ABSTRACT

Mobile communication systems face a great challenge due to the raised user expectations of quality of service and the rapid growth of the data traffic. The performance of cellular systems is mainly limited because of the presence of inter-cell interference e.g., the spectrum efficiency, peak data rate, cell-edge data rate. The cooperation between base stations (BSs) which is known as coordinated multi-point (CoMP) transmission/reception is one of the most important way to combat inter-cell interference. Coordinated multipoint can either coordinate or exploit the interference to improve the system throughput and the user fairness.

For systems beyond 4G, further enhancement of the system throughput and user fairness is required considering the recent exponential increase in the volume of mobile traffic and the needs for enhanced delay high volume services such as video streaming. To accommodate such requirements, non-orthogonal multiple access can again be a promising candidate as a downlink wireless access scheme for systems beyond the fourth generation. To make non-orthogonal multiple access favorable and promising, it should be used with advanced reception techniques such as a successive interference cancellation (SIC) which is different from the third generation mobile communication system.

This thesis explores the performance of coordinated multipoint transmission and reception techniques using Non Orthogonal Multiple Access (NOMA) with superposition coding in heterogeneous network, comparing with orthogonal multiple access (OMA), evaluating user and cell throughput.

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List of Abbreviations

1G	First Generation
2G	Second Generation
3G	Third Generation
3GPP	Third Generation Partnership Project
4G	Fourth Generation
5G	Fifth Generation
AAS	Active Antenna Systems
ABS	Almost Blank subframe
ACK	Acknowledge
AMC	Adaptive Modulation and Coding
AMPS	Advanced Mobile Phone System
BLER	Block Error Rate
CA	Carrier Aggregation
CC	Component Carrier
CDD	Cyclic Delay Diversity
CDF	Cumulative Distribution Function
CDMA	Code Division Multiple Access
CINR	Carrier to Interference and Noise Ratio
CSG	Closed Subscriber Group
CLSM	Closed Loop Spatial Multiplexing
COMP	Coordinated Multi-Point
CP	Cyclic Prefix
CS/CB	Coordinated Scheduling/Beamforming
CSI	Channel State Information
CQI	Channel Quality Indicator
D2D	Device to Device
DCS	Dynamic Cell Selection
DFT	Discrete Fourier Transform
DMRS	Demodulation Reference Signal
DPC	Dirty Paper Coding
DS-CDMA	Direct Sequence Code Division Multiple Access
DSL	Digital Subscriber Line
EE	Energy Efficient
eICIC	Enhanced Inter Cell Interference Coordination
eNB	Enhanced NodeB
EPC	Evolved Packet Core
FDD	Frequency Division Duplex
FFT	Fast Fourier Transform
FPA	Fixed Power Allocation
FRA	Future Radio Access
FSPA	Full Search Power Allocation
FTP	File Transfer Protocol
GMSK	Gaussian Minimum Shift Keying
GSM	Global System for Mobile

HeNB	Home Enhanced Node
HetNets	Heterogeneous Networks
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
HUE	Home User Equipment
ICIC	Inter Cell Interference Coordination
IDMA	Interleave Division Multiple Access
IFFT	Inverse Fast Fourier Transform
IMT	International Mobile Telecommunications
IP	Internet Protocol
IRC	Interference Rejection Combining
IS-95	Interim Standard 95
ISD	Inter Side Distance
ITU	International Telecommunication Union
JP	Joint Processing
JT	Joint Transmission
LOS	Line Of Site
LCS	Location Service
LDPC	Low Density Parity Check
LTE	Long Term Evolution
LTE-A	Long Term Evolution-Advanced
MA	Multiple Access
MDT	Minimization of Drive Test
MIB	Master Information Block
MIMO	Multiple Input Multiple Output
MBMS	Multimedia Broadcast and Multicast Service
MBSFN	Multimedia Broadcast Single Frequency Network
MCS	Modulation and Coding Scheme
MME	Mobility Management Entities
MNB	Macro Node B
MPF	Modified Proportional Fair
MTC	Machine Type Communication
MUE	Macro User Equipment
NACK	Negative Acknowledge
NCT	New Carrier Type
NLOS	Non Line Of site
NOMA	Non Orthogonal Multiple Access
OFDM	Orthogonal Frequency Division Multiplexing
OFDMA	Orthogonal Frequency Division Multiple Access
OMA	Orthogonal Multiple Access
PAPR	Peak to Average Power Ratio
PBCH	Physical Broadcast Channel
PCFICH	Physical Control Format Indicator Channel
PDCCH	Physical Downlink Control Channel
PDSCH	Physical Downlink Shared Channel
PF	Proportional Fair

PHICH	Physical Hybrid ARQ Indicator Channel
PMCH	Physical Multicast Channel
PRACH	Physical Random Access Channel
PRB	Physical Resource Block
PSK	Phase Shift Keying
PUCCH	Physical Uplink Control Channel
PUSCH	Physical Uplink Shared Channel
QAM	Quadrature Amplitude Modulation
QoS	Quality of Service
QPSK	Quadrature Phase Shift Keying
RB	Resource Block
RE	Resource Element
RF	Radio Frequency
RM	Rate Matching
RS	Reference Signal
SAE	System Architecture Evolution
SC-FDMA	Single Carrier-Frequency Division Multiple Access
SEGW	Security Gateway
SGW	Serving Gateway
SIC	Successive Interference Cancellation
SINR	Signal Interference / Noise Ratio
SIR	Signal to Interference Ratio
SNR	Signal to Noise Ratio
SON	Self Organizing Network
SRS	Sounding Reference Signal
TCMA	Trellis Code Multiple Access
TDD	Time Division Duplex
TDMA	Time Division Multiple Access
TM	Transmission Mode
TPA	Transmit Power Allocation
TTI	Transmission Time Interval
UE	User Equipment
UMTS	Universal Mobile Telecommunications System
UTRA	Universal Terrestrial Radio Access
UTRAN	Universal Terrestrial Radio Access Network
WLANs	Wireless Local Area Networks