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Network Coding/Forward Error Correction Code for Multiple-Input Multiple-Output Wireless Communication System

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Outlines

1. Introduction to the wireless communication system (Slides 3-4).
2. Problem and Solution (Slides 5-13).
3. Aim and Initial results (Slides 14-16).
4. Methodology (Slide 17).

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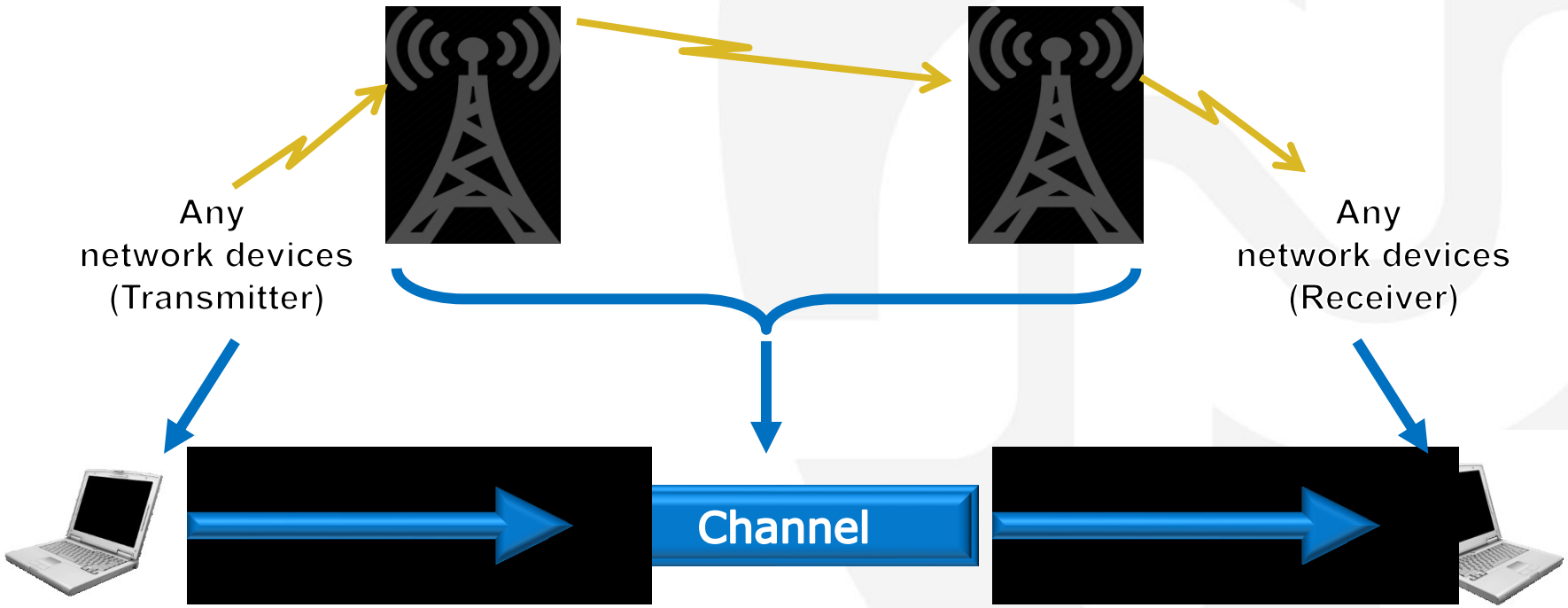
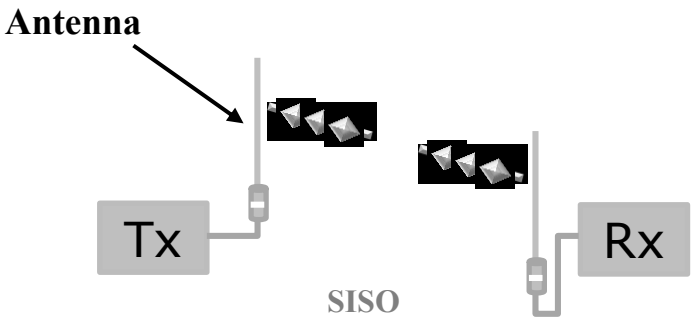
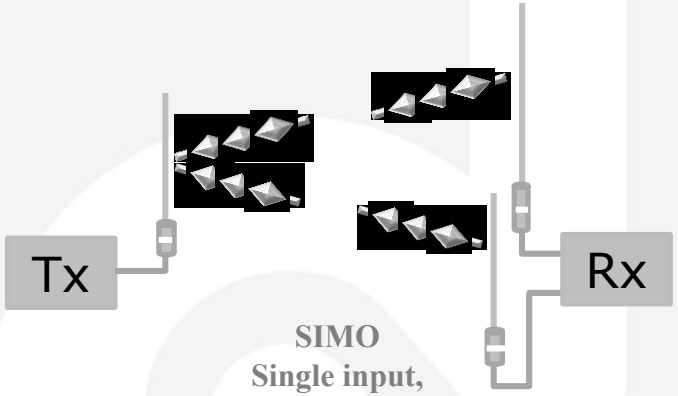
Wireless Network Communication System



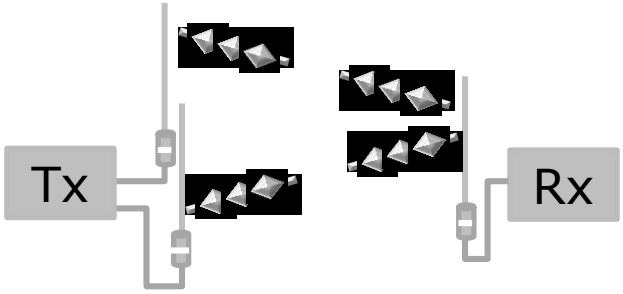
Antenna Technology for Wireless communication



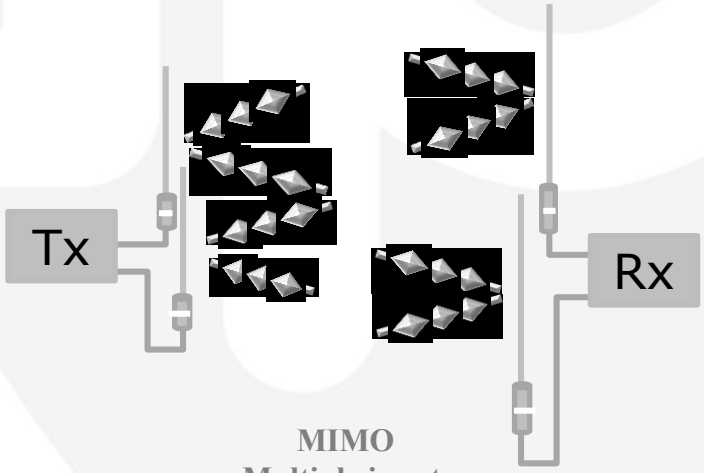
SISO
Single input,
Single output



SIMO
Single input,
Multiple output



MISO
Multiple input,
Single output



MIMO
Multiple input,
Multiple output

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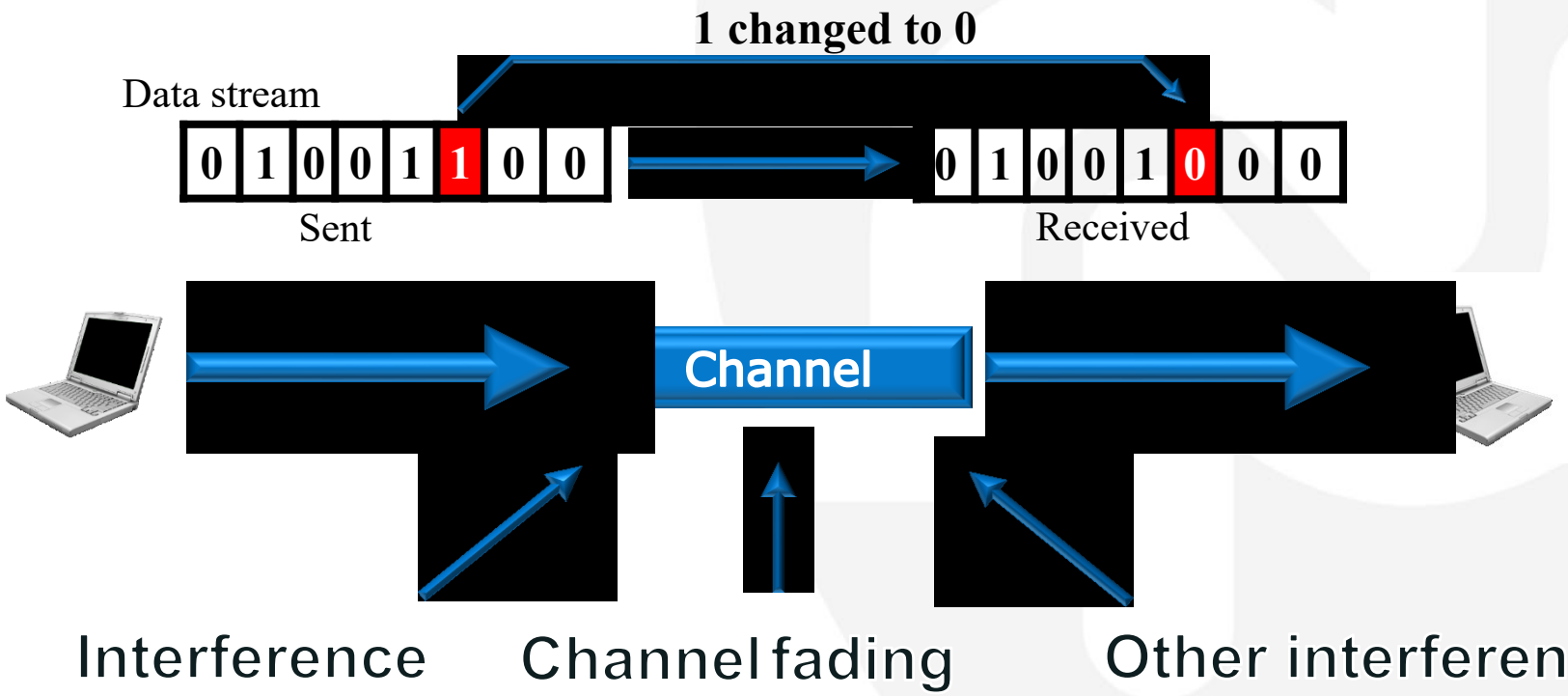
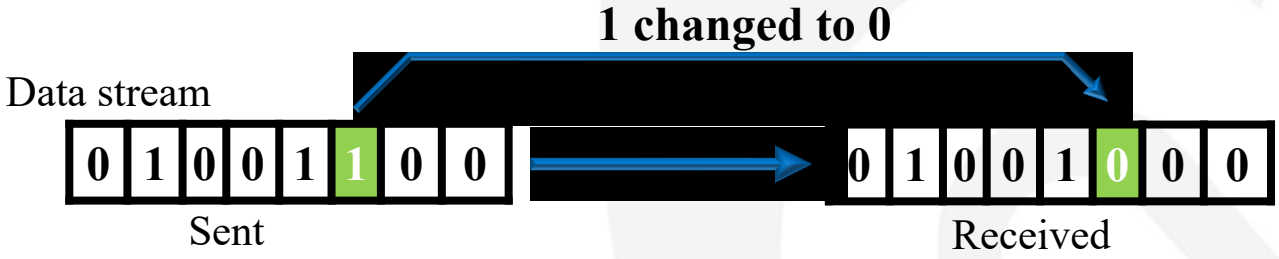
What is the problem?

Data can be corrupted during transmission

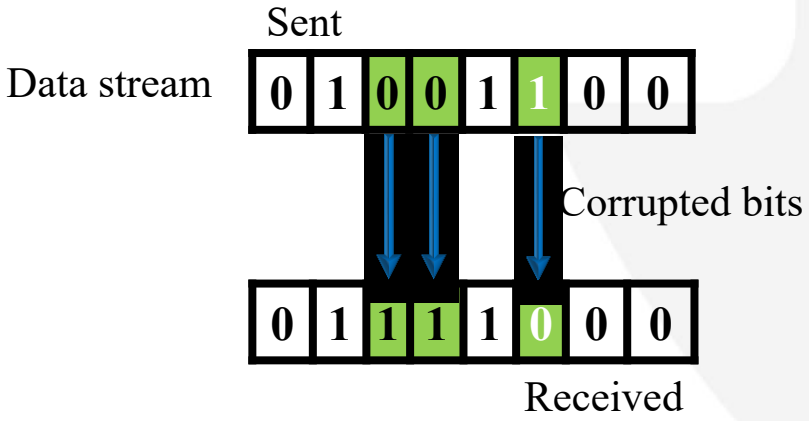


Types of Errors

1- Single-bit error: In this type only 1- bit in the data stream has changed



2- Multiple (Burst) errors: In this type 2 or more bits in the data stream have changed



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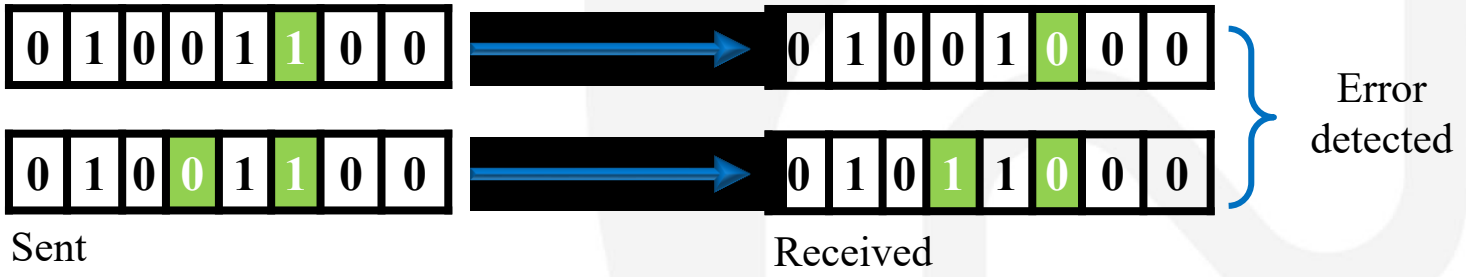
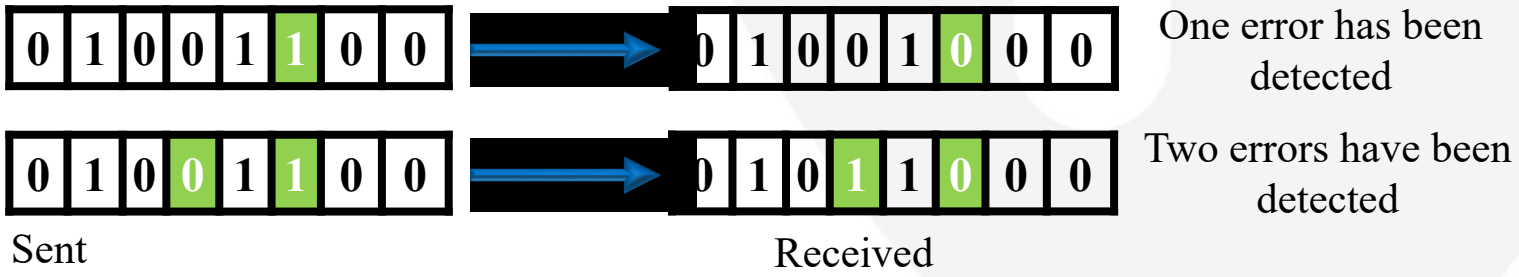
What is the existing solution?

Error Detection and Correction

Error detection: In this technique looking only if any error has occurred. The number of errors is not important.



Error correction: In this technique looking for the approximate number of corrupted data and their location in the received data stream



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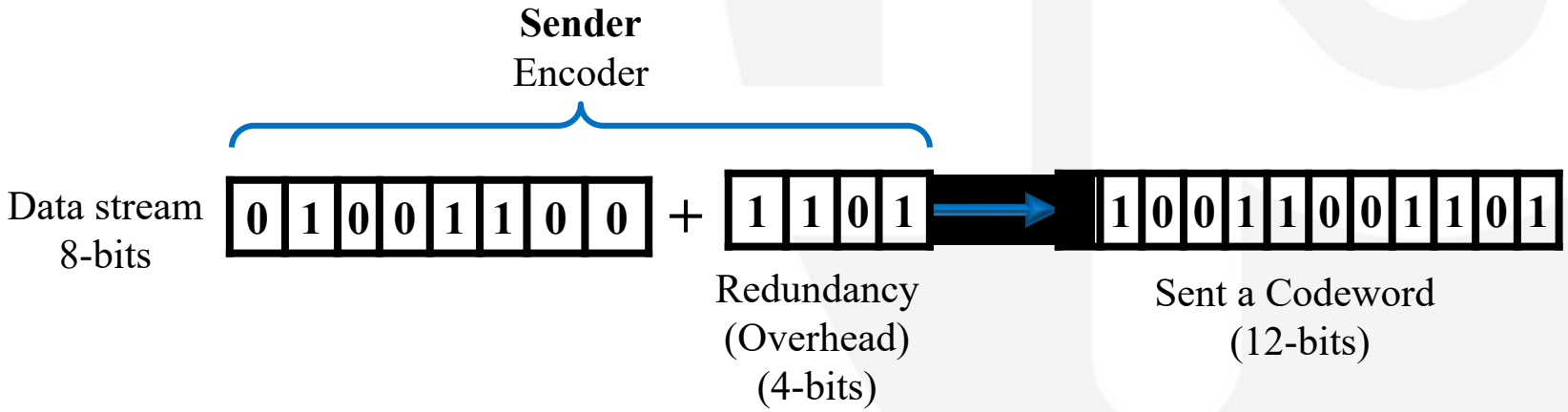
How the receiver detects the error?

Coding Technique

Use a redundancy (extra bit) → **Error detection and correction**



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How the receiver corrects the error?

Error correction approaches

1- Automatic Repeat Request (ARQ):

2- Forward error correction (FEC) (Channel coding):.

Existing FEC for MIMO

Advantage

- decoding performance close to the theoretical channel capacity..

Disadvantage

- SLOW.
- Requires very long code word lengths.
- Computational complexity increases transmission time.
- Poor performance at low BER (symbol error rate).
- Requires a high overhead.

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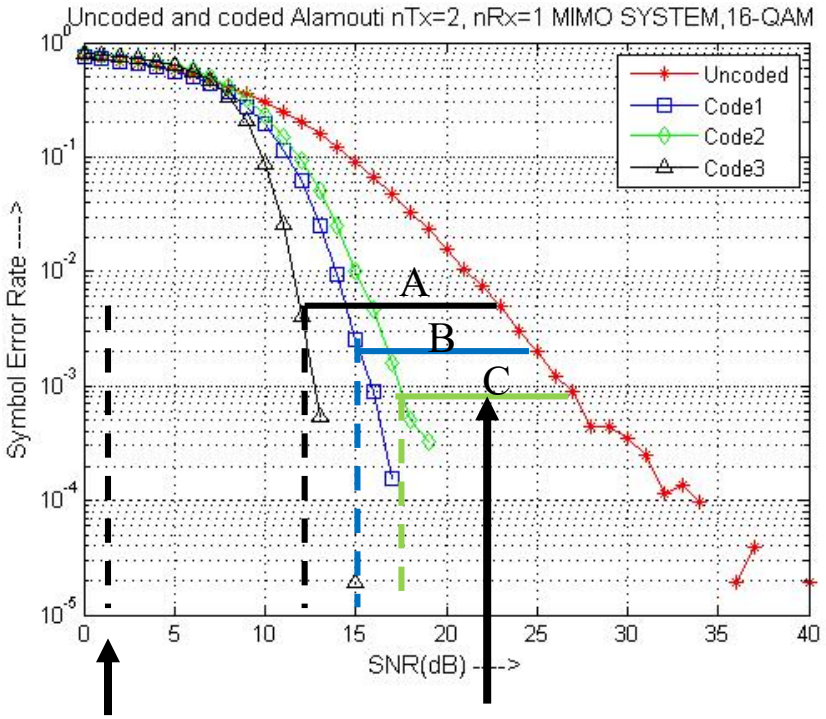
Aim

Design and improve a suitable FEC code algorithm to combine with the MIMO system to decrease the BER (or symbol error rate) and increase wireless communication data throughput (Bit rate or symbol rate). The computational complexity and the data overhead will be used to measure the performance efficiency of the proposed algorithm

The performance of proposed FEC code with MIMO system

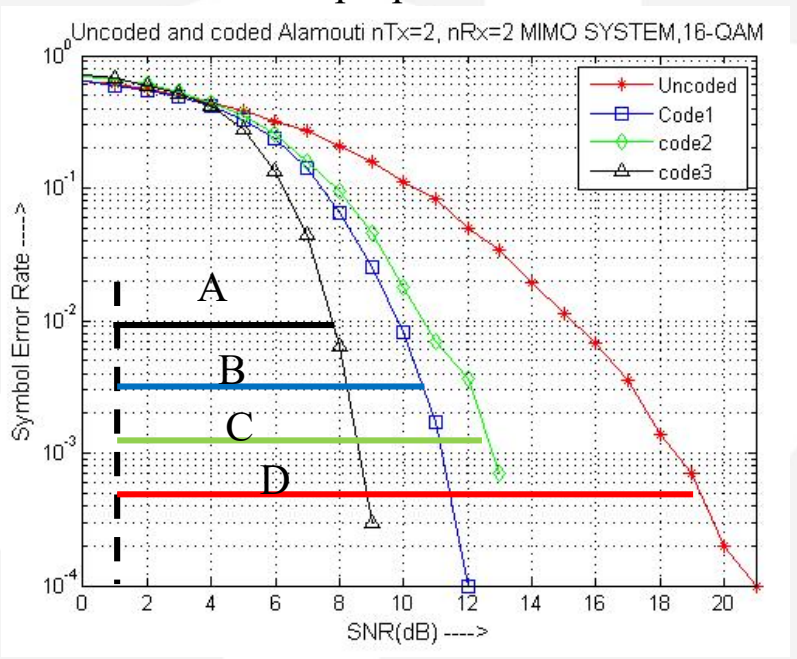
Fig 1: code1= RS, code2=BCH and code3=proposed code



A>B>C

A, B and C represent the coding gain. We need to get large distance.

Fig 2:code1= RS, code2=BCH and code3=proposed code



A<B<C<D

A, B and C represent the distance to channel capacity. We need to get small distance

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Methodology

1) Understand and analyse FEC code algorithms. ✓
2) Simulate FEC code; ✓
3) Understand MIMO system; ✓
4) Simulate the uncoded MIMO system. ✓
5) Combine FEC code With the uncoded (Alamouti and V-Blast) MIMO system and analyse the results in terms of computational complexity and the data overhead .
6) Modify existed FEC code.
7) Combine the modified FEC With the uncoded MIMO system and analyse the results in terms of computational complexity and the data overhead .
8) Compare the results for (7) with (5) in terms of computational complexity and the data overhead .

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Thank You

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Q & A

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