BICM-ID-based IDMA over Multipath Fading Channels

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***Abstract*—We proposed a detection scheme for Bit Interleaved Coded Modulation with Iterative Detection-based Interleave Division Multiple Access system in fading channels by combinning with turbo equalizer, in which the codes are also effective in achieving excellent performance, the achieved frame error rate is only 0.5 dB away from the outage probability. In order to deeply elaborate the proposed system, in this paper we use extrinsic information transfer chart analysis combined with Matlab simulation results.**

I. Introduction

The Interleave Division Multiple Access (IDMA) concept well exploits the advantageous characteristic of using very low rate codes where the informantion sequence to be transmitted is encoded by an iteratively decodable low rate code. However, designing such low rate code has been a bottle neck in utilizing IDMA in practical systems. Furthermore, in multipath fading channels, a good frame error rate (FER) performance can be achieved using turbo equalizer.

In this paper, we firstly focus on code design by using extrinsic informantion transfer (EXIT) constrained binary switching algorithm (EBSA) [1]. Then, we move on to the concept of combined turbo equalizer. After that we evaluate the performance by simulation results.

II. System Model

The transmission structure for Bit Interleaved Coded Modulation with Iterative Detection (BICM-ID)-based IDMA, is shown in Fig. 1. Each user uses the same BICM-ID structure, where the encoder is Single Parity Check Code and Irregular Repetition Code (SPC-IrR) [2]. The encoded bit sequence is bit-interleaved by a random interleaver Π_k, and then accumulated by doped accumulator (DACC) with a switching ratio p to generate a new bits sequence $u_{m,j}$, where j is the timing index at the output of DACC. The DACC output binary sequence $u_{k,j}$ are serial-to-parallel converted, and mapped on to a 4-QAM signal point, and in part, according to the non-Gray labeling pattern to produce transmission symbols x_m at the timing index m, with modulation mixing ratio D.

At the receiver part, as shown in Fig. 2. Each user is detected independently, and then through the turbo equalizer, the inter-symbol interference (ISI) from the other users is cancelled by the soft cancellation iteration by iteration until it is fully eliminated. After that, hard decision is made before output.

III. EXIT Analysis and Simulation Results

EBSA makes it easier to design suitable low rate code, from Fig. 3(a), very good match between the EXIT charts of demapper and decoder can be observed. It is one of the important reasons why the codes are effective in achieving excellent performance.

The FER performance is shown in Fig. 3(b), it can be observed that single user's performance is close to the theoretical outage probability, only about 0.5 dB gap exists. Meanwhile, the peformance of 8-user is close to the single user's case, also roughly 0.5 dB gap exists.

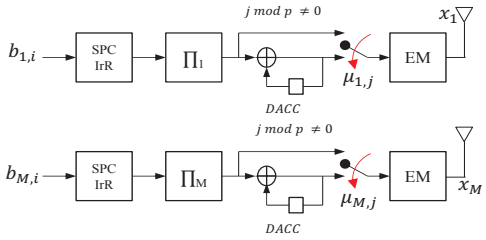

Fig. 1. Transmission Structure

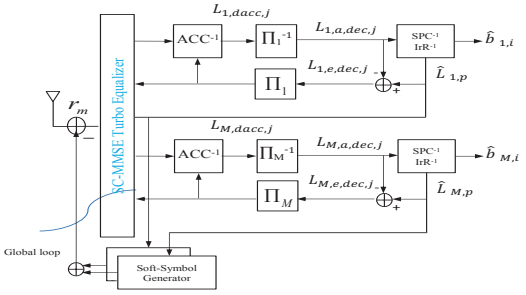

Fig. 2. Receiver Structure

IV. Conclusions

We have evaluated performance of BICM-ID-based IDMA combined with turbo equalizer in multipath fading channels. We found that the excellent performance can be obtained by using very low rate code.

References

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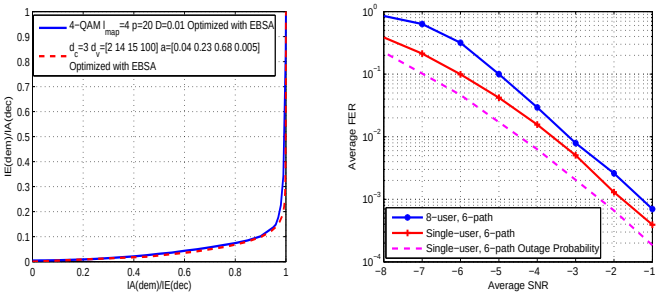

(a) (b)

Fig. 3. EXIT Chart and FER