

# Contents

<b>1</b>	<b>Introduction</b>	<b>3</b>
1.1	History of Chaos Theory . . . . .	3
1.2	Basic Definitions . . . . .	5
1.3	Research Objectives and Contributions . . . . .	8
1.4	Thesis Structure . . . . .	8
<b>2</b>	<b>Chaos in Metric Spaces</b>	<b>9</b>
2.1	Devaney's Definition of Chaos . . . . .	9
2.2	D-Chaos . . . . .	15
<b>3</b>	<b>Cross Links of Transitivity</b>	<b>19</b>
3.1	Topological Transitivity . . . . .	19
3.2	Discontinuity and Transitivity . . . . .	25
3.3	Indecomposability and Transitivity . . . . .	28
<b>4</b>	<b>Generalizations and Relaxations on Devaney's Chaos</b>	<b>33</b>
4.1	Chaos Space . . . . .	33
4.1.1	Relation between TC-Definition and DC-Definition . . . . .	34
4.1.2	Other Definitions of Chaos . . . . .	39
4.2	New Proposed Definition of Chaos . . . . .	43
<b>5</b>	<b>Building Hash Functions Using Chaotic Functions</b>	<b>50</b>
5.1	Basics . . . . .	50
5.1.1	Definition of a Hash Function . . . . .	50
5.1.2	Applications and Security Requirements . . . . .	52
5.1.3	Construction of Hash Functions . . . . .	55
5.2	Chaos Theory as basis for Hash Function Construction . . . . .	57
5.2.1	Prior Work . . . . .	58
5.3	Using the Chaotic Double Map . . . . .	63
5.3.1	Suggested Hash function . . . . .	64
5.3.2	Experiments . . . . .	66
<b>A</b>	<b>Hashing Algorithm Code</b>	<b>71</b>
<b>B</b>	<b>Hashing Algorithm Example</b>	<b>74</b>