D centers and to the business units of Mitsubishi Electric Corporation. Within the Communications and Information Systems division, our Wireless Communication Systems team focuses its research interests on wireless communications for factory automation, automotive, railway, satellite, and access network fields. We combine long-term research with applied research resulting in contributions in international standards and development of proprietary technologies for in-house products.

Internship subject

5G technologies are nowadays commercially available all over the world. In international standardization forums such as 3GPP, the standardization of 5G-Advanced already started and standardization of 6G technologies is foreseen at the horizon 2026-2028, targeting 6G commercially available products before 2030. 6G pre-standardization work is currently ongoing in different R&D forums across the world. Recent advances on technologies such as integrated communication, sensing and positioning or AI/ML assisted air interface open the way to exploring the Terahertz spectrum and aim achieving 6G new key performance indicators.

The purpose of the internship is to evaluate the capabilities of different candidate waveforms for 6G communications for performing operations such as sensing at the physical layer level. The study will consider the properties of the different candidate waveforms, the tradeoff between sensing capabilities and the communication performance, the advantages and limitations of different candidates, and evaluate their pertinence in a 6G context.

Detailed objectives

- Bibliographic study of 6G physical layer candidates
- Identification of pros and cons of different technology classes

- Development of a simulation environment to validate the physical layer performance of one or several identified technologies
- Writing the internship's report

Prerequisites

- Interest in research
- Good knowledge of wireless systems and technologies, signal processing technologies, and solid understanding of single carrier and multi-carrier air interfaces
- Capacity to develop in Matlab
- Autonomy
- Good skills in English (read and written)

References

[1] HEXA-X deliverable D2.1, Towards Tbps Communications in 6G: Use Cases and Gap Analysis, June 2021.

[2] Nokia Bell Labs white paper on "Joint design of communication and sensing for Beyond 5G and 6G systems", online, 2021.

[3] vivo 6G white paper "6G Services, Capabilities and Enabling Technologies", online, July 2022.

[4] S. Li, W. Yuan, C. Liu; Z. Wei; J. Yuan; B. Bai, D. W. K. Ng, "A Novel ISAC Transmission Framework Based on Spatially-Spread Orthogonal Time Frequency Space Modulation," in IEEE Journal on Selected Areas in Communications, vol. 40, no. 6, pp. 1854-1872, June 2022.

Duration: 6 months

Period: Flexible, depending on schools' internships periods

Contact :

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Please provide us an application letter and your CV mentioning the reference of the internship.

The signature of an Internship Agreement with your school is mandatory.