

Performance analysis of RS Encoded and self-synchronizing RS Encoded PPM through Gamma-Gamma Channel

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INTRODUCTION

- Reed Solomon (RS) codes are the most common type of FEC codes .
- Represented by RS(n, k).
- Non-binary codes that operate over Galois Field or GF (2^m) .
- Can correct bit as well as burst errors.

- Mostly used with Pulse Position Modulation.
- RS (n, k) can correct up to t errors by using 2t parity for sending a k bit message .

$$2t=n-k$$

- n is the block length of RS(n, k).

$$n=2^m-1$$

- RS codes have 2^m-1-2k degree of comma freedom.

SELF-SYNCHRONIZING REED SOLOMON CODES

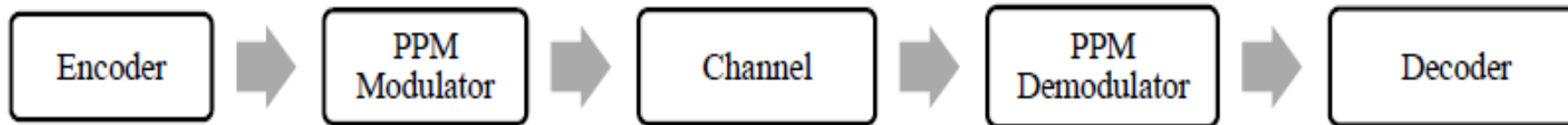
- Proposed by Reed and Solomon in 1968.
- Ability to deal with mis-synchronization of coded sequences without any external help.
- Self-sync RS (n, k) have a degree of comma freedom $> 2^{m-1} - 2k$.

MOTIVATION

- To put such an encoding scheme to use that works best for FSO networks while being compatible with the existing Modulation schemes and provides additional degree of comma freedom.
- To gain an insight into the use of self-synchronizing RS codes in terms of their efficiency.

METHODS

- Used RS (255,223) and SSRS (255,223) .
- 16-PPM is used as modulation scheme.



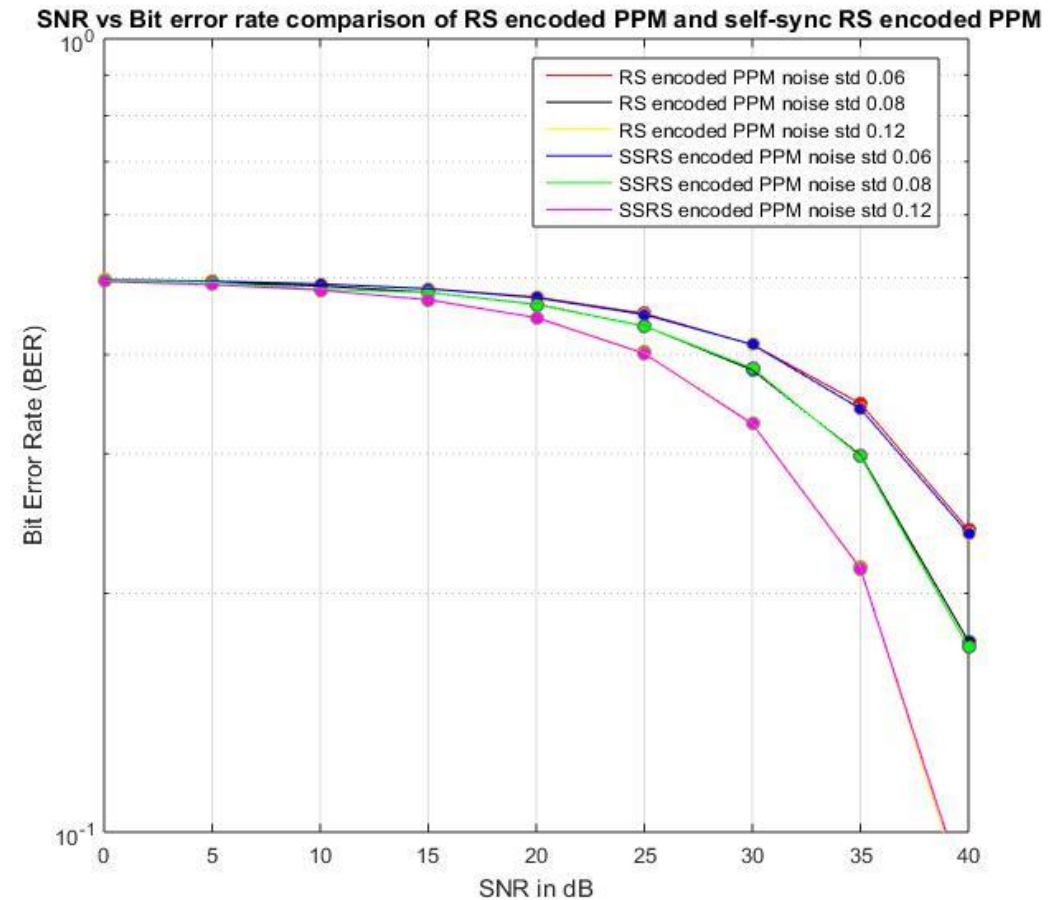
- Gamma-gamma Channel model

- M-PPM is chosen because of its power efficiency.
- Gamma –gamma channel model is simple, tractable and caters all kinds of turbulence conditions.
- In self-synchronizing RS codes ,a vector $C = \{x^m\} = \{1, \beta^m, \beta^{2m}\}$ is added to each codeword individually.
- β is the primitive element of the $GF(2^m)$.

- The value of irradiance is kept constant.
- The bit error rate (BER) is recorded for each model and plotted against signal to noise ratio (SNR) in decibels.

RESULTS

- Negligible difference in their bit error rates.
- For larger values of noise std. and SNR exceeding 25 dB ,the bit error rates of self-synchronizing RS (255,223) show some improvement over RS (255,223).
- Significant improvements in the bit error rate are not seen.



- Reason for the similar behavior of both models can be :
 1. use of lower state of PPM.
 2. the choice for our channel model.
 3. low noise variance levels.

Conclusion

- Self-synchronizing RS codes should exhibit an improved bit error rate because they have greater degree of comma freedom than original RS codes. However, our results show a little performance improvement.
- To improve the results, time and slot synchronization techniques can be applied in harmony with higher states of M-PPM and using channels known statistics to decode the codewords at all the possible distances.

*Thank
you*

