Bandwidth Efficient Channel Coding Scheme for Non-cooperative Overloaded Multiuser MIMO Systems

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Outline

- Introduction
- Current Problems
- Objectives
- Proposed Solution
- Simulation Results
- Conclusion

Introduction

- Multiuser MIMO systems are mainly categorize into three types of systems on the basis of antennas at the transmitter N_{T_x} and receiver N_{R_x}:
  - Under loaded system $\left(N_{R_x} > N_{T_x}\right)$
  - Critically loaded system $\left(N_{R_x} = N_{T_x}\right)$
  - Overloaded system $\left(N_{R_x} < N_{T_x}\right)$

Current Problems

- The overloaded MIMO-OFDM system faces the following problems;
  - High complexity and performance degradation of optimal and suboptimal multi user detection algorithm respectively.
  - Low throughput in terms of channel capacity.
  - High Bit Error Rate (BER).
  - High Packet Drop Rate (PDR).

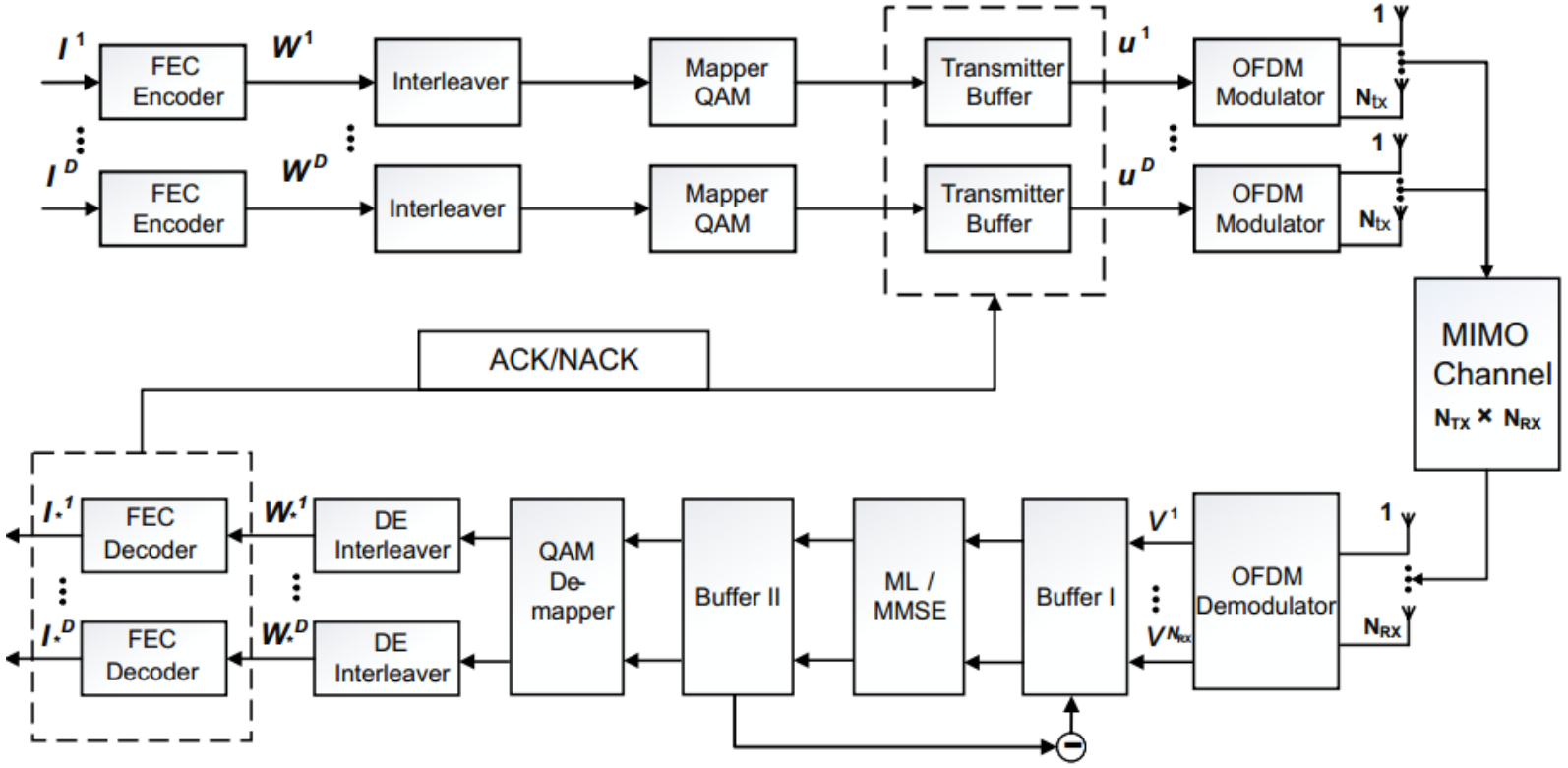
Objectives

- To design a bandwidth efficient channel coding scheme for overloaded MIMO systems.
- To perform efficient and low complex multiuser detection.
- To achieve High channel capacity.
- To reduce the BER and PDR.

Proposed Solution

Features	Implemented
Adopted Scheme	Virtual Receive antennas
Error Detection	CRC
Error Correction	LDPC
Retransmission Scheme	Hybrid Automatic Repeat Request with Chase Combining (CC-HARQ)
Data Storage	Buffer-I, Buffer-II
Buffer-I	Stores the received vector
Buffer-II	Stores estimated received vector
Detection Algorithms	ML, MMSE
The throughput η_{cc} of CC-HARQ	$\eta_{cc} = \frac{p_c^1}{(\mathcal{O}_{cc}+1)/\mathcal{R}}$ $\mathcal{R}$, code rate of FEC encoder $\mathcal{O}_{cc}$, overhead due to CC-HARQ.

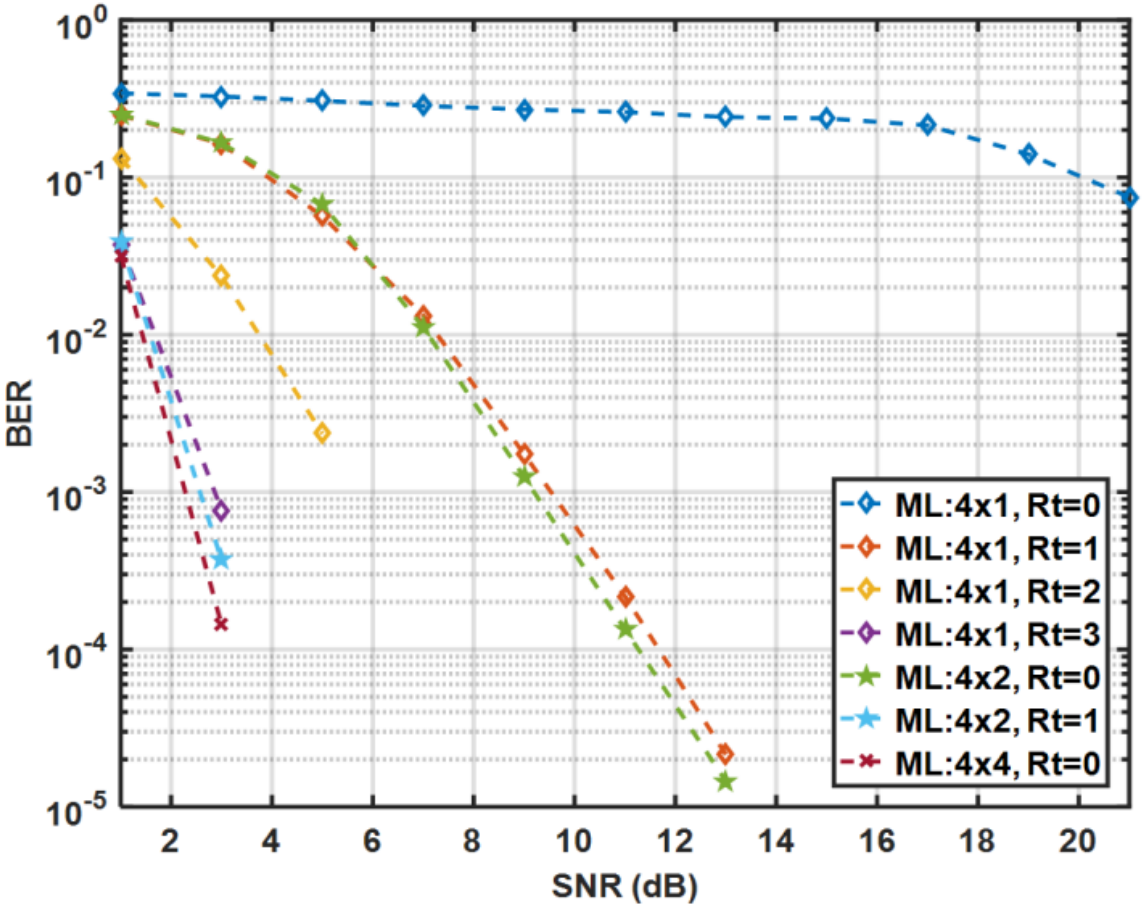
System Model 2/2



Simulation Results 1/8

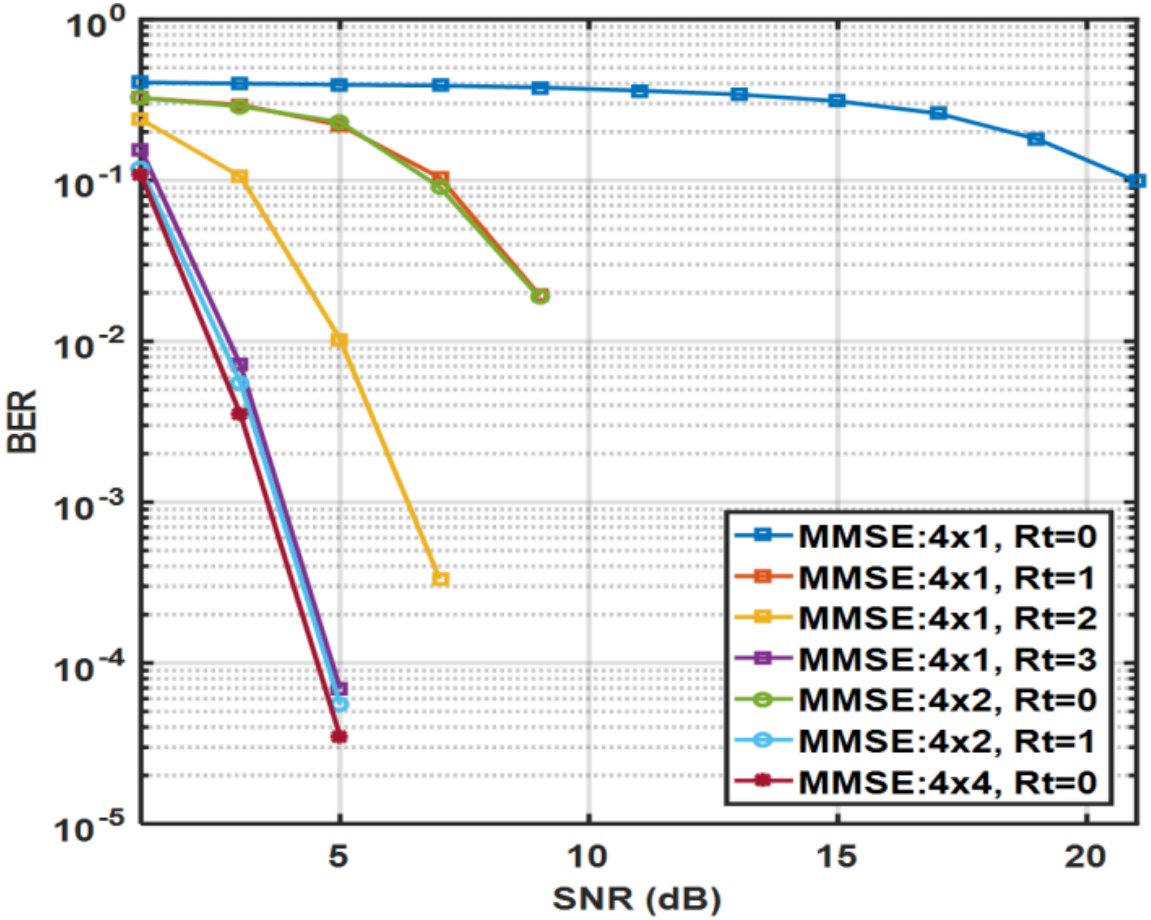
Simulation Parameters	
Modulation Type:	4 QAM
Channel used:	Rayleigh fading Channel
Platform:	MATLAB
Traffic Model	Uplink
Transmit antennas (N_{Tx})	4
Receive antennas (N_{Rx})	1, 2 and 4
Retransmissions (R_t)	0,1,2,3
Information bits + CRC	32400

Simulation Results 2/8



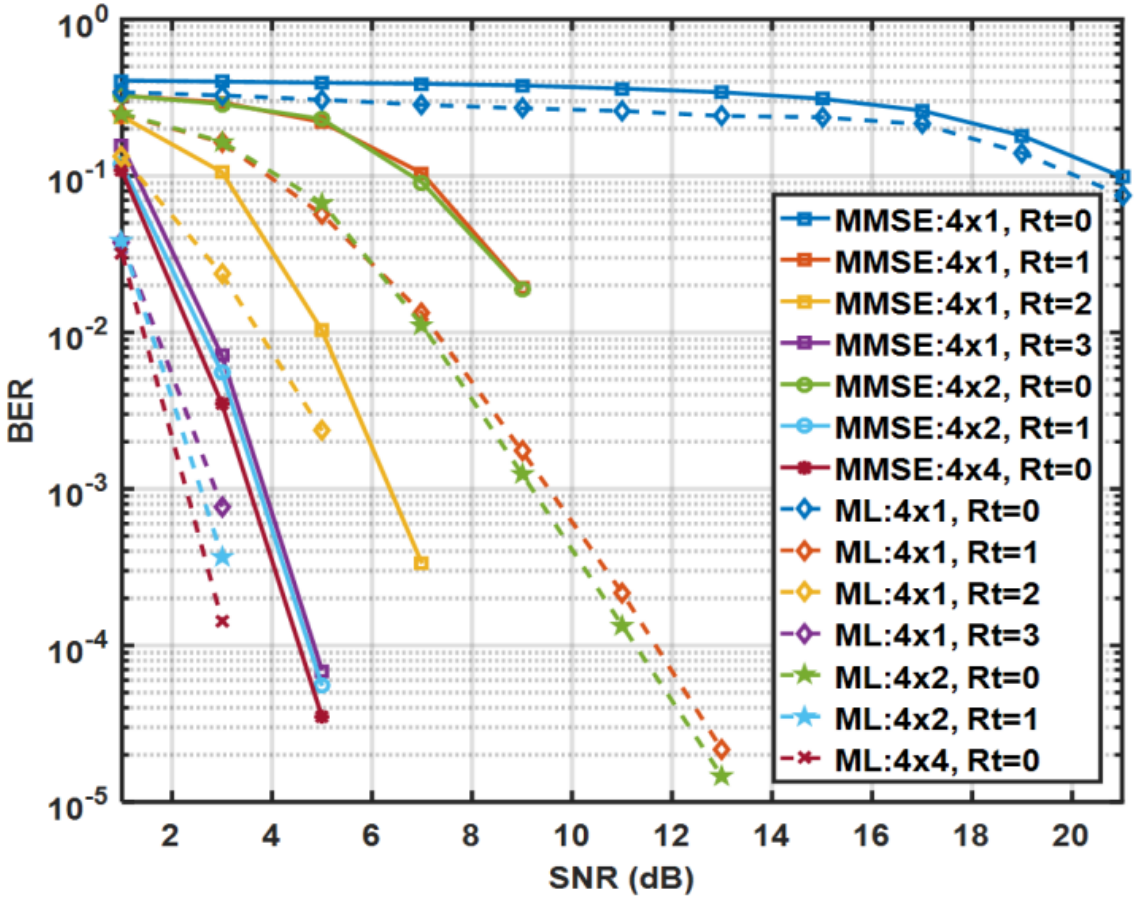
Multi user MIMO-OFDM systems' performance in terms of BER with proposed scheme, using ML detector.

Simulation Results 3/8



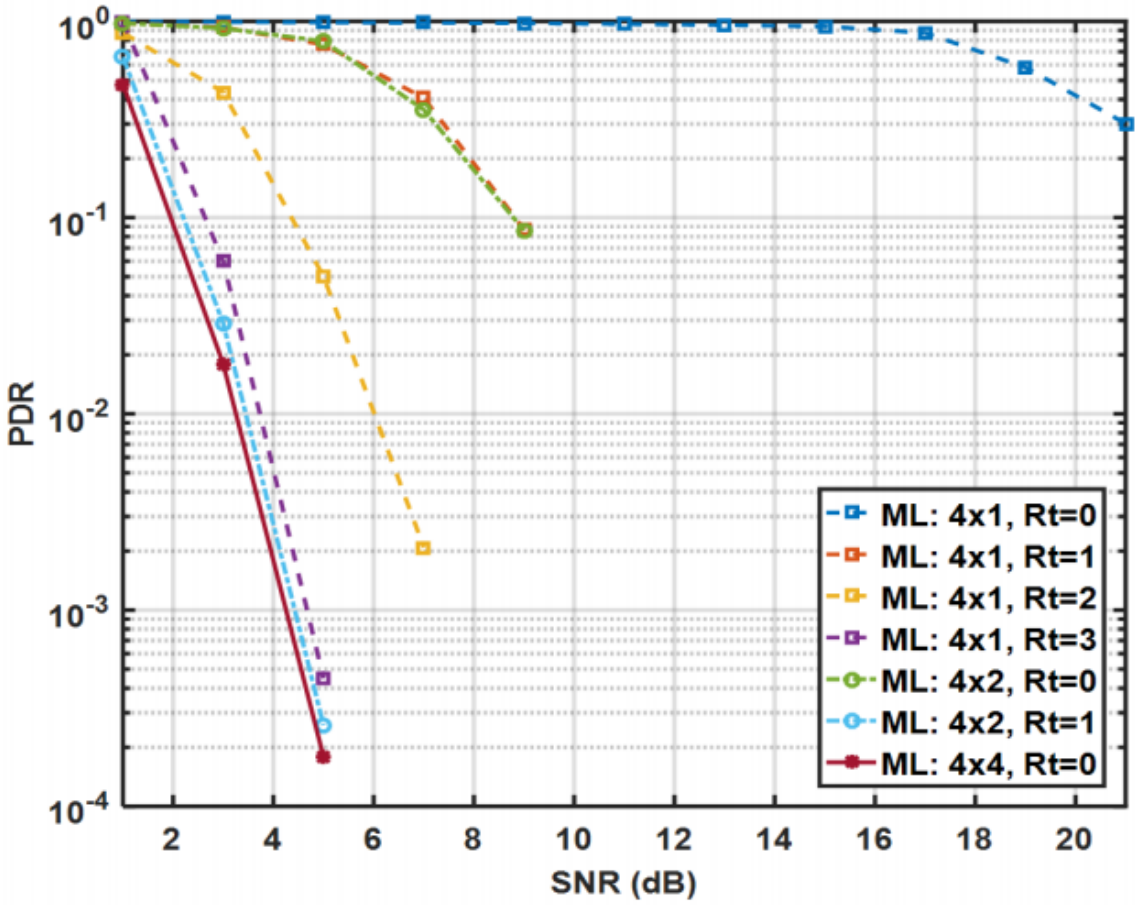
Multi user MIMO-OFDM systems' performance in terms of BER with proposed scheme, using MMSE detector.

Simulation Results 4/8



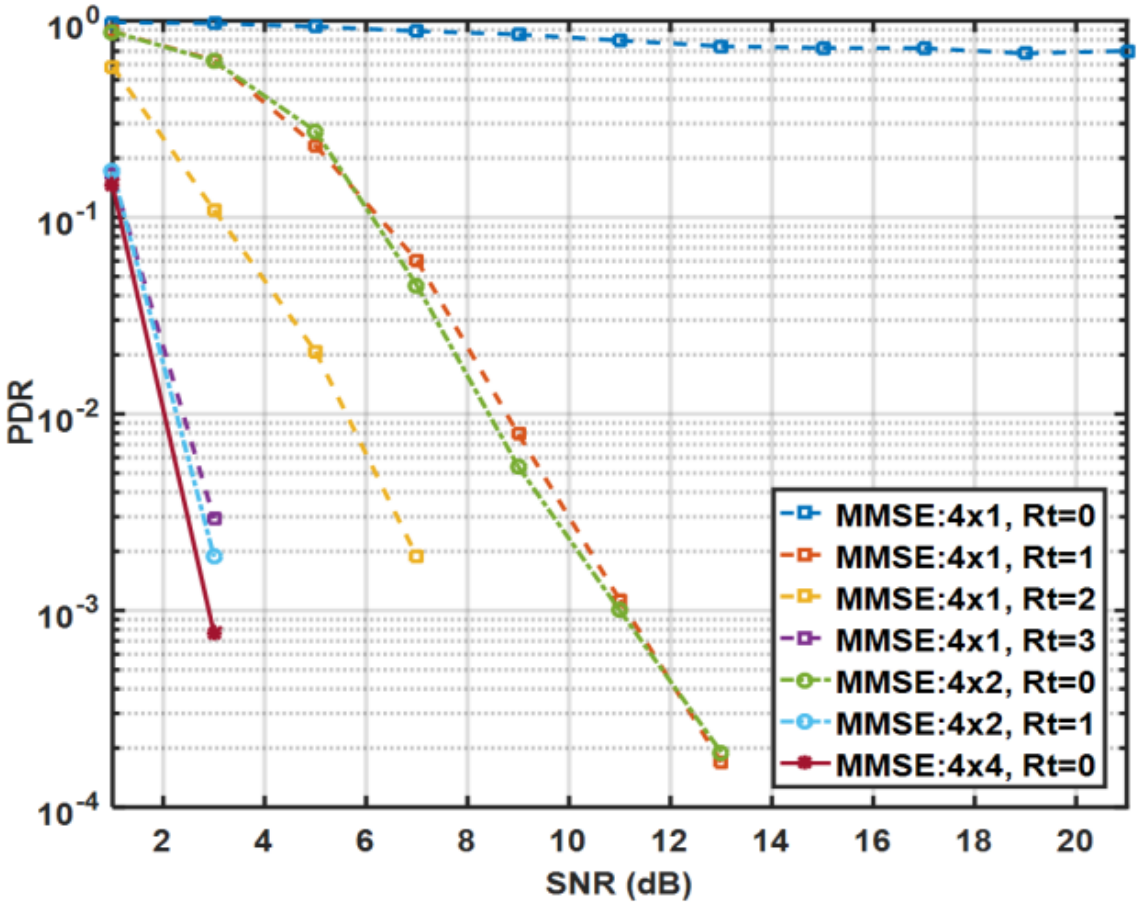
Multi user MIMO-OFDM systems' performance comparison in terms of BER with proposed scheme, while using MMSE detector and ML detector

Simulation Results 5/8



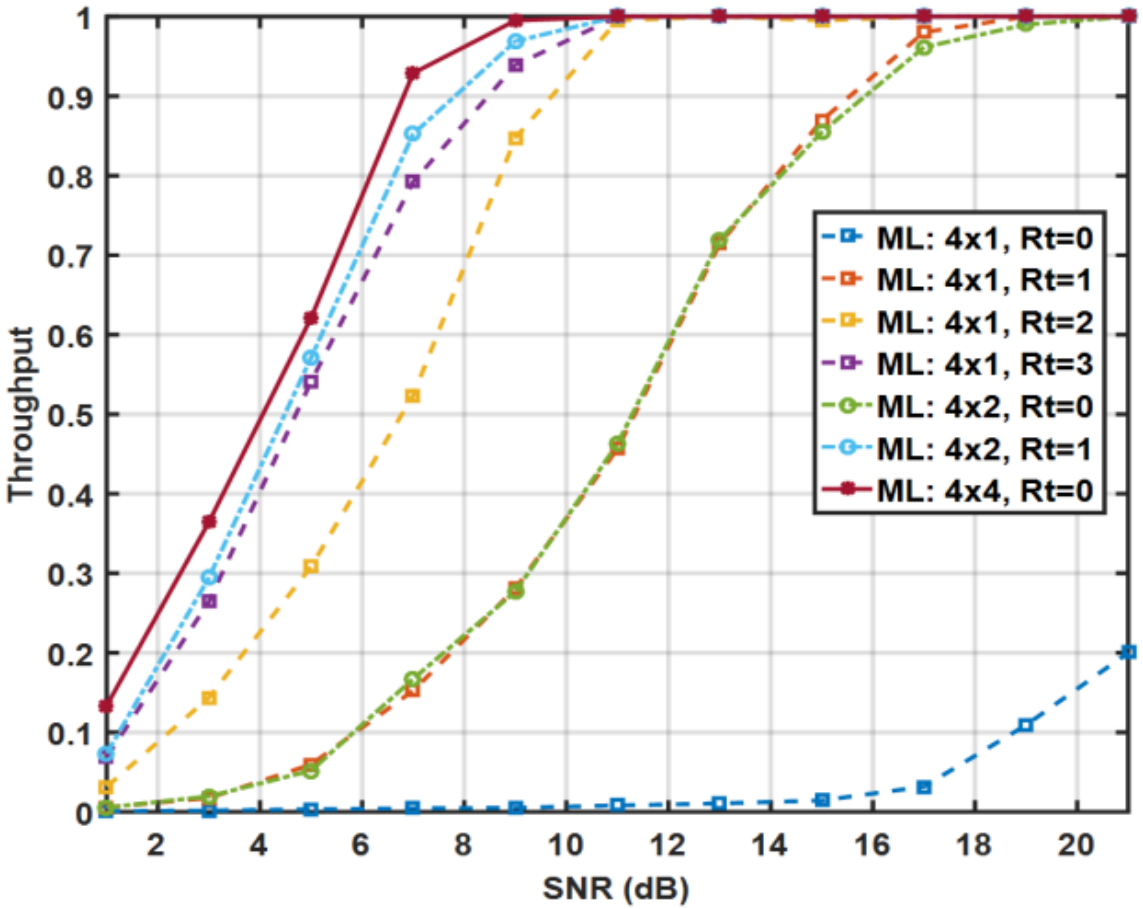
Multi user MIMO OFDM systems' performance in terms of PDR with four transmitter antennas $N_{Tx} = 4$, using ML detector

Simulation Results 6/8



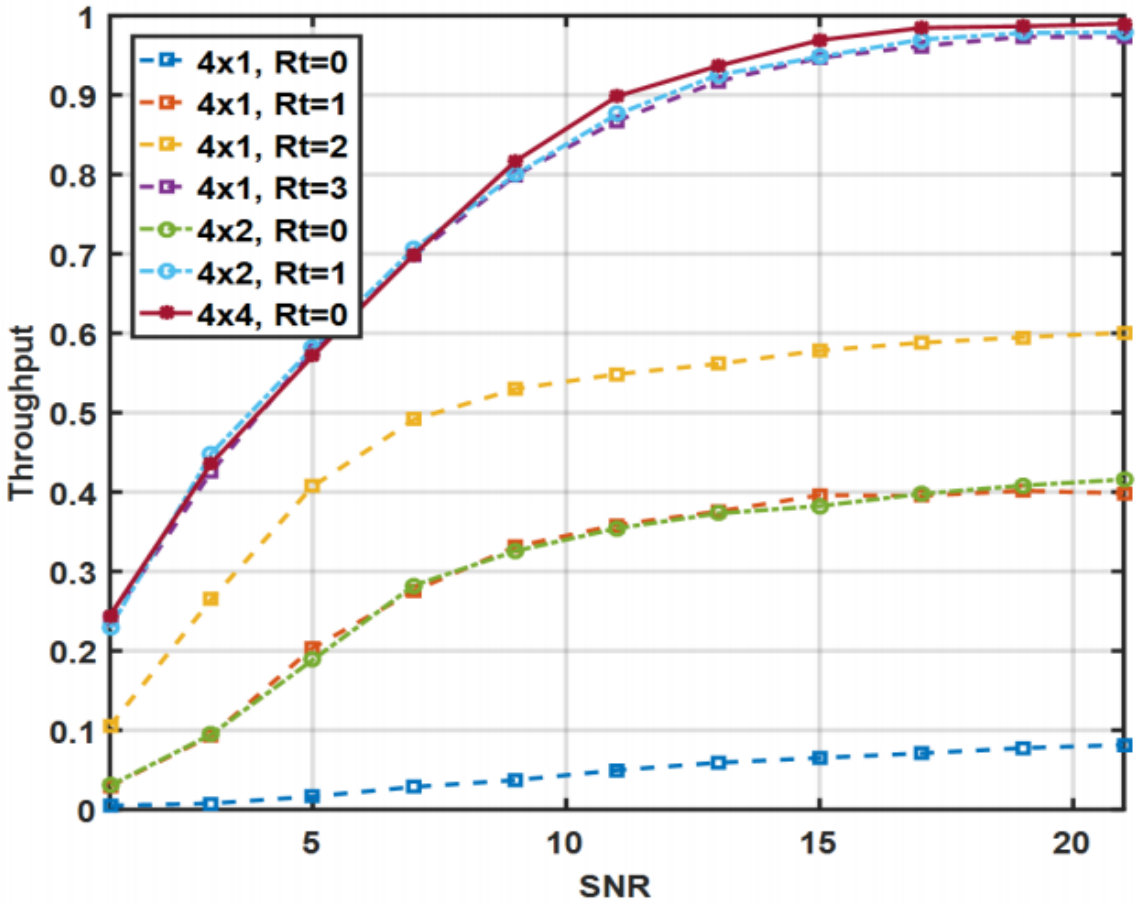
Multi user MIMO OFDM systems' performance in terms of PDR with four transmitter antennas $N_{Tx} = 4$, using MMSE detector

Simulation Results 7/8



Multi user MIMO OFDM systems' performance in terms of throughput with four transmitter antennas $N_{Tx} = 4$, using ML detector

Simulation Results 8/8



Multi user MIMO OFDM systems' performance in terms of throughput with four transmitter antennas $N_{Tx} = 4$, using MMSE detector

Conclusion

- VRAs are created to convert an overloaded to under loaded or critically loaded system.
- Through this scheme, up to 20% performance improvement can be achieved in overloaded Multiuser MIMO OFDM Systems.

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THANK YOU