Contents

Abet	ract.	page
Absti Ackn	owledgments	x xii
Contents		XV
	of Figures	xvi
List o	f Symbols	xix
Char	oter 1: Introduction	
1.1	The interface of graph theory and quantum mechanics	1
	1.1.1 Quantum graph	1
	1.1.2 Graph C* algebra	2
	1.1.3 Quantum walk and state transfer1.1.4 Graph theory in quantum error correcting codes	2
	1.1.5 Graph states	3 3 3 4
	1.1.6 Tensor network	3
1.2	A brief overview on our contribution	4
Char	oter 2: Graph Theory and Quantum Information	
2.1	An introduction to quantum information theory	5
2.2	From graph theory to quantum information	57
	2.2.1 Essential terminologies of graph theory	7 8
	2.2.2 Basic assumptions on graphs2.2.3 Matrices related to graphs	
	2.2.4 Graph Laplacian quantum states and their properties	9 10
	2.2.5 Revisit pure and mixed states	12
	2.2.6 Relation between clustering on the vertex set and Hilbert spaces	1
2.3	Graph structure of some quantum states	15
	2.3.1 Two qubit entangled states and Bell States 2.3.2 Three-qubit GHZ States	15 16
	2.3.3 Quantum states with signed Laplacian matrices	16
	2.3.4 Werner state	17
	2.3.5 Isotropic state	18
2.4	2.3.6 X state What next?	19 20
•		
	oter 3: Graph Theoretic Aspects of Quantum Dynamics	01
3.1	An introduction to unitary evolution and graph switching Operations on single qubit quantum states	21 23
3.2 3.3	Operations on multi-qubit quantum states	23
<i>J</i> . <i>J</i>	3.3.1 X Gate	25
	3.3.2 Ygate	26
	3.3.3 Z gate	27
	3.3.4 <i>H</i> Gate 3.3.5 Operation on arbitrary qubit	28 30
	3.3.6 CNOT gate operation	31
	3.3.7 Bell state generation	33 34
3.4	What next?	34
Char	oter 4: Graph Theoretic Aspects of Quantum Entanglement	
4.1	An introduction to quantum entanglement	35
4.2	Graph theoretic aspects of partial transpose	36
4.3	Separability condition on graphs	38 43
4.4 4.5	Graph isomorphism and quantum entanglement What next?	43
		10
	oter 5: Graph Theoretic Aspects of Quantum Discord	A
5.1 5.2	An introduction to quantum discord Graph theoretic aspects of commuting normal matrices	47 49
2•ر	5.2.1 Commuting normal matrices generated by the blocks of simple graphs	50

5.3 5.4 5.5		53 56 60 61 63 63 64 65 66 68 68
6.1 6.2 6.3 6.4 6.5	ter 6: Construction of Cospectral Graphs An introduction to graph spectra A system of Lyapunov equations and its solution Construction of cospectral graphs Examples of non-isomorphic cospectral GTPT equivalent graphs What next? ter 7: Conclusion Summary	71 72 75 85 89 91
References		i