

# Error Detection and Correction Using Chinese Remainder Theorem in CDMA

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**Abstract:** In communication systems corruption of data and hacking of data is unavoidable. These are the major problems we are facing in communication system. This project presents an enhanced multiple error detection and correction scheme based on the Redundant Residue Number System (RRNS). RRNS is often used in parallel processing environments because of its ability to increase the robustness of information passing between the processors. The proposed multiple error correction scheme utilizes the Chinese Remainder Theorem (CRT) together with a novel algorithm that significantly simplifies the error correcting process for integers. This enhanced scheme is compared with the existing method and this enhanced scheme is used in the CDMA application.

**Keywords:** Redundant Residue Number System (RRNS), Chinese Remainder Theorem (CRT) CDMA.

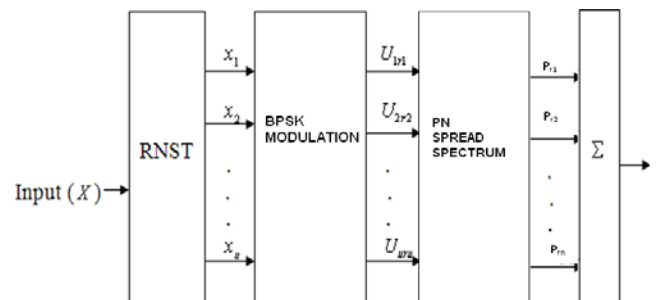
## INTRODUCTION

A Residue Number System (RNS) for integers describes methods of representing an integer as a set of its remainders or residues. Error control is achieved by addition of extra residues, hence the term RRNS. The RRNS code used in this work uses the Chinese Remainder Theorem (CRT) as a means of recovering the integer from a set of its residues. Error correcting codes based on the CRT are attractive because of their ability to perform carry-free arithmetic and lack of ordered significance among the residues. Some of the concepts related to this error correction technique such as the terms legitimate range and illegitimate range for consistency checking.

## RRNS (RESIDUE REDUNDENCY NUMBER SYSTEM)

A residue number system (RNS) represents a large integer using a set of smaller integers, so that computation is performed more efficiently. It relies on the Chinese remainder theorem of modular arithmetic for its operation, a mathematical idea from Sun Tsu Suan-Ching, when redundant residues are added to the information residues then it is called redundant residue number system. The receiver applies the same algorithm to the received data bits and compares its output to the received check bits; if the values do not match, an error has occurred at some point during the transmission. In a system that uses a "non-systematic" code, such as some raptor codes, data bits are transformed into at least as many code bits and the transmitter sends only the code bits.

## TRANSMITTER MODEL



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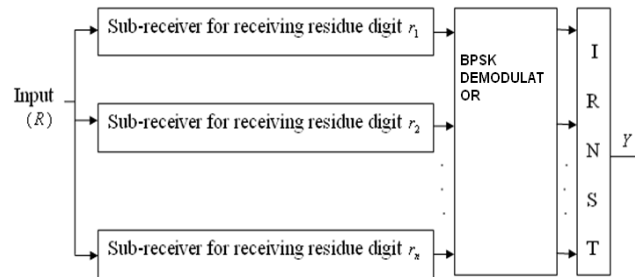
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### CHINESE REMAINDER THEOREM

The Chinese remainder theorem is a result about congruence's in number theory and its generalizations in abstract algebra. The Chinese remainder theorem can also be used in Secret sharing, which consists of distributing a set of shares among a group of people who, all together (but no one alone), can recover a certain secret from the given set of shares. Each of the shares is represented in congruence, and the solution of the system of congruence's using the Chinese remainder theorem is the secret to be recovered. Secret Sharing using the Chinese Remainder Theorem uses, along with the Chinese remainder theorem, special sequences of integers that guarantee the impossibility of

### RECEIVER MODEL



### CHANNEL RESULT

- During transmission, errors propagate into the residue vector  $x$  at positions  $u_1= 1, u_2=3, u_3=5$ . Therefore, let the received vector be  $y= \{2, 2, 2, 7, 3, 7\}$ ,  $x = \{1, 2, 0, 7, 7, 7\}$ ,  $y = \{2, 2, 2, 7, 3, 7\}$  Three errors are introduced because  $t = r - 1 = 3$

### RECEIVER RESULT

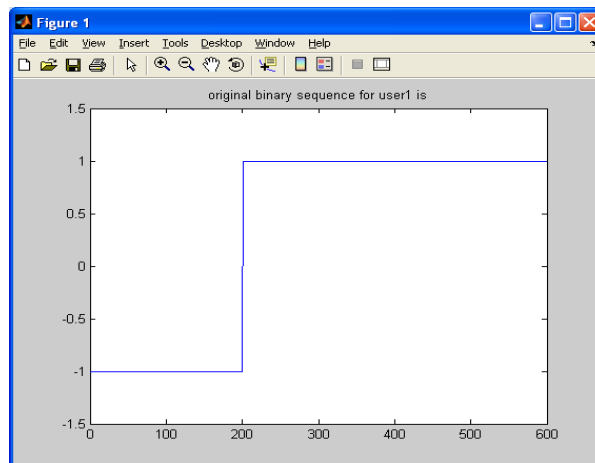
- From  $y$ , the computed integer  $Y$  using,  $= 88832$

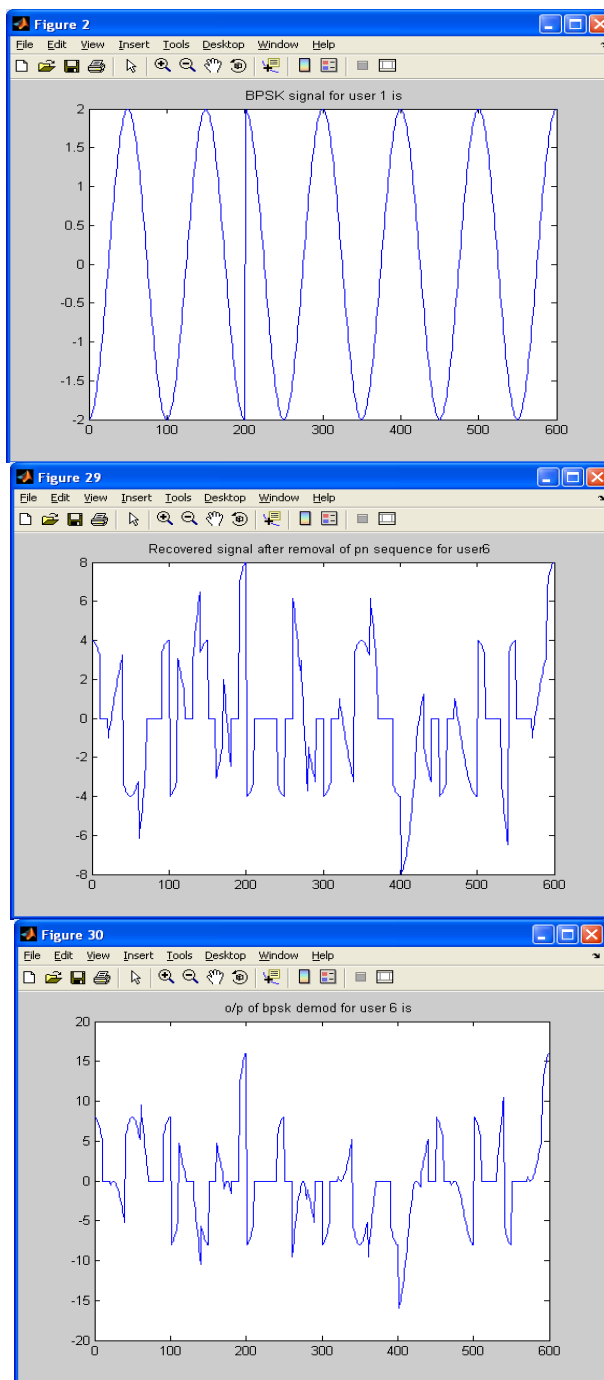
$$Y = \sum_{i=1}^n y_i M_i a_i \text{ mod } M$$

- The corresponding values of  $M_i$  and the multiplicative inverse are
- $M_i = \{85085, 51051, 36465, 23205, 19635, 15015\}$ ;
- $a_i = \{2, 1, 4, 2, 8, 13\}$ ;
- The minimum Hamming distance is 3. Hence the set =  $\{2, 7\}$ .
- The moduli set for the integer 2 (elements in S) is  $\{2, 3, 5, 7, 11, 13\}$ .
- The moduli set for the integer 7 (elements in S) is  $\{3, 5, 7, 11, 13, 17\}$ .
- $S = \{11, 13, 17, 19, 23, 29, 31\}$

Since the moduli set for integer 7 and are same, the transmitted integer is 7.

### OUTPUT





## CONCLUSION

In this project, a modified algorithm is proposed for correcting multiple errors. This is different from existing multiple error correction schemes. This algorithm is quite simple and easy to implement. The proposed algorithm can correct more errors than the other existing schemes at the expense of marginal increase in computation and it is compared with the existing method without implementing in the CDMA application but when it is implemented in the CDMA application the BER is calculated for several SNR values. The future work is to reduce the number of orthogonal codes and computation.

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