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Improving bit error-rate based on adaptive Bose-Chaudhuri Hocquenghem concatenated with convolutional codes

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ABSTRACT

Several algorithms have been proposed to avoid the error floor region, such as the concatenation codes that requires high computational demands in addition to high complexity. This paper proposes a technique based on using cascaded BCH and convolutional codes that leads to better error correction performance. Moreover, an adaptive method based on sensing the channel's noise to determine the number of the parity bits that will be added to the used BCH that reduces the consumed bandwidth and the transmitted parity bits is presented. A further enhancement is fulfilled by using parallel processing branches, resulting in reducing the consumed time and speed up the performance. The results show that the proposed code presents a better performance. A high reduction in the number of cycles that will be used in the encoding and decoding compared with the classical method and finally a flexible parity bits method based on the signal-to-noise ratio of the channel that reduced the parity bits which leads to reduce the consumed bandwidth. The MATLAB simulation and the field programmable gate array (FPGA) implementation will be provided in this paper to validate the proposed concept.

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1. INTRODUCTION

The communications field is witnessing a struggle to achieve better performance. The efforts to get a high throughput, low bit-error-rate (BER) and also low consumption of power are the main target of all the communication systems. In this paper, two techniques will be discussed: Bose-Chaudhuri Hocquenghem (BCH) and the convolutional codes [1]. The error floor is the phenomenon that faces the error correcting algorithms such as BCH, the BER decreases as the signal-to-noise ratio (SNR) becomes better [2]. There is a point after which the curve does not fall as quickly as before, the region where the performance flattens is called the error floor region and the region before the huge drop is called the waterfall [3], [4].

This paper will use the BCH and the convolutional codes to approve the idea of this article. The BCH features are the possibility to design code that can correct multiple errors and the easy decoding process using low-power electronic sources. The main features of using convolutional codes are the easy implementation, the better performance in the cases of having higher noisy channels and error probability rates, these codes have memory and Information bits are spread along the sequence.

Concatenated codes concatenation of an inner convolutional code with an outer block code is very common and effective coding structure for solving the error floor problem. The convolutional code works better in low SNR range, but its BER curve roll-off slowly and can have irreducible error floor in fading