[4-34]

Rate-Compatible Punctured Serial Concatenated Convolutional Codes

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Abstract

The next generation mobile communication systems require error correcting coding schemes that can be adaptable to various code rates and SNR values. Serial concatenated convolutional code can be a coding scheme satisfying those requirements. In this paper, we propose rate-compatible punctured serial concatenated convolutional code (RCPSCCC) which performs better than RCPSCCC proposed by Chandran and Valenti [6] in the sense of the rate compatibility. In order to design puncturing patterns, the rate-compatibility restriction is considered, implying that all the code bits of a high rate punctured code are used by the lower rate codes.

1. Introduction

The next-generation mobile communication systems should support high data rate and asymmetric transmission as in the HSDPA (High Speed Downlink Packet Access) system [1]. Therefore, FER (Frame Error Rate) should be down to 10^{-4}~10^{-5} at the interesting SNR range and the latency should be within 80ms. To satisfy the above requirements, the error-correcting codes should have the rate compatibility and the good performance for various codeword lengths. The concept of rate-compatible codes was presented for the first time in [2], where rate-compatible convolutional codes are obtained by adding a rate-compatibility restriction to the puncturing rule. This restriction requires that the rates are organized in the way that all the coded bits of a higher rate code are used by all the lower rate codes by using the appropriate puncturing patterns. The concept of rate-compatible codes was extended to Turbo codes, called RCTC [3]. Turbo codes have an error floor in the region of moderate-to-high SNR due to a small number of low weight codewords [4]. Especially, at high rate and short code length, the effect of error floor becomes more serious, which is an obstacle to the high reliability of packet transmission. On the other hand, serial concatenated convolutional codes (SCCC) can provide better FER performance than Turbo codes in the region of moderate-to-high SNR because SCCC shows little error floor [5]. Therefore, SCCC is better suited for offering error-free packet transmission [5]. RCTC and rate compatible punctured serial concatenated convolutional code (RCPSCCC) are compared and analyzed by Chandran and Valenti [6]. Although RCTC have error floor problem, RCPT is better than RCPSCCC in the sense of rate compatibility [6]. In this paper, we propose RCPSCCC which shows better performance than RCPSCCC proposed in [6]. To obtain RCPSCCC, optimal puncturing patterns are studied.

2. Overview of Serial Concatenated Convolutional Codes

Serial concatenated convolutional code is proposed by Benedetto and Divsalar [5]. The structure of SCCC encoder is shown in Fig. 1. SCCC encoder consists of