Next-Generation Nonorthogonal Communications

Project Leader
HAMAMURA Masanori, PhD
Professor, Information Systems Engineering

1. Objective

This project is aimed at:

Creating a new form of next-generation communication technology to improve spectral efficiency (channel capacity) and other performance metrics. Many studies are being conducted using nonorthogonal methods that remove the orthogonality between the elements of the communication systems. Of particular note is a series of studies on spectrally efficient frequency division multiplexing (SEFDM) proposed and promoted by Professor Darwazeh and his group at UCL. The SEFDM uses non-orthogonality between signals of sin(x)/x type in the frequency domain. We develop that approach further by introducing other elements of communication systems.

2. Project Outline

To that end, the project will consist of the following phases:

(a) Review of past investigations;
(b) Creation of new systems;
(c) Theoretical analysis, numerical analysis, computer simulations, and experimental verification; and
(d) Publication of the findings/developments in academic papers.

3. Expected Performance

In this project, the successful candidate would be expected to:

(a) Publish at least two research papers in top-tier journals;
(b) Work independently under the supervision of the project leader;
(c) Report project progress at meetings; and
(d) Assist the laboratory members in their research.

4. Required Skills and Knowledge

The successful candidate for this project will have the following knowledge and skills:

(a) Knowledge of and skills in communication systems, information theory, signal processing, statistics, and the like;
(b) Programming skills (MATLAB, Python, C);
(c) Publication of least one technical paper in English as primary author; and
(d) Experience in the building of experimental systems for wireless links and the measurement of their performance (preferred).

References

[1] M.R.D. Rodrigues and I. Darwazeh, A spectrally efficient frequency division multiplexing based communications system, Proceedings of the 8th International OFDM-Workshop (InOWo'03), September 2003.
[2] I. Darwazeh, T. Xu, T. Gui, Y. Bao, and Z. Li, Optical SEFDM system; Bandwidth saving using non-orthogonal sub-carriers, IEEE Photonics Technology Letters, vol.26, no.4, February 2014.
[3] T. Xu and I. Darwazeh, A soft detector for spectrally efficient systems with non-orthogonal overlapped sub-carriers, IEEE Communications Letters, vol.18, no.10, October 2014.

[4] H. Ghannam and I. Darwazeh, SEFDM over satellite systems with advanced interference cancellation, IET Communications, vol.12, Iss.1, pp.59-66, 2018.
[5] M. Hamamura and S. Tachikawa, Bandwidth efficiency improvement for multi-carrier systems, Proceedings of the IEEE 15th International Symposium on Personal, Indoor and Mobile Radio Communications (PIMRC 2004), vol.1/4, pp.48-52, September 2004.
[6] M. Hamamura and J. Hyuga, Spectral efficiency of orthogonal set of truncated MC-CDMA signals using discrete prolate spheroidal sequences, Proceedings of the IEEE Wireless Communications and Networking Conference (WCNC 2008), pp.980-984, April 2008.

See KUT's admission guidelines:
https://www.kochi-tech.ac.jp/english/admission/ssp_aft19oct/ssp_application_guideline.html

Contact
E-mail: hamamura.masanori@kochi-tech.ac.jp