

CONTENTS

APPROVAL PAGE

SELF DECLARATION AGAINST PLAGIARISM PAGE

ABSTRACT	i
UCAPAN TERIMA KASIH	ii
PREFACE	iii
Contents	iv
List of Figures	vii
List of Tables	viii
DAFTAR PENGHARGAAN	ix
1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Identification	3
1.3 Objective and Contributions	3
1.4 Scope of Research	3
1.5 Research Methodology	4
1.6 Organization of the Thesis	4
2 BASIC CONCEPT	6
2.1 General Communication Systems	6
2.2 Accumulate Codes	6
2.3 Quantum Error Codes Correction	7
2.4 Quantum Decoherence	8
2.5 Quantum Encoder	8
2.5.1 Quantum Hamming Bound	8
2.5.2 Quantum Singleton Bound	8
2.5.3 Encoded Qubit	8
2.6 Quantum Encoder	9

2.6.1	5-Qubit Encoder	9
2.6.2	7-Qubit Encoder	9
2.7	Quantum Decoder	11
2.7.1	5-Qubit Decoder	11
2.7.2	7-Qubit Decoder	12
2.8	Syndrome Extraction	13
3	THE PROPOSED QUANTUM ACCUMULATE CODES	15
3.1	System Model	15
3.2	The Proposed Quantum $[[5, 1, 3]]$ Accumulate Codes	16
3.2.1	Quantum Hamming and Singleton Bound for 5-Qubit Codes	16
3.2.2	The 5-Qubit Stabilizers	17
3.2.3	The 5-Qubit Codewords	18
3.3	The Proposed Quantum $[[12, 2, 4]]$ Accumulate Codes	20
3.3.1	Quantum Hamming and Singleton Bound for 12-Qubits Codes	21
3.3.2	The 12-Qubit Stabilizers	21
3.3.3	The 12-Qubit Codewords	26
3.4	Channel	27
3.4.1	Depolarizing Channel	27
3.4.2	Amplitude Damping Channel	27
4	PERFORMANCE EVALUATIONS	29
4.1	Syndrome Extraction Based on Quantum $[[12, 2, 4]]$ Accumulate Codes	29
4.1.1	Syndrome Extraction for No Qubit Error	29
4.1.2	Syndrome Extraction for Single Qubit Error of X, Y, Z	30
4.1.3	Syndrome Extraction for Two Qubits Error of X, X	31
4.1.4	Syndrome Extraction for Two Qubits Error of X, Y	32
4.1.5	Syndrome Extraction for Two Qubits Error of X, Z	34
4.1.6	Syndrome Extraction for Two Qubits Error of Y, Y	36
4.1.7	Syndrome Extraction for Two Qubits Error of Y, X	38
4.1.8	Syndrome Extraction for Two Qubits Error of Y, Z	40
4.1.9	Syndrome Extraction for Two Qubits Error of Z, Z	42
4.1.10	Syndrome Extraction for Two Qubits Error of Z, X	44
4.1.11	Syndrome Extraction for Two Qubits Error of Z, Y	46
4.1.12	QWER Performance	48
5	CONCLUSION	53
5.1	CONCLUSION	53

5.2 RECOMMENDATION	53
Bibliography	54