Postdoc position: Design of short packet wiretap codes for 6G

Starting date: As soon as possible (flexible)

Full time, 1 year contract funded by the NF-HiSec project of the PEPR 5G Future Networks. Possibility of 1 year renewal through another grant.

The ETIS Laboratory is located in Cergy-Pontoise, 30 km from Paris.

Requirements: We seek candidates with a strong academic background, ideally with expertise in coding theory and / or information theory.

In 6G networks, the deployment of massive MIMO systems with sharp beamforming at sub 6GHz, as well as of mmWave and THz bands communication systems, characterized by highly directional and short-range transmissions, will facilitate the use of physical layer security (PLS) techniques and provide a concrete scenario for wiretap channels.
The aim of this project is to investigate the use of wiretap coding in highly directive links. In the asymptotic setting, it is known that polar codes achieve the secrecy capacity of a wide range of wiretap channels [1]. However, most potential use cases for PLS technologies in 6G communication systems require short packets or low latency, and it is important to obtain tight bounds for the information leakage in finite blocklength. Currently, the available constructions of short packet wiretap codes with information-theoretic security are limited to extremely short blocklengths and / or very low rates. The project will focus on the design of wiretap codes based on polar codes and their variants [3] with the goal of approaching the optimal secrecy rate as a function of the blocklength, information leakage and error probability [2].

References

[1] H. Mahdavifar and A. Vardy, "Achieving the secrecy capacity of wiretap channels using polar codes", *IEEE Transactions on Information Theory*, vol. 57, no. 10, Oct 2011.

[2] W. Yang, R. F. Schaefer, and H. V. Poor, "Wiretap channels: Nonasymptotic fundamental limits", *IEEE Transactions on Information Theory*, vol. 65, no. 7, pp. 4069–4093, 2019.

[3] M. Shakiba-Herfeh, L. Luzzi, A. Chorti, "Finite blocklength secrecy analysis of Polar and Reed-Muller codes in BEC semi-deterministic wiretap channels", *IEEE Information Theory Workshop*, Kanazawa, Japan, Oct. 2021

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