CODE MODULATION SPREAD SPECTRUM: A HIGH DATE RATE ENERGY EFFICIENCY COMMUNICATION SYSTEM

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ALIGO INNOVATION

Partner institution:

ÉTS

OVERVIEW

Most of today's research is focused on how to increase the throughput using the spatial diversity of the wireless channel. The proposed technology explores a new domain (spreading code domain) with the goal of enhancing the data rate without
increasing the system's complexity by using a new dimension to map the transmitted bits. It is a new efficient scheme for high data rate transmission called Code Modulation- Spread Spectrum (CM-SS). This scheme based on spread spectrum quadrature shift keying (SS-QPSK) modulation can achieve higher data rates with lower energy consumption than the conventional system while being simple to implement.

COMPETITIVE ADVANTAGES

The analysis shows that compared to the traditional SS system, the technology would allow doubling the throughput, reducing by 50% the transmitted energy, with 25% less complexity, with less performance degradation, and avoiding

BACKGROUND

The fundamental goal for wireless communications research is to attain the best utilization of the radio spectrum (i.e. high spectral efficiency). This is due to the growth in demand for data caused by the increased number of networked devices and the quality and types of wireless services. Additionally, in recent years, energy consumption has become a critical factor for the design of wireless networks. Energy efficient schemes have the potential to reduce the energy cost and carbon footprint in high power cellular networks and extend the battery of mobile devices. Furthermore, wireless technologies are being utilized in a variety of new scenarios which require low energy consumption such as wireless body area networks (WBANs) and wireless sensor networks (WSNs). Consequently, innovative schemes need to be developed for future wireless
technologies that achieve both high data rates and energy efficiency.

TECHNOLOGY

In the CM-SS, the spreading code is used to spread and to map the transmitted bits. With the transmitter using an elegant mapping method only half of the bits are required to be physically transmitted over the channel. At the receiver side, the transmitted symbols are demodulated using the inverse process. The result is increased in the system's throughput, decreased energy consumption, and a system that is easy to implement. Moreover, the advantages of the spreading spectrum modulation are maintained in the proposed CM-SS scheme.

PERFORMANCE

The conventional DS-SS system outperforms the proposed system by about 3 dB for both AWGN and Rayleigh channels. This 3 dB degradation comes from the error in the code detection. However, the performance degradation gap
between QPSK and higher order modulation with four bits per symbol like 16-PSK over an AWGN channel is 8 dB which is larger than the 3 dB gap with our proposed system. This is because the mapped bits don't reduce the Euclidian distance between the transmitted bits as in the conventional
modulation. Therefore, our proposed CM-SS system increases the data rate with a 5 dB gain in BER relative to the equivalent conventional higher order modulation schemes. Future work will focus on further improvements to the BER performance of the system.

APPLICATIONS

Potential applications in wireless networks with limited energy,
for example in:
- Military communication systems.
- Wireless sensor networks (WSN).
- Wireless body area networks (WBAN).
- Wireless personal area networks (WPAN).
- Mobile radio communication systems.

TECHNOLOGY DEVELOPMENTAL STAGE
Detailed design.

PATENT STATUS
Pending.

BUSINESS OPPORTUNITY
Licensing and co-development.

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