[7-2]
Construction and Performance Analysis of Accumulate Concatenated Zigzag Codes[1]

Hyeong-Gunn Joo, Song-Nam Hong, and Dong-Joon Shin

Division of Electrical and Computer Engineering

Hanyang University, Seoul, Korea

{yangpablue, sunny795}@ccrl.hanyang.ac.kr, djshin@hanyang.ac.kr

Abstract

Capacity-approaching codes using iterative decoding have been the active research area during past ten years. In this paper, a new channel coding scheme called Accumulate Concatenated Zigzag (ACZZ) codes is proposed. ACZZ codes can be viewed as a subclass of Low Density Parity Check (LDPC) codes with fast encoder structure. They are constructed by applying precoding to the Concatenated Zigzag (CZZ) codes and a rate-1 two-state accumulate code is used as a precoder. Using computer simulation, it is verified that ACZZ codes show better performance than CZZ codes and we obtained the optimal rate-1/2 ACZZ code with the maximum information node degree 4.

I . INTRODUCTION

In 1993, turbo codes were introduced [1], which completely changed the research direction in channel coding area by demonstrating that the capacity-approaching performance could be achieved by the iterative decoding. Especially, turbo codes have better performance in waterfall region than other iteratively decodable codes. However, turbo codes show the worst error floor particularly for high code rate and small block length, and the decoder complexity is rather high because BCJR algorithm is used [2]. Low-density parity-check (LDPC) codes were introduced by Gallager [3] and rediscovered by MacKay and Neal [4]. Richardson, Shokrollahi and Urbanke [5] showed that irregular LDPC codes could have better performance on the AWGN channel than turbo codes, which was very close to the Shannon limit. However, the encoding complexity of LDPC codes is quadratic in the block length, which results in slow encoding.

It has been an important research area to find efficient encoding algorithms [6] and various linear-

time encodable codes such as Irregular Repeat Accumulate (IRA) codes, Concatenated Tree (CT) codes and Concatenated Zigzag (CZZ) codes were proposed [7], [8], [9]. CZZ codes are simple but show worse performance than turbo codes. To improve the performance of CZZ codes, the precoding concept of the Accumulate Repeat Accumulate (ARA) codes [10] is adopted in this paper. In Section III, a new channel coding scheme called the proposed Accumulate Concatenated Zigzag (ACZZ) codes are proposed, which can be viewed as a subclass of Low Density Parity Check (LDPC) codes with linear-time encoder structure. This paper is organized as follows. In Section II, the overview of Concatenated Zigzag codes is given. In Section III, new ACZZ codes are introduced and compared with CZZ codes. In Section IV, the simulation results of ACZZ codes are provided. Finally, Section V presents conclusions.