

IMPLEMENTATION OF MULTI CARRIER-CODE DIVISION
MULTIPLE ACCESS-FREQUENCY DIVISION MULTIPLE ACCESS
WITH BEYOND 4G SPECIFICATIONS

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ABSTRACT

Hybrid code division multiple access techniques present the open door for the future of code division multiple access and wireless communications. Multicarrier CDMA is the most popular type of hybrid CDMA because of its robustness against multipath fading channels and flexible multiple access capability. MC-CDMA is a predictable technique for future high data rate wireless communication systems according to these appealed properties. The main drawback of MC-CDMA is the power level in uplink, i.e. the ratio of peak power to the average power is high and leads to high instantaneous power which is required in transmission of mobile station. However, there are many researchers working towards reducing the level of the transmitted power. This research presents new method of peak to average power ratio (PAPR) reduction. The proposed method is making use of the characteristics of uplink for current 4th Generation (single carrier frequency division multiple access) which has low PAPR into current MC-CDMA system to reproduce a new MC-CDMA system (MC-CDMA-FDMA) with low PAPR and keep all the characteristics of the basic MC-CDMA system. MC-CDMA-FDMA reduced the level of power from 10 dB to 2 dB in case of 64 FFT size and Walsh Hadamard code is used in spreading block. In addition bit error rate has been reduced from 96×10^{-5} bps to 82×10^{-5} bps comparing to SC-FDMA bit error rate. The proposed system also has high flexibility to deal with modern communication systems with minimum required hardware at the base station through optimization of FFT size. The simulation results show that MC-CDMA-FDMA system will be a good candidate for beyond 4th Generation for mobile communications.

ABSTRAK

Teknik kod hibrid pelbagai akses merupakan kod akses pelbagai dan komunikasi tanpa wayar masa depan. Multicarrier CDMA adalah salah satu hibrid CDMA yang paling popular kerana keteguhan terhadap saluran pudar berbilang dan keupayaan pelbagai akses yang fleksibel. MC-CDMA adalah satu teknik untuk kadar data yang tinggi bagi sistem komunikasi data tanpa wayar masa depan kerana ciri-cirinya yang menarik. Kelemahan utama MC-CDMA adalah tahap kuasa di bahagian pautan atas, iaitu nisbah kuasa puncak kepada kuasa purata yang tinggi menyebabkan kuasa serta-merta menjadi tinggi, di mana kuasa tinggi ini sangat diperlukan dalam process pemancaran ke stesen mudah alih. Walau bagaimanapun, terdapat ramai penyelidik bekerja ke arah mengurangkan tahap kuasa pemancaran yang dihantar. Kajian ini membentangkan kaedah baru untuk mengurangkan puncak kuasa purata nisbah (PAPR). Kaedah yang dicadangkan menggunakan ciri-ciri pautan atas untuk Generasi ke-4 (iaitu pembawa tunggal frekuensi bahagian akses pelbagai) yang mempunyai PAPR rendah ke dalam sistem MC-CDMA terkini untuk menghasilkan satu sistem baru MC-CDMA yang dikenali sbagai (MC-CDMA FDMA) dengan PAPR rendah dan mengekalkan semua ciri-ciri asas sistem MC-CDMA. MC-CDMA FDMA telah mengurangkan tahap kuasa dari 10 dB 2 dB dalam kes dimana 64 saiz FFT dan Walsh kod Hadamard digunakan dalam menyebarkan blok. Di samping kadar bit ralat telah dikurangkan daripada 96×10^{-5} bps kepada 82×10^{-5} bps jika dibandingkan dengan SC-FDMA kadar "bit error". Sistem yang telah dicadangkan juga mempunyai fleksibiliti yang tinggi untuk berurusan dengan sistem komunikasi moden dan menggunakan perkakasan yang minimum pada stesen pangkalan melalui pengoptimuman saiz FFT. Keputusan simulasi menunjukkan bahawa sistem MC-CDMA-FDMA akan menjadi calon yang sesuai untuk Generasi ke-4 bagi komunikasi mudah alih.

TABLE OF CONTENTS

	TITLE	I
	DECLARATION	IV
	ACKNOWLEDGEMENT	VI
	ABSTRACT	VII
	TABLE OF CONTENTS	IX
	LIST OF FIGURES	XVI
	LIST OF TABLES	XXI
	CONTRIBUTIONS AND PUBLISHED WORKS	XXIII
	LIST OF ABBREVIATIONS	XXVII
CHAPTER 1	INTRODUCTION	1
	1.1 Research Background	1
	1.2 Problem statement	2
	1.3 Objectives of the research	3
	1.4 Research Methodology	4
	1.5 Scope of the research	6
	1.6 Contributions and Novelty of the Research	7

1.7	Thesis Outlines	8
CHAPTER 2	MULTIPLE ACCESS SCHEMES	10
2.1	Introduction	10
2.2	Frequency Division Multiple Access (FDMA)	11
2.3	Time Division Multiple Access (TDMA)	14
2.4	Orthogonal Frequency Division Multiple Access (OFDMA)	16
2.5	Code Division Multiple Access (CDMA)	17
2.5.1	Direct Sequence Code Division Multiple Access (DS- CDMA)	19
2.5.2	Frequency Hopping Code Division Multiple Access (FH- CDMA)	20
2.5.3	Time Hopping Code Division Multiple Access (TH- CDMA)	23
2.5.4	Hybrid Code Division Multiple Access	24
2.5.4.1	Multi Carrier-Code Division Multiple Access (MC- CDMA)	25
2.5.4.2	Multi Carrier-Direct Sequence-Code Division Multiple	26

	Access (MC-DS-CDMA)	
2.5.4.3	Time Division-Synchronous Code Division Multiple	27
	Access (TD-SCDMA)	
2.6	Summary	28
CHAPTER 3	MULTI CARRIER-CODE DIVISION MULTIPLE	29
	ACCESS	
3.1	Introduction	29
3.2	MC-CDMA System Structure	30
3.2.1	MC-CDMA Signal Generation	30
3.2.2	MC-CDMA Signal Analysis	31
3.2.3	MC-CDMA Downlink Signal	33
3.2.4	MC-CDMA Uplink Signal	36
3.3	Spreading Codes	38
3.3.1	Orthogonal Walsh Codes	39
3.3.2	Pseudo Noise Codes	43
3.4	Advantages of MC-CDMA System	45
3.5	Drawbacks of MC-CDMA System	46
3.6	MC-CDMA Signal and PAPR Definition	47
3.7	Effect of PAPR in MC-CDMA System	49

3.8	PAPR reduction techniques for MC-CDMA System	51
3.8.1	Amplitude Clipping and Filtering	51
3.8.2	Coding	52
3.8.3	Selective Mapping	53
3.8.4	The Adaptive pre-distortion Technique	54
3.8.5	DFT Spreading	54
3.9	PAPR Reduction Techniques Comparison	56
3.10	Summary	59
CHAPTER 4	SINGLE CARRIER-FREQUENCY DIVISION MULTIPLE ACCESS	60
4.1	Introduction	60
4.2	SC-FDMA Transmission Structure	61
4.2.1	Time-Domain Signal Generation	62
4.2.2	Frequency-Domain Signal Generation (DFT-S-OFDM)	65
4.3	SC-FDMA Time and Frequency Structure	70
4.4	Advantages of SC-FDMA	75
4.5	Drawbacks of SC-FDMA	76
4.6	Peak-to-Average Power Ratio Characteristics of SC-FDMA system	77
4.7	Summary	78

CHAPTER 5	DESIGN OF MC-CDMA, SC-FDMA AND MC-CDMA-FDMA SYSTEMS	79
5.1	Introduction	79
5.2	Design of MC-CDMA System	80
5.3	Design of SC-FDMA System	84
5.4	Design of MC-CDMA-FDMA System	87
5.5	Optimization of FFT size for MC-CDMA, SC-FDMA and MC-CDMA-FDMA	99
5.6	Summary	101
CHAPTER 6	PERFORMANCE ANALYSIS OF MC-CDMA, SC-FDMA AND MC-CDMA-FDMA	102
6.1	Introduction	102
6.2	Performance of MC-CDMA System	103
6.2.1	Performance of MC-CDMA System with Walsh Hadamard Code	103
6.2.1.1	Performance of MC-CDMA System over AWGN Channel	105
6.2.1.2	Performance of MC-CDMA System over Rayleigh Fading and AWGN Channel	107
6.2.2	Performance of MC-CDMA System with Pseudo Random Code	110
6.2.2.1	Performance of MC-CDMA System over AWGN Channel	111

6.2.2.2	Performance of MC-CDMA System over Rayleigh Fading and AWGN Channel	114
6.2.3	Comparison of Simulated MC-CDMA system with Previous Work done elsewhere	117
6.2.4	PAPR of MC-CDMA System over Rayleigh and AWGN Channel	118
6.2.5	MC-CDMA System with N-point FFT size	120
6.2.5.1	MC-CDMA System with QAM Modulation Technique	120
6.2.5.2	MC-CDMA System with PSK Modulation Technique	122
6.2.6	PAPR of MC-CDMA with N-point FFT Size	131
6.3	Performance of SC-FDMA System	132
6.3.1	Performance of SC-FDMA system with Various Modulation Techniques	135
6.3.2	Peak Power Characteristics of Single Carrier FDMA Signal	136
6.3.3	SC-FDMA System with N-point FFT size	137
6.3.3.1	SC-FDMA System with QAM Modulation Technique	137
6.3.3.2	SC-FCDMA System with PSK Modulation Technique	140
6.4	Performance of MC-CDMA-FDMA System	149
6.4.1	Performance of MC-CDMA-FDMA System with Various Modulation Techniques	150
6.4.2	PAPR of MC-CDMA-FDMA System	152
6.4.3	MC-CDMA-FDMA System with N-point FFT Size	153



6.4.3.1	MC-CDMA-FDMA System with QAM Modulation Technique	154
6.4.3.2	MC-CDMA-FDMA System with PSK Modulation Technique	156
6.5	Summary	165
CHAPTER 7	CONCLUSIONS AND FUTURE WORKS	168
7.1	Conclusions	168
7.2	Recommendations and Future Works	171
	REFERENCES	172
Appendix A	AWARDS AND PATENT	181



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PERPUSTAKAAN TUNKU TUN AMINAH

LIST OF FIGURES

2.1	An illustration of different multiple access scheme concepts	11
2.2	Principle of frequency division multiple access	12
2.3	Principle behind time division multiple access	14
2.4	Classification of CDMA Techniques	18
2.5	Carrier frequency hopping from one frequency to another	21
2.6	Basic FH transmitter	22
2.7	Block diagram of TH-CDMA transmitter and receiver	24
2.8	MC-DS-CDMA transmitter for M carriers	26
3.1	MC-CDMA signal generation for one user	31
3.2	Multi-carrier spread spectrum signal generation	33
3.3	MC-CDMA downlink transmitter	34
3.4	OFDM block	35
3.5	MC-CDMA Receiver	37
3.6	Inverse OFDM block	37
3.7	MC-CDMA single-user detection	38
3.8	Walsh code generator for Walsh code of length 8	41
3.9	Walsh code generator for Walsh code of length 16	42
3.10	Pseudo Random code generator	44
3.11	Masking in Pseudo Random code generator	45
3.12	MC-CDMA with Clipping & Filtering	52

3.13	Block diagram of selective mapping (SLM) technique for PAPR reduction	53
3.14	Subcarrier mapping for uplink in OFDMA systems: DFDMA and LFDMA	55
4.1	SC-FDMA time-domain transmit processing	62
4.2	Distributed transmission with equal-spacing between occupied subcarriers	63
4.3	SC-FDMA frequency-domain transmit processing (DFT-S-OFDM) showing localized and distributed subcarrier mappings	65
4.4	Subcarrier mapping modes; distributed and localized	67
4.5	Different subcarrier mapping schemes for $M = 4$, $Q = 3$, and $N = 12$	68
4.6	Multiple access with resource sharing in the frequency domain with SC-FDMA and frequency domain signal generation	69
4.7	Uplink resource grid	73
4.8	Physical mapping of a block in RF frequency domain (f_c : carrier center frequency)	75
5.1	MC-CDMA Diagram of Transmitter	81
5.2	MC-CDMA Diagram of Receiver	83
5.3	SC-FDMA Diagram of Transmitter	85
5.4	SC-FDMA Diagram of Receiver	86
5.5	MC-CDMA-FDMA Diagram of Transmitter	92
5.6	Spreading and De-spreading operations	93
5.7	MC-CDMA-FDMA Diagram of Receiver	95
5.8	BER values for MC-CDMA-FDMA, MC-CDMA and SC-FDMA at $SNR=8dB$	97
5.9	MC-CDMA frame for 64 sub-carriers	98

6.1	MC-CDMA system (4 Users) broadcasting on AWGN channel	105
6.2	MC-CDMA system (16 Users) broadcasting on AWGN channel	106
6.3	MC-CDMA system (32 Users) broadcasting on AWGN channel	106
6.4	MC-CDMA system (64 Users) broadcasting on AWGN channel	107
6.5	MC-CDMA system (4 Users) over Rayleigh fading and AWGN channel	108
6.6	MC-CDMA system (16 Users) broadcasting on Rayleigh fading and AWGN channel	108
6.7	MC-CDMA system (32 Users) broadcasting on Rayleigh fading and AWGN channel	109
6.8	MC-CDMA system (64 Users) broadcasting on Rayleigh fading and AWGN channel	110
6.9	MC-CDMA system (4Users) broadcasting on AWGN channel	111
6.10	MC-CDMA system (16Users) broadcasting on AWGN channel	112
6.11	MC-CDMA system (32Users) broadcasting on AWGN channel	113
6.12	MC-CDMA system (64Users) broadcasting on AWGN channel	113
6.13	MC-CDMA system (4Users) broadcasting on Rayleigh fading and AWGN channel	114
6.14	MC-CDMA system (16Users) broadcasting on Rayleigh fading and AWGN channel	115
6.15	MC-CDMA system (32Users) broadcasting on Rayleigh fading and AWGN channel	116
6.16	MC-CDMA system (64Users) broadcasting on Rayleigh fading and AWGN channel	116

6.17	PAPR of MC-CDMA system	119
6.18	BER for MC-CDMA system using QAM modulation technique	120
6.19	BER for MC-CDMA system using BPSK modulation technique	122
6.20	BER for MC-CDMA system using QPSK modulation technique	124
6.21	BER for MC-CDMA system using 8PSK modulation technique	126
6.22	BER for MC-CDMA system using 16PSK modulation technique	128
6.23	BER for MC-CDMA system using 32PSK modulation technique	129
6.24	PAPR for MC-CDMA system with various FFT size	131
6.25	Flow chart of SC-FDMA block diagram	133
6.26	BER for SC-FDMA system using different modulation techniques	135
6.27	PAPR for SC-FDMA system	136
6.28	BER for SC-FDMA system using QAM modulation technique	138
6.29	BER for SC-FDMA system using BPSK modulation technique	140
6.30	BER for SC-FDMA system using QPSK modulation technique	142
6.31	BER for SC-FDMA system using 8PSK modulation technique	144
6.32	BER for SC-FDMA system using 16PSK modulation technique	146
6.33	BER for SC-FDMA system using 32PSK modulation technique	148
6.34	BER for MC-CDMA system using different modulation techniques	150
6.35	BER for MC-CDMA-FDMA system using different modulation techniques	151
6.36	PAPR for MC-CDMA-FDMA and MC-CDMA	152

6.37	BER for MC-CDMA-FDMA system using QAM modulation technique.	154
6.38	BER for MC-CDMA-FDMA system using BPSK modulation technique	156
6.39	BER for MC-CDMA-FDMA system using QPSK modulation technique	158
6.40	BER for MC-CDMA-FDMA system using 8PSK modulation technique	160
6.41	BER for MC-CDMA-FDMA system using 16PSK modulation technique	162
6.42	BER for MC-CDMA-FDMA system using 32PSK modulation technique	164



LIST OF TABLES

3.1	Index for Walsh code of length 8	41
3.2	Advantages and disadvantages of PAPR reduction techniques	58
4.1	Resource block characteristics	71
4.2	Summary of symbols for uplink physical layer description	71
4.3	Normal cyclic prefix and extended cyclic prefix	74
5.1	Simulation Parameters	96
6.1	Comparison of MC-CDMA system with other researchers' systems	117
6.2	Relationship between FFT size and BER in case of QAM modulation technique	121
6.3	Relationship between FFT size and BER in case of BPSK modulation technique	123
6.4	Relationship between FFT size and BER in case of QPSK modulation technique	125
6.5	Relationship between FFT size and BER in case of 8PSK modulation technique	127
6.6	Relationship between FFT size and BER in case of 16PSK modulation technique	128
6.7	Relationship between FFT size and BER in case of 32PSK modulation technique	130

6.8	Optimum FFT size for MC-CDMA system	132
6.9	Relationship between FFT size and BER in case of QAM modulation technique	139
6.10	Relationship between FFT size and BER in case of BPSK modulation technique	141
6.11	Relationship between FFT size and BER in case of QPSK modulation technique	143
6.12	Relationship between FFT size and BER in case of 8PSK modulation technique.	145
6.13	Relationship between FFT size and BER in case of 16PSK modulation technique	147
6.14	Relationship between FFT size and BER in case of 32PSK modulation technique	149
6.15	Relationship between FFT size and BER in case of QAM modulation technique	155
6.16	Relationship between FFT size and BER in case of BPSK modulation technique	157
6.17	Relationship between FFT size and BER in case of QPSK modulation technique	159
6.18	Relationship between FFT size and BER in case of 8PSK modulation technique	161
6.19	Relationship between FFT size and BER in case of 16PSK modulation technique	163
6.20	Relationship between FFT size and BER in case of 32PSK modulation technique	165
6.21	Comparison of MC-CDMA, SC-FDMA, and MC-CDMA-FDMA	166



LIST OF ABBREVIATIONS

3G	-	Third Generation
4G	-	Fourth Generation
A/D	-	Analog to digital
AWGN	-	Additive White Gaussian Noise
BER	-	Bit Error Rate
BPSK	-	Binary Phase Shift Keying
BS	-	Base Station
CDF	-	Cumulative Distribution Function
CDMA	-	Code Division Multiple Access
CDS	-	Channel Dependent Scheduling
CP	-	Cyclic Prefix
D/A	-	Digital to analog
DAC	-	Digital to Analog Converter
DFDMA	-	Distributed FDMA
DFT	-	Discrete Fourier Transform

DFT-S-OFDM	-	Discrete Fourier Transform-Spread- Orthogonal Frequency Division Multiplexing
DS	-	Direct Sequence
DS-CDMA	-	Direct Sequence- Code Division Multiple Access
DS-SS	-	Direct Sequence- Spread Spectrum
DwPTS	-	Downlink Pilot time Slots
ECSLM	-	Error Control Selective Mapping Scheme
ESN	-	Electronic Serial Numbers
FD	-	Frequency Division
FDD	-	Frequency Division Duplexing
FDE	-	Frequency Domain Equalizer
FDMA	-	Frequency Division Multiple Access
FEC	-	Forward Error Correction
FFT	-	Fast Fourier Transform
FH	-	Frequency Hopping
FH-CDMA	-	Frequency Hopping- Code Division Multiple Access
FH-SS	-	Frequency Hopping Spread Spectrum
FM	-	Frequency Modulation
GP	-	Guard Period
GSM	-	Global System for Mobile Communications

HPA	-	High Power Amplifier
IBR	-	Input Buffered Router
IDFT	-	Inverse Discrete Fourier Transform
IEEE	-	Institute of Electrical and Electronics Engineers
IFDMA	-	Interleaved Frequency Division Multiple Access
IFFT	-	Inverse Fast Fourier Transform
IS	-	Interim Standard
ISI	-	Inter Symbol Interference
ITU	-	International Telecommunications Union
LANs	-	Local Area Networks
LFDMA	-	Localized FDMA
LOS	-	Line Of Sight
LTE	-	Long Term Evolution
MAI	-	Multi Access Interference
MC	-	Multi Carrier
MC-CDMA	-	Multi Carrier Code Division Multiple Access
MC-DS-CDMA	-	Multi Carrier-Direct Sequence -Code Division Multiple Access
MCM	-	Multi Chip Module
MS	-	Mobile Station
MSE	-	Mean Square Error

OBE	-	Out-of-Band Emission
OBR	-	Output Buffered Router
OFDM	-	Orthogonal Frequency Division Multiplexing
OFDMA	-	Orthogonal Frequency Division Multiple Access
PAPR	-	Peak-to-Average Power Ratio
PG	-	Processing Gain
PN	-	Pseudo noise
PPM	-	Pulse Position Modulation
PSK	-	Phase Shift Keying
PTS	-	Partial Transmit Sequences
PUCCH	-	Physical Uplink Control Channel
PUSCH	-	Physical Uplink Shared Channel
QAM	-	Quadrature Amplitude Modulation
QPSK	-	Quadrature Phase Shift Keying
RAM	-	Random Access Memory
RF	-	Radio Frequency
SC-FDMA	-	Single Carrier Frequency Division Multiple Access
SF	-	Spreading Factor
SLM	-	Selected Mapping
SNR	-	Signal to Noise ratio

TD	-	Time Division
TDD	-	Time Division Duplexing
TDD-CDMA	-	Time Division Duplexing Code Division Multiple Access
TDMA	-	Time Division Multiple Access
TD-SCDMA	-	Time Division Synchronous Code Division Multiple Access
T-FF	-	Toggle Flip Flop
TH	-	Time Hopping
TH-CDMA	-	Time Hopping- Code Division Multiple Access
TH-SS	-	Time Hopping Spread Spectrum
UpPTS	-	Uplink Pilot Time Slots
UWB	-	Ultra WideBand
WH	-	Walsh Hadamard
WiMAX	-	Worldwide Interoperability for Microwave Access



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