

Contents

Abstract	i
Kurzfassung	iii
1. Introduction	1
1.1. Cooperative Communication in Mobile Wireless Networks	2
1.2. Infrastructure-less Wireless Networks	5
1.3. Infrastructure-based Wireless Networks	6
1.4. Contributions and Outline	7
2. Cooperative Broadcasting in Mobile Ad Hoc Networks	11
2.1. Classical Broadcasting Methods	11
2.2. Multistage Cooperative Broadcast	12
2.3. Scalability of Routing Overhead	14
2.4. Conclusion	16
3. Stochastic Geometry Based Performance Prediction	17
3.1. Related Work	18
3.2. System Model	19
3.3. Inter-Node Distances	20
3.4. Performance Prediction of Multistage Cooperative Broadcast	25
3.5. Multi Hop Transmission Performance Prediction	34
3.6. Conclusion	39
4. Leakage Based Multi-User MIMO Precoding	41
4.1. Related Work	43
4.2. System Model	44
4.3. Rate Optimal Leakage Based Precoding	45
4.4. Leakage Based Target Rate Precoding	56
4.5. Conclusions	66

5. Leakage Based Beam Shaping	67
5.1. Related Work	68
5.2. Scenario and System Setup	69
5.3. Pattern Synthesis	71
5.4. Performance Evaluation	78
5.5. Practical Considerations and Discussion	82
5.6. Conclusions	87
6. Quantize-and-Forward Virtual MIMO Receive Cooperation	89
6.1. Related Work	90
6.2. System Model and Problem Formulation	91
6.3. Backhaul Resource Allocation	93
6.4. Relay Selection	95
6.5. Cascade Resource Allocation	102
6.6. Conclusions	107
7. Cooperative Communication in Military Mobile Ad Hoc Networks	109
7.1. Range Extension	110
7.2. Spatial Multiplexing	115
7.3. Conclusions	119
8. User Cooperation Enabled Traffic Offloading in Urban Hotspots	121
8.1. Related Work	122
8.2. System Setup	123
8.3. User Cooperation for Ultra Dense Environments	124
8.4. Simulation Framework	127
8.5. Uplink Performance Evaluation	128
8.6. Downlink Performance Evaluation	133
8.7. Spatial Reuse and Local User Performance	139
8.8. Conclusions	145
9. Summary and Conclusion	147
A. Appendix	149
A.1. Directive Antenna Pattern	149
A.2. WINNER II, Scenario C2 Channel Model	149
A.3. 60 GHz Log-Distance Path Loss Model	150

A.4. Monotony of Achievable Rates of Leakage Based Precoding	151
A.5. Derivation of the Partial Derivative of the Cascade Decoding Rate . . .	153
List of Figures	155
Acronyms	159
Notation and Variables	161
Bibliography	167
Curriculum Vitae	177