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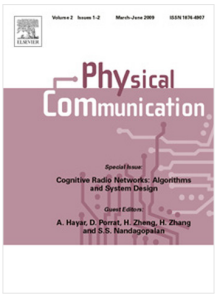

An efficient guided local search approach for multiuser detection in UWB systems

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An efficient guided local search approach for multiuser detection in UWB systems

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Abstract

In this paper, we tackled the performance of a multiuser detection (MUD) in ultra wideband (UWB) systems over extreme multipath channel model (CM4) based on TH-PPM and DS-PAM in a rake receiver. For better performance at receiver side, a novel guided local search (GLS) algorithm is proposed for UWB systems. Simulation results show a significant bit error rate (BER) performance gain can be achieved based on the proposed GLS-MUD method, with conventional detector (CD). In addition, the technique is very promising when the number of interfering users increases.

Keywords: Ultra wideband, Multiuser detection, Guided local search, Combinatorial optimization problem

1. Introduction

UWB technology is a promising solution for short range, wireless and remote sensing applications among many others. In addition, they also have the advantages of low power consumption to reduce the interference between UWB and other wireless systems, large frequency bandwidth, high speed and support multiple users within the same radio channel [1]-[3].
Direct Sequence (DS) and Time Hopping (TH) are the two popular multiple access techniques that are proposed for UWB systems combined with several modulation techniques, such as Pulse Position Modulation (PPM), Pulse Amplitude Modulation (PAM), Binary Phase-Shift Keying (BPSK), Orthogonal Frequency Division Multiplexing (OFDM),...[4]-[7].
Performance analysis of multi-user UWB systems with different multiple access and modulation schemes has been already conducted in the literature [1],[7],[8]. In this paper, TH-PPM and DS-PAM schemes are considered. In TH-PPM, a pseudorandom sequence defines the time when the pulses are transmitted, and in DS-PAM the pulses are transmitted conditionally using a pseudorandom sequence for the spreading of information bits.
The interference between users is an additional source of noise that may degrade the performance of the system. Consequently, the choice of the modulation schemes and the codes allowing multiple access are crucial for the enhancement of the system performance, especially, the elaborate of MUD. Most past research [1],[2],[8] has focused on the interference provoked by undesired users as background noise, thus employ a single-user matched filter (MF) for signal recovery. In [8] a two-stage multiuser detection structure is proposed. In the first stage a bank of correlators is applied to extract all the active users. In the second stage a linear multiuser detector (LMD) is applied to remove multi user interference (MUI). Other works have tackled the optimal MUD [9],[10]. However, the