A New Coding Technique for Interference Mitigation

Tech ID: 24498 / UC Case 2015-077-0

BACKGROUND

For high data rates and massive connectivity, the next generation cellular networks are expected to deploy many small base stations. While such dense deployment provides the benefit of bringing radio closer to end users, it also increases the amount of interference from neighboring cells. Consequently, smart management of interference is becoming a key enabling technology for high-spectral-efficiency, low-power, broad-coverage wireless communication. Over the past decades, several techniques at different protocol layers have been proposed to mitigate adverse effects of interference in wireless networks. One important conceptual technique at the physical layer is simultaneous decoding whereby each receiver decodes for the desired signal as well as part or whole of interference.

When interference is strong this simultaneous decoding technique achieves the optimal performance for the two user Gaussian interference channel using good point-to-point codes. Moreover, it achieves the optimal maximum likelihood decoding performance in general, when the encoders are restricted to point-to-point random code ensembles. The celebrated Han-Kobayashi coding scheme, which achieves the best known performance for general two-user interference channels, also uses simultaneous decoding as a crucial component. As a main drawback, however, each receiver in simultaneous decoding has to employ some form of multiuser sequence detection, which usually requires high computational complexity to implement.

TECHNOLOGY DESCRIPTION

Engineers from the University of California have developed a low-complexity coding foundation for communication channels with multiple pairs of senders and receivers, in which the signals from the senders interfere with each other and thus the signal observed at each receiver is a mix of the desired signal as well as one or more interfering signals and some noise. This technology will mitigate the adverse effect of interference caused by other communicating parties.

More specifically, this technology decomposes a data stream into multiple substreams. These substreams are communicated over multiple units (“blocks”) of the span of time/frequency/space dimensions. Each sender encodes each of its substreams into a codeword that spans over multiple blocks and transmits multiple codewords simultaneously by superimposing them in a staggering manner. The characteristics of the codewords (coded modulation) and the mechanism of superimposing them (superposition) can be optimized with respect to the communication channel parameters as well as other transmission constraints. Each receiver recovers the codewords from its desired sender as well as some codewords from interfering senders by decoding its received signal over a sliding window of multiple blocks. For each window, multiple codewords (both desired and interfering) can be recovered one by one (successive cancellation decoding), which allows for each decoding step to be low-complexity. The selection of the codewords to be recovered as well as their decoding order can be optimized.

APPLICATIONS

5G cellular systems and wi-fi systems. This technique may become as a system-wide method for mitigating the adverse effect of interference caused by other communicating parties.

STATE OF DEVELOPMENT

The concept of this invention is fully developed and patent-pending. The inventors are currently optimizing different design parameters.

RELATED MATERIALS

- Lele Wang, Eren Sasoglu, Young-Han Kim. Sliding-Window Superposition Coding for Interference Networks. (2014 IEEE International Symposium on Information Theory) - 01/01/2014
- Hosung Park, Young-Han Kim, Lele Wang. Interference Management via Sliding-Window Superposition Coding. (Globecom 2014) - 01/01/2014

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OTHER INFORMATION

CATEGORIZED AS

- Communications
  - Wireless

RELATED CASES

2015-077-0, 2013-133-0

HYPER-LINKED TECHNOLOGIES

2013-133

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Published Application	20170294981	10/12/2017	2015-077

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