Report on "Enhanced architecture and implementation of spectrum shaping codes", manuscript ID: 93175

January 7, 2024

Chapter 1

Summary and Evaluation

1.1 Summary

In this paper, the author presented an architecture about the spectrum shaping codes. Authors introduced all process given in Figure 1 that are scrambling-unscrambling, $k-$ constrained encoder -decoder and MASP. By transforming the recursive equation (4) in the scrambling algorithm to the equation (10) which is not iterative anymore, they reduced the time complexity from $\mathcal{O}(n)$ to $\mathcal{O}(1)$. And then, authors represented a few algorithms for the process of MASP. First of them is the improvement of MASP with remainder operation. The others enhanced algorithms are without remainder and square. Finally, authors implemented an example involves all proposed process and obtained good results.

1.2 Evaluation

This manuscript provides a presentation of a research article which represents a architecture improves the spectrum shaping code with guided scrambling. Moreover, it is an interesting and effective implementation for spectrum shaping codes by using the basic mathematically facts.

The paper is well-written. The results of study are correct and effective on the implementation area. Nevertheless, some special first visible errors and comments are given in Other Comments. As a result it can publish to "PeerJ Computer Science", if it is corrected regard as the suggestions in the part of "Other Comments".

Chapter 2

Recommendation and Other Comments

2.1 Recommendation

Recommendation about the manuscript of Enhanced architecture and implementation of spectrum shaping codes" is **minor revision**.

2.2 Other Comments

- In the equation (2) of the section "Simplified scrambling and unscrambling algorithms", the number b_i should be written in front of the sum expression, like this:

$$c_i = b_i + \sum_{k=0}^{p-1} (g_{p-k-1} c_{i-k-1})$$

  Because, it is not clear whether the number b_i is included in the sum or not.

- In the section "Simplified scrambling and unscrambling algorithms", when describing the scrambling algorithm which obtains the bit set $\{c_0, c_1, ..., c_{n-2}\}$ from the bit set $\{b_0, b_1, ..., b_{n-2}\}$ by using the GS polynomial, authors introduced a recursive equation with number (2) and its modified form (3) with the operation bit-wise XOR for all i where $p \leq i \leq n-2$. However, bits of $\{c_p, c_{p+1}, ..., c_{n-2}\}$ can be generated by using this recursive equation and that is if the $\{c_0, c_1, ..., c_{p-1}\}$ values are known. How to obtain the values of the bit set $\{c_p, c_{p+1}, ..., c_{n-2}\}$ was not described in this part. Thus, it should be added this missing process to this scrambling part. Moreover, the shortcomings as mentioned above should be completed for

the next GS decoding process, similarly. Equation 4 is the same of Equation (2), it doesn't need the equation takes a new label. It can be said like this: "to get b_i from c_i we are using the equation (2) or (3) and adding $b_i \oplus c_i$ on the both hand side of the equation (2) or (3). Hence, we get the desired last equation gives the values of b_i".

- In Step 1 of the Section "The algorithm of k-constrained encoding and decoding", the encoded bit set $e = \{e_0, e_1, ..., e_{n-1}\}$ is generated by adding a bit 1 to the scrambled bit set $c = \{c_0, c_1, ..., c_{n-2}\}$ where $e_0 = 1$. As I understand the values of bit set c does not change and they are equal to the values of bit set e except for the bit e_0. However, the equality of the sets $\{c_0, c_1, ..., c_{n-2}\} = \{e_1, e_2, ..., e_{n-1}\}$ can not mean $c_0 = e_1, c_1 = e_2, ..., c_{n-2} = e_{n-1}$ because it is not represented as equality of the sequence. If you mean $c_i = e_{i+1}, i = 0, 1, ..., n-2$ you should use the sequence notation such that $(c_0, c_1, ..., c_{n-2}) = (e_1, e_2, ..., e_{n-1})$.

- In Step 2 of the Section "The algorithm of k-constrained encoding and decoding", there is a grammar error it should be like: " ... e is splitted into L blocks ... "

- In Step 2 of the Section "The algorithm of k-constrained encoding and decoding" there is a confusion. The number of e_i is equal to $\frac{n-q-0}{q} + 1 = \frac{n-1}{q}$ in the sentence "L blocks consist of $e_0, e_q, ..., e_{n-q-1}$". However, It was $n = L * q$. It is a contradiction. The authors should be check whether the numbers satisfied or not. After this correction, authors should follow the next steps with decoding part.

- In the Equation (8), the size of the square brackets should be adjusted according to the size of the symbols in the equation.

- If you explain how did you obtain the Equation (9), it would be better.

- In the section of The Enhanced Algorithms (Page 5), the sentence "... where n equals 78 .. ". Where did "78" come from? If it is ok, it should be written as "... equals to ..".

- There is an expression " Sine and cosine are symmetric functions " In subsection of "Improved MASP with remainder operation". Actually, "sine and cosine are symmetric according to the origin and y- axis, respectively. Besides, all sine values can be written by at least a cosine value includes an angle with first quadrant". Moreover, you already converted the sine values to cosine values before Step 3. It doesn't need to be explained anything about the sine values, anymore. These are really obvious mathematical facts. Also, it doesn't need to give the sentence with the example after the Equation (13).

- At the rows 194 and 195, the sentence started as "Let a shaping code ... is 77 bits." should be corrected as " Let a shaping code .... be 77 bits."

- I think that a latex code was written wrongly such that "hat f(x)" at the rows 278 and 289. It should be corrected in the latex form :)
- Although the manuscript is well-written in terms of the language properties, it would be better to polish the language.