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Study of a most meaningful Block Decodable Line Code for High Speed Optical Communication

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Abstract- In this paper a coding scheme is presented that allows the use of high-rate error control codes with a simple line code that gives tight run-length bounds. This implementation offers a small decrease in the overall code rate and is of particular interest in high speed optical communication systems. This code provides a most feasible mechanism for fruitful operation of an Optical Fiber Communication System.

Index Terms- Coding Scheme, Code Rate, Feasible, High Rate Error, Mechanism

I. INTRODUCTION

There is evidence that the error performance of long-haul high speed optical communication systems, employing optical amplifiers, can be improved if maximum run-length limited sequences are transmitted. In an experimental system, the bit error rate of a link was found to be markedly higher when a long m-sequence (with runs of the order of 30 bits) was used to generate the input data, compared with the results obtained using a short m-sequence (with runs of the order of **7** bits). This indicates that there is potential benefit in using run length limited coding. Since systematic error control, typically based on Reed-Solomon (RS) codes, is now employed for such systems, it is appropriate to devise arrangements that enable run-length limiting to be incorporated. In this particular context it is important to note that the data rates are very high (1 Gb/s and greater) so that any proposed codes must be of relatively low complexity if it is to be practically realizable.

II. A BLOCK DECODABLE LINE CODE

When RS coded data are used with a block decodable line code, the input size of the line code word can be selected to match the symbol size of the error control code. This avoids error extension due to the line code since it is restricted in only one n bit symbol of the RS code **.** The disadvantage of this approach is that the maximum rate of the line code that can be used is n/(n+l). If a higher-rate line code is used, the error extension of the line code will affect more symbols, and in order to achieve the same residual bit error rate the use of either a more powerful RS code or interleaving is required. Here we present a new procedure which allows higher rate block decodable line codes to be used. Conventional techniques utilize an inner line code and an outer error control code. This has the disadvantages mentioned above. Our technique also utilizes two cascaded codes. However, the line code encapsulates the error control code. The decoder is similar to that used in **Error** Correcting Line Codes 241. The received code word is initially error control decoded (before line decoding takes place) therefore error extension is virtually eliminated. Furthermore a line code **with** an arbitrary symbol length can be used.

The later only codes the information symbols, leaving the error control symbols uncoded, and so without run-length limitations. To combat this, the error control symbols are distributed **as** single bits between the lines coded symbols. By correctly designing the line code it is possible in most cases to incorporate this addled bit in the maximum run-length of the code. To further increase the code rates, some of the information bits can be distributed uncoded between the line code words.

III. IMPLEMENTATION EXAMPLE

As an example consider an RS (255,245) five error correcting line code. For each code word **2040** bits are transmitted. With our procedure, 238 of tlhe input symbols can be encoded using a 13B14B line code giving 136 line codewords, and leaving **136** bits uncoded (10 error control symbols and **7** information symbols) Those bits can be distributed one after each line code word, giving a sequence with a maximum run of **6** identical symbols.

This procedure can be viewed **as** using a line code with one 'systematic' bit. Such a code has the property that the non-systematic part is decoded independently of the value of that bit. This allows the transmission of the uncoded control symbols with a small increase in the complexity of the code.

IV. CONCLUSION

A coding scheme has been described that allows the use of high rate error control codes with a simple line code that gives tight run-length bounds with a small decrease in the overall code rate. This scheme is of particular interest in high speed optical communication systems.

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