School of Computing, Engineering, and the Built Environment
Edinburgh Napier University

PHD STUDENT PROJECT

Funding and application details

Funding status: Self funded students only

Application instructions:
Detailed instructions are available at https://blogs.napier.ac.uk/scebe-research/available-phd-student-projects/

Prospective candidates are encouraged to contact the Director of Studies (see details below) to discuss the project and their suitability for it.

Project details

Supervisory Team:
- DIRECTOR OF STUDY: Petros Karadimas (Email: P.Karadimas@napier.ac.uk)
- 2ND SUPERVISOR:

Subject Group: Cyber-security and system engineering

Research Areas: Communications Engineering, Electrical Engineering, Electronic Engineering, Applied Mathematics, Engineering Mathematics, Mathematical Modelling Probability, Statistics, Stochastic Processes

Project Title: Hybrid OFDM transmission system for connected autonomous vehicles

Project description:

Orthogonal Frequency Division Multiplexing (OFDM) is a technique that exploits orthogonal carriers to transmit information and enhance received signal diversity and consequently increase received signal-to-noise ratio (SNR). In wireless mobile communications, carrier orthogonality is violated due to the inherent Doppler spread arisen by the temporal variability of the wireless channel. This effect causes degradation of received signal quality and becomes more evident in high mobility scenarios such as in connected autonomous vehicles (CAVs). However, the increased Doppler spread in CAVs provides an alternative signal diversity

mechanism characterized as Doppler diversity. Starting from a very thorough literature review, the OFDM technique will be theoretically studied and analyzed to understand the important parameters affecting its performance in CAV scenarios. The PhD candidate should come up with a solution compensating the increased Doppler spread in such scenarios. The project will then investigate the implementation of a hybrid OFDM architecture by incorporating Doppler diversity in CAV scenarios. Both the hybrid and the standard OFDM architectures should be then implemented/simulated in an appropriate software tool (e.g., Matlab, Labview). A comparative study of both architectures will demonstrate the performance improvement (if any) of the hybrid against the standard OFDM architecture.

References:

[1] A. Goldsmith, "Wireless communications," Cambridge university press, 2005.

[2] A. M. Sayeed and B. Aazhang, "Joint multipath-Doppler diversity in mobile wireless communications," IEEE Transactions on Communications, vol. 47, no. 1, pp. 123-132, Jan. 1999.

[3] Tiejun Wang, J. G. Proakis, E. Masry and J. R. Zeidler, "Performance degradation of OFDM systems due to Doppler spreading," IEEE Transactions on Wireless Communications, vol. 5, no. 6, pp. 1422-1432, June 2006.

[4] R. Hadani et al., "Orthogonal Time Frequency Space Modulation," 2017 IEEE Wireless Communications and Networking Conference (WCNC), 2017, pp. 1-6.

Candidate characteristics

Education:

A first-class honours degree, or a distinction at master level, or equivalent achievements in Electrical/Electronic Engineering, or Mathematics

Subject knowledge:

- Communication Principles
- Digital Communications
- Signal Processing
- Digital Signal Processing
- Statistics and Stochastic Processes
- Engineering Mathematics

Essential attributes:

- Good written and oral communication skills
- Strong motivation with evidence of independent research skills relevant to the project
- Good time management

Desirable attributes:

- Experience with software tools such as Matlab, Labview