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Description	



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Near-Capacity-Achieving Simple BICM-ID

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■ The irregular repetition and single parity check codes, combined with partial accumulator and

CONTRIBUTION

LABELING PATTERN OBTAINED FROM EBSA

00001	00111
00010	01000
00100 •	01101
01011	01110
10101	10000
11010	10011
11100	10110
11111	11001
00000	00110
00011	01001
00101 •	• 01100
01010	01111
10100	10001
11011	10010
11101	10111
11110	11000

EXIT CHART ANALYSIS

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Extended Mapping (EM) are used.

- We also propose EXIT-constraint Binary Switching Algorithm (EBSA) to determined optimal labeling patterns for allocating to each constellation point. Furthermore, we combine the techniques described above together with modulation doping.
- Bit Error Rate (BER) simulation results show that using our proposed technique, at a signal-noise ratio (SNR) point of only roughly 0.5dB away from the Shannon limit, clear threshold SNR happens even though required complexity is very low.

SYSTEM MODEL



Figure 3: Labeling pattern obtained from EBSA

- As using the above labeling pattern, the crossing point of the demapper and decoder EXIT curve is at (0, 0) of the mutual information point, and therefore, the trajectory does not start.
- Therefore, we introduce modulation doping technique.

DEMAPPER AND DECODER CALCULATIONS



Figure 5: EXIT charts of proposed BICM-ID

BER PERFORMANCE



Figure 1: System Model of proposed BICM-ID Extended Mapping

- The binary information sequence is encoded by channel encoder using single parity check code, and irregular repetition code.
- The encoded bit sequence is bit-interleaved, accumulated, and then mapped on to one of the constellation points.
- At the receiver side, the iterative processing is invoked, where extrinsic information is exchanged between the demapper and decoder.



CONCLUSIONS

- The very simple close Shannon limit achieving BICM-ID with Irregular repetition code and single parity check codes has been proposed.
- Using the modulation doping technique, the left most part of demapper EXIT curve is pushed up, and thereby, the trajectory starts.
- The BER simulation results show that with the proposed system model combined with EBSA technique, the demapper and decoder curve match each other very well, and therefore, the clear turbo-cliff, corresponding to the threshold SNR, is



Figure 2: Modulation Doping Technique

The idea of modulation doping is that to mix the modulation symbols having different labeling patterns (e.g., extended mapping and Gray mapping).

It aims to lift up the left most part of the demapper EXIT curve.

Initialize the weight coefficient vector $\lambda = [\lambda_0 \dots \lambda_{lamp-1}] = [0 \dots 1];$ Initialize the desirable vertical epsilon values. e.g., $\varepsilon^{v} = [0.001][1, \dots, N].$ **repeat for** i = 1 **to** 100 **do** Randomly generate labeling pattern. Perform *BSA*. **end for** Select the labeling pattern with minimum cost from *BSA*. Perform *LP* to determine the optimal node degree allocation. Draw demapper EXIT curve and *LP*-based decoder EXIT curve and evaluate the horizontal gap (ε^{h}) between this two curves. **if** the gap around Z_{ap} is larger than initialized epsilon (ε^{v}) then $\lambda_{ap} = \lambda_{ap} - 1, \quad 0 < ap < l_{map} - 1$ **end if until** the minimum gap is obtained

Figure 4: EBSA algorithm

achievable roughly only **0.5**dB away from the Shannon limit.

The complexity of the proposed technique is at an order of that required for a turbo code using memory-2 convolutional constituency codes.

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