

Contents

Danksagung	i
Zusammenfassung	ii
Abstract	iv
List of Figures	viii
List of Tables	xi
List of Abbreviations	xii
List of Symbols	xiv
1 Introduction	1
1.1 Motivation	1
1.2 State of the Art	3
1.3 Thesis Contribution	5
1.4 Outline of the Thesis	5
1.5 Notation	6
2 Multiple-Input Multiple-Output Decoding Schemes	7
2.1 Optimal MIMO Decoder	10
2.2 Unordered Decoding Schemes	11
2.2.1 Zero-Forcing Decoding	11
2.2.2 Successive Interference Cancellation	13
2.2.3 QR-Decomposition based Decoding	15
2.2.4 Minimum Mean Square Error Decoding	18
2.2.5 QR-Decomposition based MMSE Decoding	19
2.2.6 Distortionless MMSE Decoding	21
2.3 Ordered Decoding Schemes	24
2.3.1 Vertical Bell Labs Layered Space-Time Decoding	24
2.3.2 Sorted QR-Decomposition	25
2.3.3 MMSE Sorted QR-Decomposition	27

3	Automatic Repeat Request Protocols	28
3.1	Stop-and-Wait Protocol	28
3.2	Go-back- N_{ARQ} Protocol	29
3.3	Selective-Repeat Protocol	30
3.4	Hybrid-ARQ	32
3.5	MIMO ARQ Protocols	34
3.6	Recursive Spatial Multiplexing	36
4	System Description	38
4.1	System Architecture	38
4.2	Signal Decoding Scheme	40
4.3	Selective Retransmission Scheme	41
5	Search Algorithms	43
5.1	Zero-Forcing Algorithms	43
5.1.1	Exhaustive Search Algorithm	43
5.1.2	Optimal Search Algorithm	44
5.1.3	Backward Search Algorithm	49
5.1.4	Heuristic Search Algorithm	51
5.2	MMSE Algorithms	52
5.2.1	MMSE-OSA	53
5.2.2	MMSE-HSA	55
5.2.3	Distortionless MMSE Algorithm	55
5.3	Simulation Results	58
5.3.1	Comparison of Search Algorithms	58
5.3.2	Complexity Considerations	66
5.3.3	Comparison of Decoding Methods	67
6	Throughput Consideration	76
6.1	Sensor Selection	76
6.2	Simulation Results	82
7	Conclusions and Outlook	85
7.1	Conclusions	85
7.2	Open Problems	86
A	Appendix	88
A.1	Complexity of Search Algorithms	88
A.1.1	Modified Gram-Schmidt Algorithm	88
A.1.2	Optimal Search Algorithm	89
A.1.3	Backward Search Algorithm	90
A.1.4	Distortionless MMSE Algorithm	91
	Bibliography	94