

# CONTENTS

<b>APPROVAL</b>	<b>ii</b>
<b>SELF DECLARATION AGAINST PLAGIARISM</b>	<b>iii</b>
<b>ABSTRACT</b>	<b>iv</b>
<b>DEDICATION</b>	<b>v</b>
<b>ACKNOWLEDGMENTS</b>	<b>vi</b>
<b>PREFACE</b>	<b>vii</b>
<b>CONTENTS</b>	<b>viii</b>
<b>LIST OF TABLES</b>	<b>xi</b>
<b>LIST OF FIGURES</b>	<b>xii</b>
<b>LIST OF NOTATIONS</b>	<b>xiv</b>
<b>ACHIEVEMENTS</b>	<b>xvi</b>
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 Background . . . . .	1
1.2 Research Contributions . . . . .	3
1.3 Problem Identification and Objective . . . . .	4
1.4 Scope of Work . . . . .	4
1.5 Research Method . . . . .	5
1.6 Structure of Thesis . . . . .	6
<b>2 BASIC CONCEPT</b>	<b>7</b>
2.1 Raptor Codes . . . . .	7
2.2 LDGM Codes . . . . .	7
2.3 LT Codes . . . . .	9
2.3.1 LT Encoder . . . . .	9
2.3.2 LT Decoder . . . . .	10
2.4 EXIT Charts . . . . .	11

2.4.1	LDGM-based Raptor Codes Structure for EXIT Analysis . . . . .	12
2.4.2	EXIT Functions in BEC . . . . .	15
2.4.3	EXIT Functions in AWGN . . . . .	17
2.4.4	BER Estimation using EXIT charts . . . . .	19
2.5	LDGM-based Raptor Decoding Process . . . . .	19
<b>3</b>	<b>SYSTEM MODEL OF BROADBAND-IOT USING LDGM-RAPTOR CODES</b>	<b>21</b>
3.1	Practical Parameters . . . . .	21
3.2	Transmitter Structures . . . . .	21
3.3	Channel Models . . . . .	23
3.3.1	Binary Erasure Channels (BEC) . . . . .	24
3.3.2	AWGN Channels . . . . .	24
3.3.3	Multipath Rayleigh Fading Channels . . . . .	25
3.4	Receiver Structures . . . . .	26
<b>4</b>	<b>THE PROPOSED LDGM-BASED RAPTOR CODES</b>	<b>29</b>
4.1	Optimization of Degree Distributions . . . . .	29
4.1.1	EXIT Charts in BEC . . . . .	30
4.1.2	EXIT Charts in AWGN Channels . . . . .	32
4.2	Soft Decoding for LDGM-Raptor codes . . . . .	37
<b>5</b>	<b>PERFORMANCE EVALUATIONS</b>	<b>42</b>
5.1	Validations of the System Model . . . . .	42
5.2	BER Performances . . . . .	44
5.3	FER Performances . . . . .	47
5.4	Computational Complexity . . . . .	49
<b>6</b>	<b>CONCLUSIONS AND FUTURE WORKS</b>	<b>51</b>
6.1	Conclusions . . . . .	51
6.2	Future Works . . . . .	52
	<b>REFERENCES</b>	<b>53</b>
	<b>Appendices</b>	<b>56</b>
<b>A</b>	<b>MISCELLANEOUS</b>	<b>58</b>
A.1	Data for BER Estimation in BEC . . . . .	58

A.2	Data of BER Performance in AWGN Channels . . . . .	58
A.3	Data of BER Performance in Rayleigh Fading Channels . . . . .	58
A.4	Data of FER Performance in Different Iterations . . . . .	58