

Error Detectability of MB810

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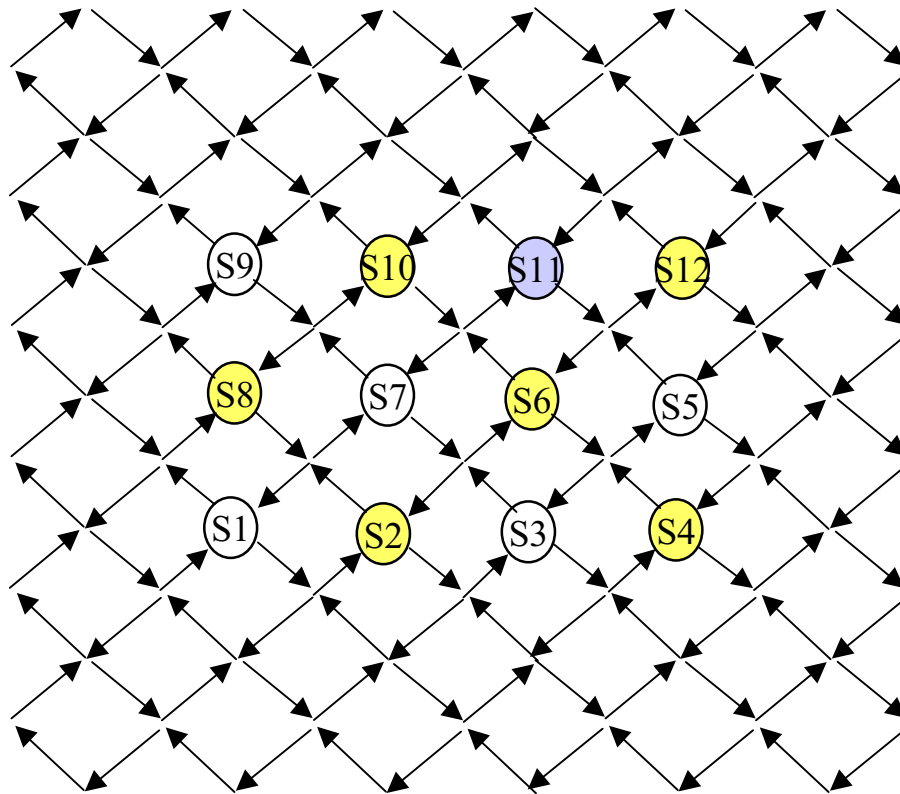
Abstract

We review the error detection capability of MB810 at the receiver. MB810 code is generated using the state information. We found some characteristics in thus generated codewords which can be used to detect transmission errors.

CONTENTS

- 1. State Transition of MB810 Encoder**
- 2. Estimation of Error Detection Capability**
- 3. Hardware Implementations**
- 4. Conclusion**

State Transition in MB810 Encoder



States are classified into Even and Odd states, each of which being six in all.

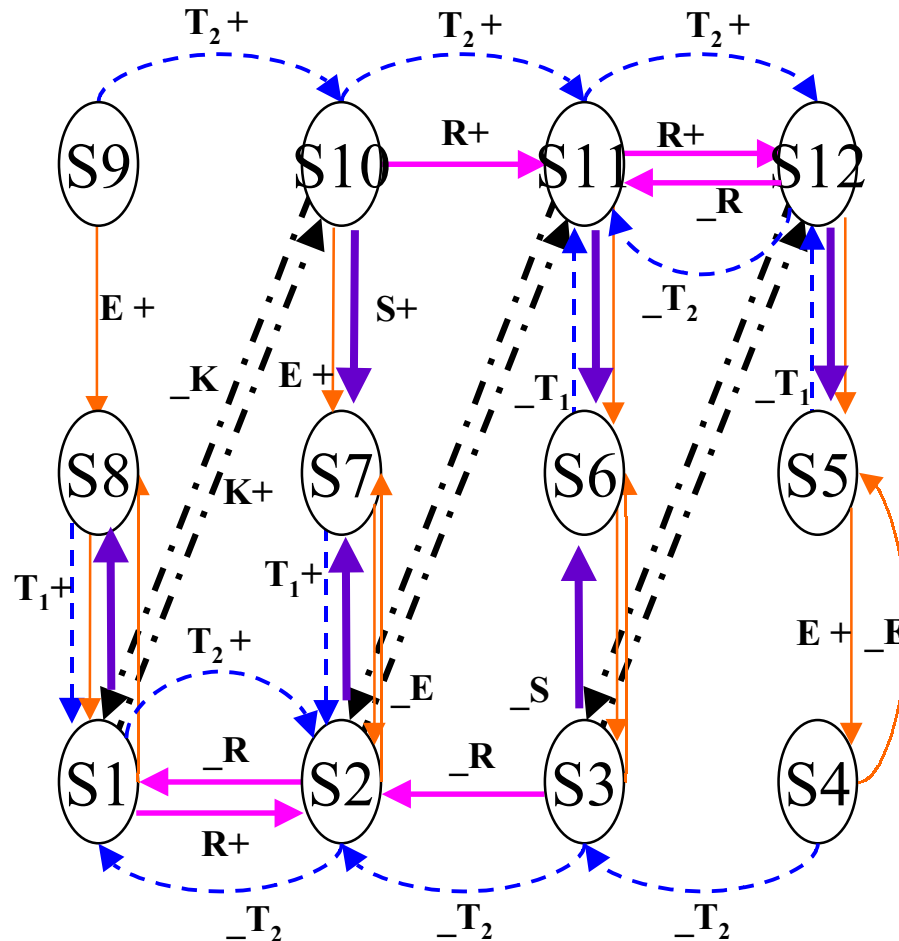
Observation

- A codeword starting at an odd state terminates at an even state.
- Output codewords exist at every other lattice in the horizontal and vertical directions. Not true of the diagonal direction.
- RAS and RDS of all possible codewords are less than 3

Calculation of State Coordinates at Receiver

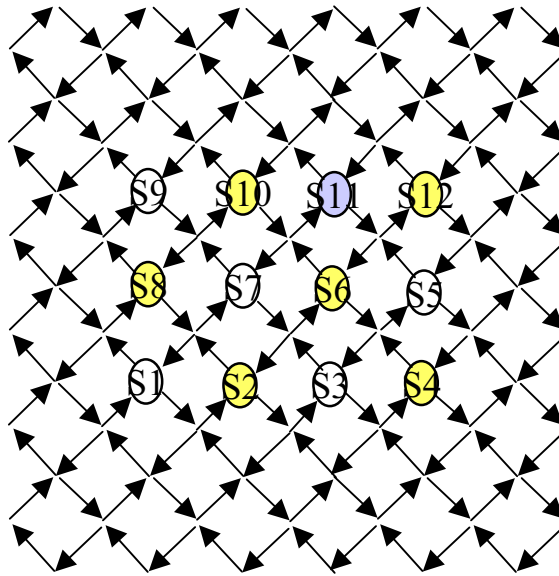
- We can express every states using coordinates in the BUDA cell stack plane;
 - RAS : vertical axis value
 - RDS: horizontal axis value
 - If we assume that S1 is origin (RDS=0,RAS=0), then;
S1: (0,0), S2: (1,0), S3: (2,0), S4: (3,0),
S5: (3,1), S6: (2,1), S7: (1,1), S8: (0,1),
S9: (0,2), S10: (1,2), S11: (2,2), S12: (3,2).
- These coordinates can be used to detect transmission errors in the receiver.

Estimation of Error Detection Capability



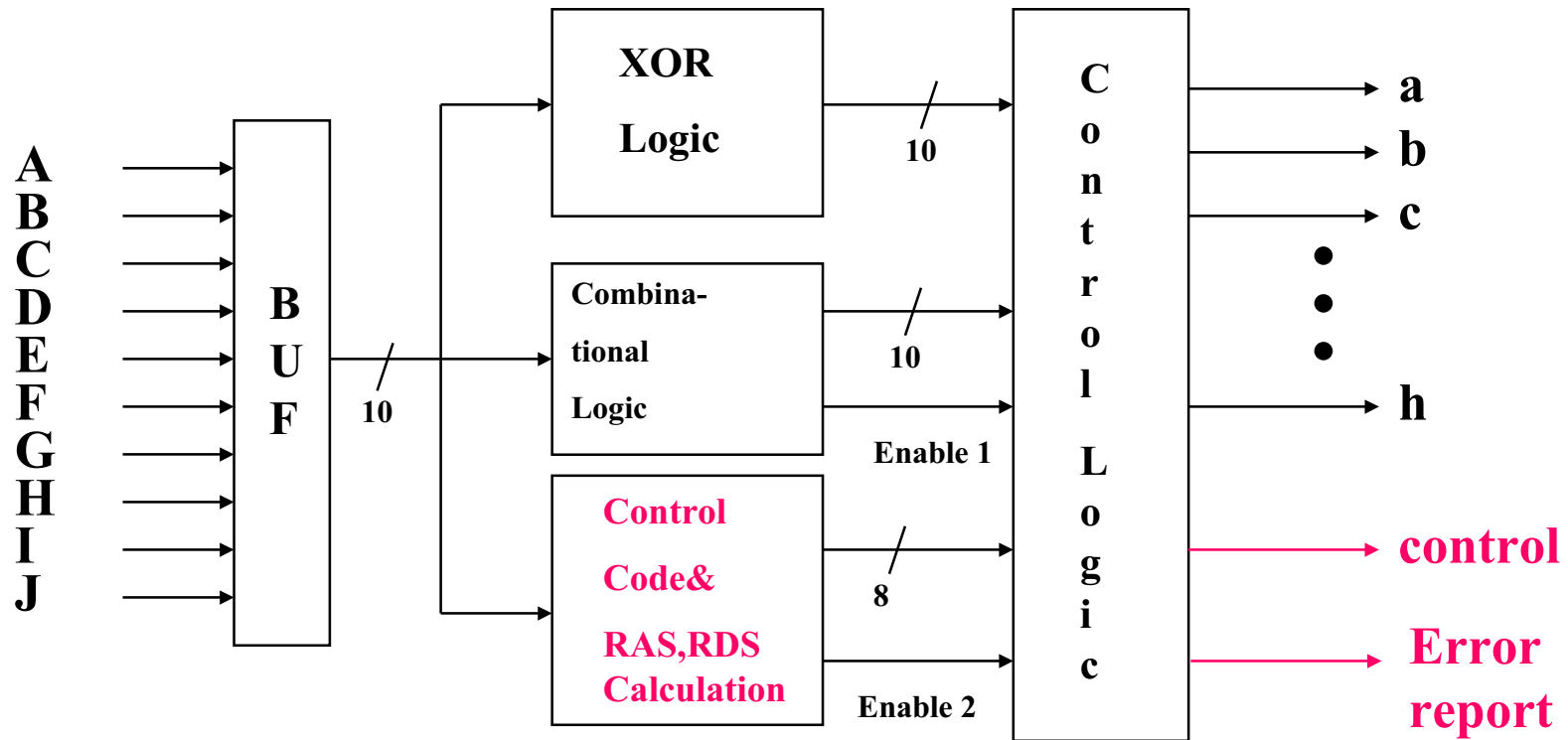
- Data encoding always starts at S5, S6, S7, and S8.
- Decoder knows the initial data encoding states and calculates next states using the received 10-bit codeword.
- Different types of End-of-Packet(EOP) are generated at specific states:
 T1+ at S7, S8
 -T1 at S5, S6
 T2+ at S1, S9, S10, S11
 -T2 at S2, S3, S4, S12
- Errors are detected by monitoring states coordinates and EOP code.

Probability of Undetected Word Errors (P_{FD})



- In the BUDA cell stack plane, possible codeword landing points (node) are 122, 12 of which are legal states.
- False landing due to random channel bit errors are distributed evenly among 122 nodal points.
- P_{FD} without Start and End information in force equals $0.098(\frac{12}{122})$
- P_{FD} enforced by EOP violation detection ranges from $0.016(\frac{12}{122} \times \frac{2}{12})$ to $0.032(\frac{12}{122} \times \frac{4}{12})$
- P_{FD} enforced by Start-State violation detection equals $0.032(\frac{12}{122} \times \frac{4}{12})$

Hardware Implementation



Conclusion

- MB810 states can be expressed by coordinates in the BUDA cell stack plane by using RDS and RAS.
- This can facilitate efficient error indication; odd to even (vice versa) transitions, legal terminal node points, and legal generation of EOP code.
- Probability of undetected word errors is approx. 2%.
- **Strong Error Monitoring** capability with no extra redundancy. Another big advantage of MB810!
- Result on MB810 implementation and performances are being updated at:
 - <http://ccl.cnu.ac.kr/LineCoding>
 - <http://routertech.etri.re.kr/English/Standard>